

# Employee experience, occupational health, and organizational supportive factors: From an integrated perspective

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# Employee experience, occupational health, and organizational supportive factors: From an integrated perspective

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# How to stimulate employees' innovative behavior: Internal social capital, workplace friendship and innovative identity

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With the digital transformation of the economy and the rise of community innovation, how stimulating employees' innovative behavior (EIB) becomes the basis for building sustainable competitive advantage in organizations. However, research has yet to systematically investigate the effect of internal social capital (ISC) on EIB. Based on social identity theory and resource conservation theory, this paper constructs a model to explain the mediating role of II between ISC and EIB and the moderating role of workplace friendship (WF). Using SPSS 27 and Amos 24 to analyze the data of 284 questionnaires, the results show that (1) ISC has a positive effect on EIB, (2) II plays a partial mediating effect in the relationship between ISC and EIB, and (3) WF has a positive moderating effect on the relationship between ISC and EIB. The conclusion provides management insight and practical guidance for creating an internal organizational climate to promote EIBs.

## KEYWORDS

internal social capital, innovative identity, workplace friendship, employees' innovative behavior, psychological factors

## Introduction

In the current context, China's economy is in a critical period of optimizing the industrial structure and transforming economic growth momentum. Leading high-quality development with scientific and technological innovation has become the primary task to grow the real economy. For enterprises, employees' innovation is the foundation of organizational innovation, which reflects that an individual's independent innovative behavior will directly affect corporate performance. Therefore, how to effectively improve employees' innovative behavior (EIB) has become a key topic in management. EIB is that employees integrate their new ideas and new technologies

into their daily work, which has a positive effect on the sustainable development of the organization and the realization of self-worth. Existing studies on EIB mainly focus on employees' personality characteristics (Wu et al., 2014; McCormick et al., 2019; He et al., 2020; Jonsson and Kahler, 2022), organizational incentives method (Zhang et al., 2015; Li-Ying et al., 2016; Lombardi et al., 2020), organizational innovation atmosphere (Wang et al., 2017; Li et al., 2019; Yang and Qin, 2022) and organizational leadership style (Reade and Lee, 2016; Tian and Zhang, 2020; Akbari et al., 2021; Shin et al., 2022). However, with the digital transformation of enterprises and the rise of community innovation, the work forms, identities, and roles of employees have changed dramatically, with innovation roles becoming more prominent, work forms becoming more networked, and younger work teams focusing more on creating a free and harmonious working environment, thus giving employees a greater sense of identity. Innovative identity means that employees identify themselves as having a sense of responsibility for innovation in their work practices, and have the responsibility and obligation to try to introduce new technologies, procedures, or knowledge into their work. This raises a practical question for managers: what kind of working environment is conducive to shaping employees' innovative identity and how to stimulate EIB?

Social capital is a social network resource embedded in interpersonal communication and organizational teams, which is precisely an important factor affecting the behavior of innovative team members. The theoretical framework of social capital includes three dimensions: structural, relational, and cognitive (Nahapiet and Ghoshal, 1998). The structural dimension refers to the overall relationship pattern among employees, including the density, connectivity, and hierarchy of interpersonal networks. The relational dimension reflects the trust, norms, identity, obligations and expectations formed by the interaction among employees. The cognitive dimension emphasizes the common coding, language and experience among employees. Existing research has begun to pay attention to the role of social capital in organizational innovation. Some scholars have pointed out that internal social capital (ISC), such as internal cooperation, employees' common experiences, employees' interactive identity, etc., has a positive impact on organizational innovation (Campbell, 2020; Zhou et al., 2021), and ISC affects EIB through relational psychological contracts, knowledge sharing, and dual learning (Ng et al., 2010; Dong et al., 2017; Cohen and Ehrlich, 2019; Kiazad et al., 2019; Li H. H. et al., 2021; Ye et al., 2021; Zhang et al., 2022). Although the influence of ISC on innovation behavior has been examined, the discussion on the relationship mechanism between the two has yet to be deeply explored, and the influence mechanism between ISC, innovative identity, and innovative behavior needs to be further studied.

In addition, the flat and networked organizational structure is more and more widely recognized in the digital age.

The relationship between employees is becoming more and more equal, thus the organizational atmosphere changes and the possibility of forming friendships in the team increases (Tsang et al., 2012; Goh et al., 2014), which also shows that workplace friendship (WF) plays an important role in modern organizational management. WF is an informal relationship formed and maintained between employees to bring mutual spiritual friendship needs (Rumens, 2017), which has significant effects on engagement (Yan et al., 2021), task performance (Methot et al., 2016), and innovation performance (Kuo et al., 2014; Abdulmuhsin and Tarhini, 2022). However, the existing literature does not directly answer how WF affects the relationship between ISC and EIB. Based on the resource dependence theory, the accumulation of employees' ISC directly affects EIB. WF, as an informal interpersonal relationship, fits the individual needs of modern employees, which can make up for the resource consumption of EIB. Therefore, it is necessary to explore the heterogeneous impact of WF on the relationship between ISC and EIB. Then, can different degrees of WF play a moderating role in the relationship between employees' ISC and innovative behavior? An in-depth investigation of this question can not only expand the relevant literature on the informal relationships in the context of community innovation but also help to further explore the conditional boundary of the impact of ISC on EIB. Based on resource dependence theory and social identity theory, this study takes employees' innovative identity as a mediator variable to explore the effect of ISC on EIB and analyzes the moderating effect of WF on the relationship between ISC and EIB, which reveals the internal mechanism of EIB and finds the path and boundary to promote EIB.

This study provides research contributions in several primary ways. Firstly, this study extends prior research on the connection between ISC and EIB. Existing research mainly focuses on the relationship between social capital and organizational innovation (Yang et al., 2014; Chen et al., 2016), and lacks research on the impact of ISC on employee innovation behavior at the individual level. Secondly, some scholars have paid attention to the influence of ISC on EIB (Cohen and Ehrlich, 2019; Li Y. B. et al., 2021; Zhang et al., 2022), but they have not discussed the influence mechanism of behavior from the perspective of identity. This study introduces the variable of innovation identity into the research framework of social capital and employee innovation behavior. We focus on the mediating effect of innovative identity, which provides a certain reference value for the application of cognitive-behavioral research in organizational management. Thirdly, this study further discusses the moderating effect of WF in the relationship between ISC and EIB. This research can not only analyze the influence boundary of ISC on EIB but also provide certain policy suggestions for organizational teams to motivate EIB.

The remainder of this paper proceeds as follows. The section following builds the theoretical model, employing prior literature on the sources of EIB, ISC, WF, and

innovative identity. Subsequently, the research methodology, data collection procedures, variables measurement, and the respondent sample are described. Results of construct validation and model testing employing the structural equation model are then reported. The paper concludes with a summary of study findings, highlighting contributions, implications, limitations and directions for future research.

## Literature review and hypotheses

### Internal social capital and employees' innovative behavior

The resource dependence theory points out that the resources owned by employees in a complex and changeable work environment are key elements in achieving high-quality work performance. Individual employees build social networks with internal and external organizations and thus obtain the resources they need to operate and innovate from team members or the external environment. This particular resource possessed by employees is valuable and affects the behavior of individuals and groups. Individual social capital is mainly concentrated on the sum of resources at the individual level that helps to achieve their own value goals. If employees have more external social capital, they can influence organizational or team activities by sharing information and technical collaboration. This study mainly focuses on the ISC at the employee level, specifically the relational resources between employees and other members of the team. So, how does ISC affect EIB? Scholars have mainly argued the relationship between the two from the connotation of ISC. First, organizational information capital improves employees' ability to acquire and absorb new technologies and knowledge (Ullah et al., 2021). When the social network among organizational members is closer, the frequency of information exchange among them will increase with the enhancement of interaction. The rich internal information capital has become an important source channel for employees to obtain industry and market information, which enables employees to better understand the future development prospects and direction of the organization (Sozbilir, 2018), thereby increasing the innovation opportunities and stimulating the innovative behaviors of employees. Secondly, the position of employees in the organizational network affects EIB. Diverse network lines reduce the cost of employees' knowledge search and integration. For example, an employee located at the center of the network has more relationships, contributing to the interdependence and interaction with other employees directly connected to him/her, which has a positive effect on the creation of an organizational innovation climate (Kumar et al., 2022). Finally, abundant ISC helps to form a good innovation environment, which helps to stimulate the creative thinking of employees. Individual employees generate creative thinking in

their interactions with other team members, rather than relying solely on their abilities and actions (Lei et al., 2021), which also reflects that a good team relationship is conducive to the formation of an innovative atmosphere. When an employee is located at the center of a social network, the employee has more access to resources than other employees. Abundant social capital can promote employees' knowledge sharing and the development of organizational innovation activities, which shows that knowledge sharing within the organization directly affects EIB (Hu and Randel, 2014; Obrenovic et al., 2020; Halisah et al., 2021). In the digital age, the widespread application of work communities within organizations helps to link employees and better share network resources. Abundant ISC cannot only enable employees to communicate and cooperate more widely in diverse team relationships but also help to improve employees' absorptive capacity and stimulate EIB. Hence, this paper proposes:

Hypothesis 1: ISC has a positive impact on EIB.

### The mediating role of innovative identity

EIB is not only a decision-making behavior of employees but also a social behavior made by employees based on their value orientation (Luoh et al., 2014; Nazir et al., 2021). This kind of social behavior can differ depending on the values (Purc and Laguna, 2019), which indicates that employees' self-innovative identity is an important factor affecting the innovation of enterprises. Social identity theory suggests that individuals' behavioral decisions are largely influenced by their social identity and that there is a high degree of consistency between the social values and emotions of individuals and their social identity. The social capital (relationship) of employees we mentioned above is precisely an important factor affecting social identity. The basic premise of employees' identity is that people have information about the category to which they belong, including the individual's knowledge about one's belonging to a certain social group and the emotional and value meaning of their group membership. Employees in an organizational team have similar basic categories of information such as work environment, language, and cultural atmosphere that form a certain identity. Personal identity within an organization reflects the degree to which individuals identify themselves as "insiders" within the group in a specific context (He et al., 2014; Liu et al., 2020), and this sense of "insiders" identity is precisely derived from the differences between individuals' self-evaluation classification and comparison with groups. Employees with a high sense of identity emphasize "group" and "identity responsibility," and engage in innovative behaviors that are conducive to the development of organizational operations



(Chen et al., 2021). In an employee's social relationship network, each employee with a unique category persists in the relational structure as part of a group attribute, and this social identity description defines the attributes of an individual as a group member. Therefore, the innovative identity attributes of employees in innovation teams will be more pronounced. Existing literature shows that employees with a high sense of identity have higher levels of engagement (Wang et al., 2020; Li H. H. et al., 2021), job satisfaction (Al-Ghazali et al., 2021; Krug et al., 2021), and innovation (Tang and Naumann, 2016). From a theoretical perspective, employees' ISC can influence their behavioral decisions by changing how they perceive in the team. Trust is an important dimension of social capital, a prerequisite for focal companies or employees to conduct extensive innovation searches in diverse network relationships. Therefore, the high level of trust brought by rich social capital leads to more open and inclusive cooperation among members in the organization, and strengthens the sense of their innovative identity, which ultimately motivates EIB. Employees with rich ISC are more likely to stimulate their innovative thinking in the process of interaction and communication. The co-working environment, language, and cultural atmosphere make employees aware of their innovative role in the organization, thus strengthening their motivation and willingness to bring new ideas and technologies to the team. Accordingly, this paper proposes:

Hypothesis 2: II plays a mediating role in the relationship between ISC and EIB.

## The moderating role of workplace friendship

WF is an informal institution that reflects the degree of employee relationships with other members of an organizational team. WF is a special relationship that not only serves individual or organizational goals but also provides employees emotional support. Nielsen et al. (2000) divided WF into two dimensions, opportunity and intensity, where friendship opportunity refers to allowing an informal relationship between employees of an enterprise, while friendship intensity represents the degree of closeness between the two parties who established an informal relationship. There is a substantial body of research on the influencing factors and economic consequences of WF. The heterogeneity of work situations is an important factor affecting WF, which specifically involves leadership styles (Kohan et al., 2018), organizational culture and other aspects (Ozbek, 2018). Workplace friendship can stimulate communication and voice behavior among team members (Lee et al., 2022), and positively promote unethical pro-organizational behavior through emotional commitment. In

addition to creating a good cultural atmosphere and enhancing feelings among colleagues, WF also plays an important role in absorbing and integrating key resources for employees (Mao, 2022). Resource conservation theory shows that organizational members maintain their resource levels primarily through resource acquisition and loss avoidance. EIB is an extremely time and energy-consuming activity, which makes employees less motivated to innovate in the face of a lack of resources. However, good WF leads to close relationships and frequent communication among organizational members, which can improve employees' social capital. At the same time, WF also promotes the level of emotional support, technical support and information support in employees' social networks. This means that employees have access to more key resources through WF to compensate for their loss of resources to carry out innovative activities. All human activities are rational behaviors in pursuit of self-interest, as a result, employees have greater opportunities to communicate in high WF situations. The accumulation of ISC of employees increases continuously as their emotions are satisfied. In this case, employees have a more innovative sense of responsibility and team ownership, which leads to individual behaviors that benefit the organization. Therefore, the innovation cost of employees will decrease with the enrichment of ISC under high WF, which makes their innovation motivation stronger. Conversely, in an environment with low WF, although greater social capital can broaden employees' access to key resources, employees still worry about facing unfriendly behavior such as gossip or hit from colleagues when their innovation activities fail. Therefore, employees in environments with low WF are likely to choose to reduce innovative behaviors to maintain existing resources and reduce losses. To sum up, this paper proposes:

Hypothesis 3: WF has a positive moderating effect on the relationship between ISC and EIB.

Based on the above analysis, this study presents the research framework among ISC, innovative identity, WF, and EIB in Figure 1.

## Research methodology

### Sample description

This research uses a questionnaire survey to collect data and selects enterprises in Beijing, Shanghai, Guangzhou, Chengdu, Dongguan, Taiyuan, Xiamen, and other places as the research objects, involving employees in manufacturing, Internet, finance, and education industries. The scales used in this study are based on maturity scales in previous research. In the process of designing the items of the scale, we invite three professors in the same field to translate

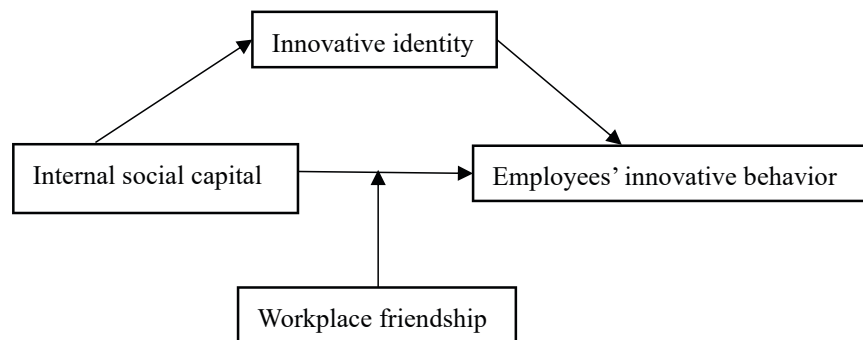


FIGURE 1  
A research framework.

and back-translate the scales, and finally the scales are modified and improved for the context of this study. The main contents of the questionnaire include employee-level ISC, innovative identity, WF, and innovative behavior. All items are expressed on a five-point Likert scale (where “1” means totally disagree and “5” means totally agree). We distribute a total of 387 online questionnaires. After excluding invalid questionnaires with answer time less than 200 s, education below high school, and excessively regular or missing answers, we finally get 284 valid questionnaires, with an effective rate of 73.4%.

## Variables

### Independent variable

#### Internal social capital

ISC this study mainly examines the relational dimension of ISC. A high level of trust among team members increases their closeness and collaboration, which fosters a shared learning atmosphere within the organization. Therefore, according to the research of Tsai and Ghoshal (1998), we mainly include 4 items in the scale such as “My relationships with colleagues are more important than my achievements,” “I can fully rely on the ability of my colleagues to work,” “It is very convenient for me to share information with my colleagues,” “My colleagues and I share common development goals.” The Cronbach’s alpha of this scale is 0.873, which has a high-reliability level.

### Dependent variable

#### Employees’ innovative behavior

EIB innovative behavior means that employees incorporate new ideas, new ideas, and new procedures into their daily work. This innovative behavior has a positive impact on organizational productivity and team management efficiency. According to the research of Scott and Bruce (1994), we mainly include 4 items in the scale such as “I will explore new technologies, new processes, skills or new products at work,” “I often have some creative ideas

or ideas at work,” “I come up with innovative ideas at work and seek support from colleagues,” “I seek funding and resources to implement innovative ideas at work.” The Cronbach’s alpha of this scale is 0.888, which has a high-reliability level.

### Mediator variable

#### Innovative identity

II mainly refers to employees’ recognition that they should have a sense of responsibility for innovation in their work practices, and have the responsibility and obligation to try to introduce new technologies, procedures or knowledge into their work. Following Smidts et al. (2001) and Song et al. (2018), the scale mainly includes 3 items such as “I feel that I have an obligation to try to introduce new procedures into my work,” “I consider myself responsible for bringing about change at work,” “I have a responsibility to correct problems in the organization.” The Cronbach’s alpha of this scale is 0.835, which has a high-reliability level.

### Moderator variable

#### Workplace friendship

This study mainly examines the intensity dimension of WF. Referring to the research of Li G. H. et al. (2021), we include 3 items in the scale such as “My colleagues are not trustworthy, so I usually don’t accept their help at work,” “I have developed strong friendships with colleagues at work,” “I had the opportunity to get to know my colleagues.” The Cronbach’s alpha of this scale is 0.814, which has a high-reliability level.

Besides, we take individual gender, age, organizational level, educational level, and years working as control variables.

## Sample distribution

In this part we analyze the demographic variables. The final sample has 284 valid observations, in which 137 (48.24%) are males and 147 (51.76%) are females. Most of the employees in the sample are between the ages of 20 and 39, of which

27% are 20–29 years old, and 60.21% are 30–39 years old. In terms of organizational level, the proportion of grassroots employees, grassroots managers, middle managers, and top managers are 33.45%, 29.93%, 26.76% and 9.86%, respectively. As for educational background, 3.87% of the sample are high school or technical secondary school, 8.80% are junior college, 67.61% are undergraduate, and 19.72% are master's degree or above. The working years of employees are mostly distributed between 1 and 10 years, of which 9.51% of employees have worked for 5 years or less, 82.39% for 6–10 years, 4.58% for 11–15 years, and 3.52% for 16 or more than. The specific demographic characteristics are described in **Table 1**.

## Reliability and validity analysis

Exploratory factor analysis is performed on the data using SPSS 21.0, and the reliability analysis results of the variables are shown in **Table 2**. In terms of structural validity, the factor loadings of all items that constitute ISC, EIB, innovative identity, and WF are all greater than 0.5. The Cronbach's alpha values of all variables also meet the criterion of greater than 0.65 (the Cronbach's alpha values of ISC, EIB, innovative identity and WF are: 0.812, 0.813, 0.721,

0.675, respectively), indicating good reliability and internal consistency of each variable measure. In addition, the mean value of average variance extracted (AVE) is also greater than 0.7, which meets the discriminant criteria. The combined reliability Composite reliability ratings (CR) values of ISC, EIB, innovative identity, and WF are 0.869, 0.886, 0.756, and 0.890, all of which are greater than 0.7, indicating high reliability.

Factor analysis is performed using AMOS21.0, from which the discriminant validity can be obtained and the results are shown in **Table 3**. In this table we can see that the fit of the four-factor model to the actual observed data ( $\chi^2/df = 1.516$ ; GFI = 0.951; NFI = 0.954; CFI = 0.984; RMSEA = 0.043) is significantly better than the alternative models of three-factor, two-factor, and one-factor, which indicates that the four-variables involved in this study has good discriminant validity.

## Empirical analysis

### Common method variation test

Firstly, in order to reduce the common method bias in the study, we adopt a reverse scoring for some items in the research design. Secondly, we analyze the degree of common method variation (CMV) using Harman's one-way test. The results show that the factor one explains 23.43%, which is less than the 50% criterion. Factor one does not explain most of the variance, which indicates that there is no homoscedasticity

TABLE 1 Sample distribution of demographic characteristics.

Variables	Category	Frequency	Percentage
Gender	Male	137	48.24%
	Female	147	51.76%
Age	20-29	77	27.11%
	30-39	171	60.21%
	40-49	19	6.70%
	50-59	16	5.63%
	60 years old and above	1	3.5%
Organizational level	Entry level employee	95	33.45%
	Grassroots managers	85	29.93%
	Middle management	76	26.76%
	Senior management	28	9.86%
Educational level	High school or technical secondary school	11	3.87%
	Junior college	25	8.80%
	Undergraduate	192	67.61%
	Master degree and above	56	19.72%
Years working	5 years and below	27	9.51%
	6-10	234	82.39%
	11-15	13	4.58%
	16-20	4	1.41%
	21 years and above	6	2.11%

TABLE 2 Exploratory factor analysis.

Constructs	Items	Factor loadings	Cronbach' alpha	CR	AVE
Internal social capital	ISC1	0.719	0.812	0.869	0.791
	ISC2	0.807			
	ISC3	0.820			
	ISC4	0.811			
Employees' innovative behavior	EIB1	0.797	0.813	0.886	0.813
	EIB2	0.817			
	EIB3	0.828			
	EIB4	0.809			
Innovative identity	II1	0.753	0.721	0.756	0.715
	II2	0.754			
	II3	0.626			
Workplace friendship	WF1	0.875	0.675	0.890	0.850
	WF2	0.899			
	WF3	0.782			

problem. Finally, this study adds common method factors for further testing. The comparison results with the four-factor model are shown in [Table 4](#), from which we can see that the increase of GFI, NFI, and CFI after adding the common method factor does not exceed 0.1, and the decrease of RMSEA does not exceed 0.05. In addition, the results of comparing the  $\chi^2$  and df of the two models are as follows:  $\Delta\chi^2 = 802.156$ ,  $\Delta df = 6$ ,  $P < 0.001$ , thus it can be concluded that there is no obvious common method bias in this study.

## Descriptive statistical analysis and correlation analysis

The mean, standard deviation and correlation coefficient of each study variable are shown in [Table 5](#), in which there is a significant positive correlation between ISC and EIB ( $r = 0.475$ ,  $p < 0.01$ ), is a significant positive correlation between ISC and innovative identity ( $r = 0.582$ ,  $p < 0.01$ ), and a significant positive correlation between innovative identity and employee innovation behavior ( $r = 0.682$ ,  $p < 0.01$ ), while there is no significant relationship between WF and ISC and EIB.

TABLE 3 Confirmatory factor analysis.

Model	$\chi^2$	df	$\chi^2/df$	GFI	NFI	CFI	RMSEA
Four-factor	107.664	71	1.516	0.951	0.954	0.984	0.043
three-factor	432.723	74	5.848	0.828	0.816	0.841	0.131
Two-factor	660.851	76	8.695	0.729	0.718	0.741	0.165
Single factor	909.820	77	11.816	0.643	0.612	0.631	0.195

Four-factor model, internal social capital, innovative identity, workplace friendship and innovative behavior; Three-factor model, internal social capital, innovative identity + workplace friendship, innovative behavior; Two-factor model, internal social capital + innovative identity, Workplace friendship + innovative behavior; Single factor model, internal social capital + innovative identity + workplace friendship + innovative behavior. “+” means mixed.

TABLE 4 Common method bias test.

Model	$\chi^2/df$	GFI	NFI	CFI	RMSEA
Four-factor	1.516	0.951	0.954	0.984	0.043
Add common method factor	1.406	0.963	0.966	0.990	0.038

TABLE 5 Descriptive statistics and correlation analysis.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. Gender	1.518	0.501	1.000								
2. Age	2.919	0.768	-0.038	1.000							
3. Educational level	4.032	0.664	0.036	0.188***	1.000						
4. Years working	2.042	0.622	0.009	0.376***	-0.029	1.000					
5. Organizational level	2.130	0.991	-0.087	0.384***	0.047	0.146**	1.000				
6. Internal social capital	3.690	0.784	-0.067	0.189***	0.140**	0.078	0.072	1.000			
7. Innovative identity	3.948	0.736	0.044	0.261***	0.168***	0.064	0.143**	0.582***	1.000		
8. Workplace friendship	3.330	0.967	0.055	-0.078	-0.058	0.132	0.030	0.089	0.051	1.000	
9. Employees' innovative behavior	3.777	0.792	-0.009	0.247***	-0.094	0.059	0.215***	0.475***	0.682***	0.029	1.000

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ .

## Empirical results analysis

We conduct an empirical analysis on Hypothesis 1, and the regression results are shown in [Table 6](#). Model 2 shows that the coefficient of ISC is 0.453 and significant at the 1% level, which indicates that ISC has a positive effect on EIB. This finding suggests the rich ISC provides employees with extensive opportunities for communication and cooperation, which helps to improve employees' knowledge absorptive capacity and acceptance of new knowledge. Therefore, Hypothesis 1 is supported.

## Mediating effect analysis

We conduct regression analysis according to the commonly used mediation test steps, and the results are shown in [Table 7](#). Firstly, Model 3 shows that ISC has a significant positive impact on innovative identity ( $\beta = 0.521$ ,  $p < 0.001$ ). Secondly, Model 4 shows that innovative identity has a significant positive effect on innovative behavior ( $\beta = 0.712$ ,  $p < 0.01$ ). Finally, take EIB as the dependent variable, we incorporate both ISC and innovative

TABLE 6 Benchmark regression analysis results.

Variable type	Variables	Innovative behavior	Innovative behavior
		Model 1	Model 2
Control variables	Gender	0.020	0.059
	Age	0.197***	0.136**
	Educational level	−0.080	−0.021
	Years working	−0.008	−0.015
	Organizational level	0.120**	0.116**
Independent variable	Internal social capital		0.453***
	R <sup>2</sup>	0.084	0.274
	F	5.075***	17.179***

\*\*\*p &lt; 0.01, \*\*p &lt; 0.05.

TABLE 7 Mediating effect analysis results.

Variable type	Variables	Innovative identity	Employees' innovative behavior	Employees' innovative behavior
		Model 3	Model 4	Model 5
Control variables	Gender	0.045	0.137*	−0.028
	Age	0.047*	0.140**	0.047
	Educational level	−0.025	−0.080	0.030
	Years working	−0.004	−0.013	−0.007
	Organizational level	0.08*	0.049	0.084**
Independent variable	Internal social capital	0.521***		0.121**
Mediating variable	Innovative identity		0.712***	0.638***
	R <sup>2</sup>	0.274	0.382	0.491
	F	17.179***	28.557***	37.919***

\*\*\*p &lt; 0.01, \*\*p &lt; 0.05, \*p &lt; 0.1.

identity into the empirical model, and the results show that innovative identity has a significant positive impact on EIB ( $\beta = 0.638, p < 0.01$ ). At the same time, ISC still has a significant positive impact on EIB, but the predictive effect is significantly reduced ( $\beta = 0.121, p < 0.01$ ). Therefore, innovative identity plays a partial mediating role in the influence path of ISC on EIB. Our empirical regression results support Hypothesis 2.

In addition, Table 8 shows that the upper and lower bounds of the Bootstrap 95% confidence interval of the direct effect of ISC on EIB and the mediating effect of innovative identity do not contain 0, indicating that ISC can not only directly affect EIB, but also have an impact on EIB through the mediating effect of innovative identity. The direct effect (0.121) and the

mediating effect (0.332) account for 26.71 and 73.29% of the total effect (0.453).

## Moderating effect analysis

The results of the moderating effect of WF between ISC and employee innovation behavior are shown in Table 9. It can be seen that the interaction item between ISC and WF has a significant positive impact on EIB ( $\beta = 0.136, p < 0.001$ ), which indicates that with high WF, the effect of ISC promotes EIB is more pronounced. Therefore, Hypothesis 3 is supported.

Figure 2 presents a moderating effect diagram indicating the effect of WF on the relationship between ISC and EIB. The solid and dashed lines show a cross trend, which indicates that WF has a significant moderating effect. The solid line represents the influence of ISC on EIB under high WF. The dashed line represents the influence of ISC on EIB under low WF. Meanwhile, the slopes of the two lines in high WF and low WF are both positive, and the slope of EIB is greater in high WF group. This shows that employees with high WF have more

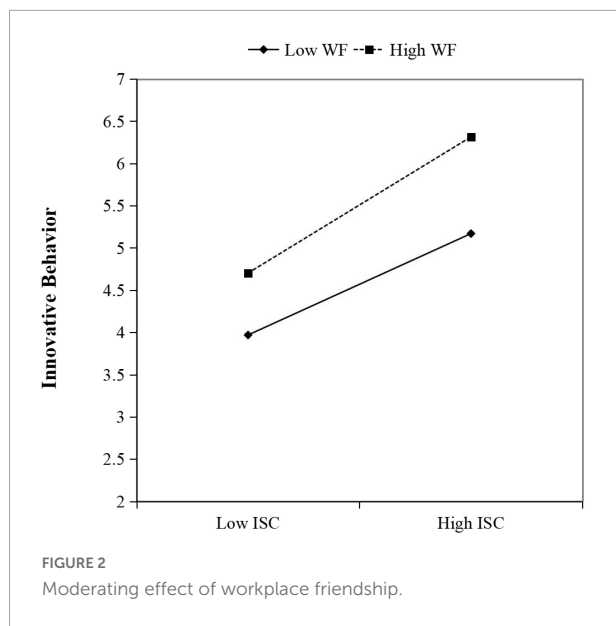
TABLE 8 Decomposition table of the total effect, direct effect and mediating effect.

	Effect value	Boot value	Boot LLCI	Boot ULCI	Relative effect value
Total effect	0.453	0.053	0.349	0.558	
Direct effect	0.121	0.054	0.014	0.228	26.71%
Mediation effect	0.332	0.051	0.235	0.453	73.29%

TABLE 9 Moderating effect regression results.

Variable type	Variables	Innovative behavior	Innovative behavior
		Model 2	Model 6
Control variables	Gender	0.059	0.018
	Age	0.136**	0.121*
	Educational level	−0.021	−0.024
	Years working	−0.015	−0.016
	Organizational level	0.116**	0.125***
Independent variable	Internal social capital	0.453***	0.444***
Moderator variable	Workplace friendship		−0.016
Interaction variable	Internal social capital*workplace friendship		0.136***
	R <sup>2</sup>	0.274	0.295
	F	17.179***	14.231***

\*\*\*p &lt; 0.01, \*\*p &lt; 0.05, \*p &lt; 0.1.



innovative behaviors than those with low WF when their ISC increases. Therefore, the influence of ISC on EIB is stronger in the context of high WF.

## Discussion

## Conclusions

This study constructs a relationship model among ISC, innovative identity, WF, and EIB, and focuses on the mediating effect of employees' innovative identity and the moderating effect of WF. Using structural equation model, multiple regression analysis and other methods to empirically test the collected data, this paper draws the following conclusions: (1) In this study, employees can learn new knowledge from other project groups through social network resources within the organization, which can improve employees' innovation motivation and work performance. The above research conclusions are consistent with those of Reddy et al. (2021) and Zhang et al. (2022). (2) Existing research has confirmed the promotion effect of ISC on EIB (Dong et al., 2017; Kiazad et al., 2019; Zhang et al., 2022). This paper enriches the research on the impact of employee emotional factors on innovation Literature on behavioral influences. This study shows that abundant ISC promotes interaction and technical learning among team members, which enables employees to develop a sense of innovative identity. And this innovative identity has a positive effect on EIB, which means that innovative identity plays a mediating role in the relationship between ISC and EIB. (3) Then, our research shows that employees with high WF s will communicate with each other more frequently and

get regular feedback about innovation from their workplace friends, which is consistent with the findings of Cao and Zhang (2020). This study further found that WF has a positive moderating effect on the relationship between ISC and EIB. In the context of higher WF, the positive effect of ISC on EIB is more significant.

## Theoretical contributions

EIB in the era of digital economy has become a hot research topic. Existing research mainly discusses the impact of external social capital on innovative behavior at the organizational level. However, the impact of ISC on EIB at the individual level is still controversial, and the impact mechanism is not yet clear. The theoretical contributions of this study are mainly in two aspects: Firstly, based on social identity theory and resource conservation theory, this paper embeds innovative identity into the relationship between ISC and EIB, and further discusses the role of innovative identity in the formation of EIB, which expands the perspective of EIB research, discovers the cognitive mechanism of the impact of ISC on EIB and responds to the call by related scholars that it is necessary to further explore the influence mechanism of ISC on EIB from the perspective of "identity" cognition. The conclusions of the study promote the cross-integration of sociology and management research. Secondly, in the context of Chinese culture, which emphasizes "interpersonal relationships," this study explores the heterogeneous impact of WF on the relationship between ISC and EIB, and examines the boundary of the impact of ISC on EIB. From the emotional level with Chinese characteristics, this paper explains why the influence of ISC on EIB is different, which responds to the relevant scholars' proposal to further analyze the reasons for the difference in the influence of ISC on employees' behavior and provides theoretical support for how to create conditions to promote individual innovative behavior in management practice.

## Practical contributions

This study provides new insights and solutions for promoting the employees' behavior. Innovation is the foundation for an enterprise to develop and maintain its competitive advantage. As an important resource in the modern workplace, the impact of ISC on EIB is an issue that scholars focus on. The samples of this survey are mainly employees born after 1985, who are usually considered to be the new generation of employees with unique personality and creativity. How to stimulate the innovative vitality of the new generation of employees to create value for the enterprise is an important practical problem faced by the



enterprise. The conclusions of this paper have important practical value for guiding the innovative behavior of the new generation of employees. Firstly, the research results show that ISC can arouse the innovative identity of the new generation of employees, which can motivate their independent innovative behavior. With the development of the digital economy and dramatic changes in organizational structure, the new generation of employees is no longer subject to authority and shackles. Therefore, organizational leaders should pay attention to the importance of ISC, and create a good internal learning and communication platform for employees through quality development, team training and cross-departmental mutual aid groups, which can enhance the trust relationship and the ability to acquire social capital among employees. In addition, the new generation of employees pays more attention to their intrinsic value. Innovative sense of identity helps to improve work enthusiasm and thus generate innovative behaviors. Therefore, managers should take identity as one of the contents of daily management and performance assessment in management practice, and should strive to cultivate a culture of innovation and empower internal community innovation, which can enhance employees' innovative identity.

Secondly, this paper shows that the relationship between ISC and EIB is affected by the level of WF. Under high WF, the innovation cost of employees will be significantly reduced with the increase of social capital, which will stimulate employees' enthusiasm for innovation. However, under low WF, even though rich ISC can broaden the channels for employees to obtain key resources, innovative behavior is reduced due to unfriendly behavior among colleagues. As an informal interpersonal relationship, WF plays an important role in promoting the formation of EIB by ISC. Therefore, managers need to emphasize the trust and friendship among team members in addition to the positive role of ISC. In view of the new generation's preference for freedom and equality, on the one hand, enterprises can create a comfortable workplace environment by establishing a "flat" organizational structure and adopting open office, group building and democratic management. On the other hand, enterprises can improve WF by organizational care and regular cross-departmental activities to meet the emotional needs of employees.

## Limitations and future research

This study also has some limitations. First, the items of the questionnaire are self-assessed by employees, and although there is no serious common method bias, it may still have an impact on the results. In the future, the article can adopt the mode of mutual evaluation and scoring between leaders and employees to reduce homologous variance. Second, this study mainly analyzes how to create an environment conducive to

innovation within the organization. Future research can explore the role of personal factors such as self-motivation and efficacy identification on EIB, and further refine the moderating role of employees' characteristic heterogeneity.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

XZ and CY conceived and designed the experiments and collected and interpreted the data. CC analyzed the data, examined, critically contributed, and finally approved the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Abdumuhsin, A. A., and Tarhini, A. (2022). Impact of wise leadership, workplace friendships on open innovation in family firms: A developing country perspective. *J. Family Bus. Manage.* 12, 1–23. doi: 10.1108/JFBM-04-2020-0028
- Akbari, M., Bagheri, A., Imani, S., and Asadnezhad, M. (2021). Does entrepreneurial leadership encourage innovation work behavior? The mediating role of creativity self-efficacy and support for innovation. *Eur. J. Innov. Manage.* 24, 1–22. doi: 10.1108/EJIM-10-2019-0283
- Al-Ghazali, B. M., Sohail, M. S., and Jumaan, I. A. M. (2021). CSR perceptions and career satisfaction: The role of psychological capital and moral identity. *Sustainability* 13:6786. doi: 10.3390/su13126786
- Campbell, J. W. (2020). Workgroup accord and change-oriented behavior in public service organizations: Mediating and contextual factors. *J. Manage. Organ.* 26, 719–735. doi: 10.1017/jmo.2018.42
- Cao, F. Y., and Zhang, H. M. (2020). Workplace friendship, psychological safety and innovative behavior in China A moderated-mediation model. *Chin. Manage. Stud.* 14, 661–676. doi: 10.1108/CMS-09-2019-0334
- Chen, H., Jiao, J., Yang, N., and Wang, X. H. (2021). How identity conflict and identity synergy influence innovative performance of employees with multiple team membership. *Psychol. Rep.* 124, 792–808. doi: 10.1177/0033294120916863
- Chen, L., Zheng, W., Yang, B. Y., and Bai, S. J. (2016). Transformational leadership, social capital and organizational innovation. *Leadersh. Organ. Dev. J.* 37, 843–859. doi: 10.1108/LODJ-07-2015-0157
- Cohen, A., and Ehrlich, S. (2019). Exchange variables, organizational culture and their relationship with constructive deviance. *Manage. Res. Rev.* 42, 1423–1446. doi: 10.1108/MRR-09-2018-0354
- Dong, Y. T., Bartol, K. M., Zhang, Z. X., and Li, C. W. (2017). Enhancing employee creativity via individual skill development and team knowledge sharing: Influences of dual-focused transformational leadership. *J. Organ. Behav.* 38, 439–458. doi: 10.1002/job.2134
- Goh, K. T., Krackhardt, D., Weingart, L. R., and Koh, T. K. (2014). The role of simmelian friendship ties on retaliation within triads. *Small Group Res.* 45, 471–505. doi: 10.1177/1046496414537689
- Halisah, A., Jayasingam, S., Ramayah, T., and Popa, S. (2021). Social dilemmas in knowledge sharing: An examination of the interplay between knowledge sharing culture and performance climate. *J. Knowl. Manage.* 25, 1708–1725. doi: 10.1108/JKM-08-2020-0631
- He, H. W., Zhu, W. C., and Zheng, X. M. (2014). Procedural justice and employee engagement: Roles of organizational identification and moral identity centrality. *J. Bus. Ethics* 122, 681–695. doi: 10.1007/s10551-013-1774-3
- He, P. X., Zhou, Q. Y., Zhao, H. D., Jiang, C. L., and Wu, Y. J. (2020). Compulsory citizenship behavior and employee creativity: Creative self-efficacy as a mediator and negative affect as a moderator. *Front. Psychol.* 11:1640. doi: 10.3389/fpsyg.2020.01640
- Hu, L. Y., and Randel, A. E. (2014). Knowledge sharing in teams social capital, extrinsic incentives, and team innovation. *Group Organ. Manage.* 39, 213–243. doi: 10.1177/1059601114520969
- Jonsson, T. F., and Kahler, H. G. (2022). The savvy and cheerful employee innovation champions: The roles of political skill and trait-positive affect in employees' championing and salary levels. *Creat. Innov. Manage.* 31, 236–247. doi: 10.1111/caim.12496
- Kiazad, K., Kraimer, M. L., and Seibert, S. E. (2019). More than grateful: How employee embeddedness explains the link between psychological contract fulfillment and employee extra-role behavior. *Hum. Relat.* 72, 1315–1340. doi: 10.1177/0018726718806352
- Kohan, N. A., Safari, A., and Teimouri, H. (2018). Friendship, transformational leadership and organizational climate. *Hum. Syst. Manage.* 37, 319–331. doi: 10.3233/HSM-17129
- Krug, H., Haslam, S. A., Otto, K., and Steffens, N. K. (2021). Identity leadership, social identity continuity, and well-being at work during COVID-19. *Front. Psychol.* 12:684475. doi: 10.3389/fpsyg.2021.684475
- Kumar, D., Upadhyay, Y., Yadav, R., and Goyal, A. K. (2022). Psychological capital and innovative work behaviour: The role of mastery orientation and creative self-efficacy. *Int. J. Hosp. Manage.* 102:103157. doi: 10.1016/j.ijhm.2022.103157
- Kuo, Y. K., Kuo, T. H., and Ho, L. A. (2014). Enabling innovative ability: Knowledge sharing as a mediator. *Ind. Manage. Data Syst.* 114, 696–710. doi: 10.1108/IMDS-10-2013-0434
- Lee, A. Y. P., Chang, P. C., and Chang, H. Y. (2022). How workplace fun promotes informal learning among team members: A cross-level study of the relationship between workplace fun, team climate, workplace friendship, and informal learning. *Empl. Relat.* 44, 870–889. doi: 10.1108/ER-06-2021-0251
- Lei, S., Qin, C. J., Ali, M., Freeman, S., and Zheng, S. J. (2021). The impact of authentic leadership on individual and team creativity: A multilevel perspective. *Leadersh. Organ. Dev. J.* 42, 644–662. doi: 10.1108/LODJ-12-2019-0519
- Li, G. H., Pervaiz, S., and Qi, H. (2021). Workplace friendship is a blessing in the exploration of supervisor behavioral integrity, affective commitment, and employee proactive behavior—An empirical research from service industries of Pakistan. *Psychol. Res. Behav. Manage.* 14, 1447–1459. doi: 10.2147/PRBM.S329905
- Li, H. H., Xu, C. W., and Zheng, H. Z. (2021). Psychological contracts and employee innovative behaviours: A moderated mediation effect model. *Discrete Dyn. Nat. Soc.* 2021:6400742. doi: 10.1155/2021/6400742
- Li, Y. B., Zhang, G. Q., and Liu, L. J. (2021). Platform corporate social responsibility and employee innovation performance: A cross-layer study mediated by employee intrapreneurship. *Sage Open* 11:21582440211021406. doi: 10.1177/21582440211021406
- Li, Z. W., Dai, L. H., Chin, T., and Rafiq, M. (2019). Understanding the role of psychological capital in humorous leadership-employee creativity relations. *Front. Psychol.* 10:1636. doi: 10.3389/fpsyg.2019.01636
- Liu, C. E., Hu, C. H., Xie, W., Liu, T. T., and He, W. (2020). The moderated-mediation effect of workplace anxiety and regulatory focus in the relationship between work-related identity discrepancy and employee innovation. *Int. J. Environ. Res. Public Health* 17:6121. doi: 10.3390/ijerph17176121
- Li-Ying, J., Paunova, M., and Egerod, I. (2016). Knowledge sharing behaviour and intensive care nurse innovation: The moderating role of control of care quality. *J. Nurs. Manage.* 24, 943–953. doi: 10.1111/jonm.12404
- Lombardi, S., Cavaliere, V., Giustiniano, L., and Cipollini, F. (2020). What money cannot buy: The detrimental effect of rewards on knowledge sharing. *Eur. Manage. Rev.* 17, 153–170. doi: 10.1111/emre.12346
- Luoh, H. F., Tsaur, S. H., and Tang, Y. Y. (2014). Empowering employees: Job standardization and innovative behavior. *Int. J. Contemp. Hosp. Manage.* 26, 1100–1117. doi: 10.1108/IJCHM-03-2013-0153
- Mao, N. (2022). The role of music therapy in the emotional regulation and psychological stress relief of employees in the workplace. *J. Healthc. Eng.* 2022:4260904. doi: 10.1155/2022/4260904
- McCormick, B. W., Guay, R. P., Colbert, A. E., and Stewart, G. L. (2019). Proactive personality and proactive behaviour: Perspectives on person-situation interactions. *J. Occup. Organ. Psychol.* 92, 30–51. doi: 10.1111/joop.12234
- Method, J. R., Lepine, J. A., Podsakoff, N. P., and Christian, J. S. (2016). Are workplace friendships a mixed blessing? Exploring tradeoffs of multiplex relationships and their associations with job performance. *Pers. Psychol.* 69, 311–355. doi: 10.1111/ppeps.12109
- Nahapiet, J., and Ghoshal, S. (1998). Social capital, intellectual capital and the organizational advantage, academy of management. *Acad. Manage. Rev.* 3, 242–266.
- Nazir, S., Shafi, A., Asadullah, M. A., Qun, W., and Khadim, S. (2021). Linking paternalistic leadership to follower's innovative work behavior: The influence of leader-member exchange and employee voice. *Eur. J. Innov. Manage.* 24, 1354–1378. doi: 10.1108/EJIM-01-2020-0005
- Ng, T. W. H., Feldman, D. C., and Lam, S. S. K. (2010). Psychological contract breaches, organizational commitment, and innovation-related behaviors: A latent growth modeling approach [Journal Article]. *J. Appl. Psychol.* 95, 744–751. doi: 10.1037/a0018804
- Nielsen, I. K., Jex, S. M., and Adams, G. A. (2000). Development and validation of scores on a two-dimensional workplace friendship scale. *Educ. Psychol. Meas.* 60, 628–643. doi: 10.1177/00131640021970655
- Obrenovic, B., Du, J. G., Tsou, D., Obrenovic, S., Khan, M. A. S., and Anwar, F. (2020). The enjoyment of knowledge sharing: Impact of altruism on tacit knowledge-sharing behavior. *Front. Psychol.* 11:1496. doi: 10.3389/fpsyg.2020.01496
- Ozbek, M. F. (2018). Do we need friendship in the workplace? The theory of workplace friendship and employee outcomes: The role of work ethics. *J. Econ. Cult. Soc.* 58, 153–176. doi: 10.26650/JECSC417777
- Purc, E., and Laguna, M. (2019). Personal values and innovative behavior of employees. *Front. Psychol.* 10:865. doi: 10.3389/fpsyg.2019.00865
- Reade, C., and Lee, H. J. (2016). Does ethnic conflict impede or enable employee innovation behavior? The alchemic role of collaborative conflict management. *Int. J. Confl. Manage.* 27, 199–224. doi: 10.1108/IJCM-09-2014-0071

- Reddy, S. M. W., Torphy, K., Liu, Y. Q., Chen, T. Q., Masuda, Y. J., Fisher, J. R. B., et al. (2021). How different forms of social capital created through project team assignments influence employee adoption of sustainability practices. *Organ. Environ.* 34, 43–73. doi: 10.1177/1086026619880343
- Rumens, N. (2017). Researching workplace friendships: Drawing insights from the sociology of friendship. *J. Soc. Pers. Relationsh.* 34, 1149–1167. doi: 10.1177/0265407516670276
- Scott, S. G., and Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Acad. Manage. J.* 37, 580–607.
- Shin, D., Woodward, M. J., Konrad, A. M., and Jung, Y. (2022). Innovation strategy, voice practices, employee voice participation, and organizational innovation. *J. Bus. Res.* 147, 392–402. doi: 10.1016/j.jbusres.2022.04.015
- Smids, A., Pruyn, A. T. H., and Van Riel, C. B. M. (2001). The impact of employee communication and perceived external prestige on organizational identification. *Acad. Manage. J.* 44, 1051–1062.
- Song, D. R., Liu, H. F., Gu, J. B., and He, C. Q. (2018). Collectivism and employees' innovative behavior: The mediating role of team identification and the moderating role of leader-member exchange. *Creat. Innov. Manage.* 27, 221–231. doi: 10.1111/caim.12253
- Sozbilir, F. (2018). The interaction between social capital, creativity and efficiency in organizations. *Think. Skills Creat.* 27, 92–100. doi: 10.1016/j.tsc.2017.12.006
- Tang, C. Y., and Naumann, S. E. (2016). The impact of three kinds of identity on research and development employees' incremental and radical creativity. *Think. Skills Creat.* 21, 123–131. doi: 10.1016/j.tsc.2016.06.003
- Tian, G. X., and Zhang, Z. (2020). Linking empowering leadership to employee innovation: The mediating role of work engagement. *Soc. Behav. Pers.* 48:e9320. doi: 10.2224/sbp.9320
- Tsai, W., and Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *Acad. Manage. J.* 41, 464–476. doi: 10.2307/257085
- Tsang, S. S., Chen, T. Y., Wang, S. F., and Tai, H. L. (2012). Nursing work stress: The impacts of social network structure and organizational citizenship behavior. *J. Nurs. Res.* 20, 9–18. doi: 10.1097/JNR.0b013e318247bf11
- Ullah, I., Mirza, B., and Jamil, A. (2021). The influence of ethical leadership on innovative performance: Modeling the mediating role of intellectual capital. *J. Manage. Dev.* 40, 273–292. doi: 10.1108/JMD-08-2020-0277
- Wang, C. H., Xu, J. H., Zhang, T. C., and Li, Q. L. M. (2020). Effects of professional identity on turnover intention in China's hotel employees: The mediating role of employee engagement and job satisfaction. *J. Hosp. Tour. Manage.* 45, 10–22. doi: 10.1016/j.jhttm.2020.07.002
- Wang, J. R., Yang, J., and Xue, Y. J. (2017). Subjective well-being, knowledge sharing and individual innovation behavior the moderating role of absorptive capacity. *Leadersh. Organ. Dev. J.* 38, 1110–1127.
- Wu, C. H., Parker, S. K., and de Jong, J. P. J. (2014). Need for cognition as an antecedent of individual innovation behavior. *J. Manage.* 40, 1511–1534. doi: 10.1177/0149206311429862
- Yan, C. H., Ni, J. J., Chien, Y. Y., and Lo, C. F. (2021). Does workplace friendship promote or hinder hotel employees' work engagement? The role of role ambiguity. *J. Hosp. Tour. Manage.* 46, 205–214.
- Yang, J., and Qin, Y. J. (2022). Influence of work pressure and psychological distance on innovation behavior of employees in the sports industry. *Rev. Psicol. Deporte* 31, 79–87.
- Yang, K. P., Chou, C., and Chiu, Y. J. (2014). How unlearning affects radical innovation: The dynamics of social capital and slack resources. *Technol. Forecast. Soc. Change* 87, 152–163. doi: 10.1016/j.techfore.2013.12.014
- Ye, P. H., Liu, L. Q., and Tan, J. (2021). Influence of knowledge sharing, innovation passion and absorptive capacity on innovation behaviour in China. *J. Organ. Change Manage.* 34, 894–916. doi: 10.1108/JOCM-08-2020-0237
- Zhang, Y., Long, L. R., and Zhang, J. W. (2015). Pay for performance and employee creativity the importance of procedural justice and willingness to take risks. *Manage. Decis.* 53, 1378–1397. doi: 10.1108/MD-11-2013-0596
- Zhang, Y., Xi, W., and Xu, F. Z. (2022). Determinants of employee innovation: An open innovation perspective. *J. Hosp. Market. Manage.* 31, 97–124. doi: 10.1080/19368623.2021.1934933
- Zhou, J., Yang, J., and Zhou, X. (2021). Customer cooperation and employee innovation behavior: The roles of creative role identity and innovation climates. *Front. Psychol.* 12:639531. doi: 10.3389/fpsyg.2021.639531



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# Self-reported work-related accumulative fatigue of nurses: A cross-sectional study in public hospitals in China

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**Objectives:** Work-related fatigue is a serious safety risk to nurses and their patients. This study aimed to assess self-reported work-related accumulative fatigue of nurses and its associated factors.

**Methods:** A questionnaire survey of 2,918 clinical nurses conveniently sampled from 48 public hospitals across six provinces in China was conducted. The "Self-diagnosis Checklist for Assessment of Workers' Accumulated Fatigue" was adopted to assess the level of work-related accumulative fatigue of the study participants. Chi-square tests and ordinal regression analyses were performed to determine the sociodemographic characteristics associated with work-related accumulative fatigue.

**Results:** About one third of respondents reported low work-related accumulative fatigue, compared with 23.1% reporting high and 24.6% reporting very high levels of work-related accumulative fatigue. Higher levels of work-related accumulative fatigue were associated with female gender (AOR = 0.614 for male relative to female,  $p = 0.005$ ), age between 30 and 40 years (AOR = 1.346 relative to >40 years,  $p = 0.034$ ), 5–10 years of work experience (AOR = 1.277 relative to >10 years,  $p = 0.034$ ), and bachelor or above degree qualifications (AOR = 0.806 for associate degree relative to bachelor or above degree,  $p = 0.007$ ). Those who worked in rural county hospitals (AOR = 0.816 for metropolitan relative to rural county hospitals,  $p = 0.006$ ) and resided in central China (AOR = 1.276 relative to western China,  $p = 0.004$ ) had higher odds of reporting higher levels of work-related accumulative fatigue.

**Conclusion:** High levels of work-related accumulative fatigue are evident in nurses of public hospitals in China. The problem is more serious in the female nurses in their mid-career and those who worked in the central region and rural setting.

## KEYWORDS

work-related accumulative fatigue, nurse, public hospital, cross-sectional survey, China

## Introduction

Fatigue of nurses is a safety risk for both nurses and patients (1, 2). It not only affects the health of nurses, but also increases the risk of medical errors (3–5). Fatigue is associated with anxiety, depression, poor quality of sleep (6), and increased sick leave (7). It jeopardizes the clinical performance of healthcare workers (8–10). Nurse fatigue was reported to have played a role in 83% of medical errors (11). Long night shifts are often blamed for inevitable fatigue of nurses (12–14). However, our understanding about work-related accumulative fatigue in nurses has been limited.

Nursing services are critical in all aspects of health care. As the largest health workforce, nurses have made great contributions to the maintenance of population health and ensuring global health security (15). However, the shortage of nursing staff has been a worldwide concern (16), which can impose excessive physical and mental loads on the practicing nurses (17). Many nurses have experienced accumulative fatigue and burnout, and eventually chosen to leave the healthcare industry, resulting in a vicious circle of workforce shortage (18–20).

Over the past few decades, China has experienced unprecedented rapid socioeconomic development, including in the health sector. However, like in many low- and middle-income countries (21), a sustained shortage of human resources in health has been a significant barrier for meeting the ever-increasing needs of consumers. The shortage of nursing workforce is particularly serious in China. Although the number of registered nurses more than doubled within 10 years, increasing from 1.85 million (1.39 per 1,000 population) in 2009 to 4.10 million (2.94 per 1,000 population) in 2018 (22), the nursing shortage problem persists in China (23). On average, the world has 4 nurses per 1,000 population in 2017, 15.7 in the United States, 12.7 in Japan, and 7.5 in Korea in 2018 (24). The doctor-nurse ratio in China reached 1:1.14 in 2018 (1: 1.15 in 2020), still lower than the target (1:2) set up by the Chinese government (22, 25).

There exist significant regional and setting disparities in the distribution of health workforce in China (26). In 2018, the number of registered nurses per 1,000 population reached 5.08

in urban facilities in China, compared with 1.80 in rural. The central region had the lowest number of nurses (2.7 per 1,000 urban and rural population) (22).

This study aimed to determine the prevalence of work-related accumulative fatigue in nurses in China's public hospitals and its associated factors.

## Methods

A cross-sectional survey of nurses in public hospitals was conducted. Ethics approval was granted by the Research Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (No: IORG0003571).

### Study setting

The study was conducted in the public hospitals sampled from both urban and rural settings across eastern, central, and western regions of China. In China, public hospitals account for more than 73% of hospital beds whilst employing more than 79% of registered nurses in 2018 (22). Consumers enjoy freedom to choose among different levels of medical institutions. Both urban and rural public hospitals are usually overcrowded (27, 28).

### Study sample

Study participants were recruited using a multi-stage stratified sampling strategy. Two provinces from the most developed eastern region (Shandong and Hebei), the developing central region (Hubei and Hunan), and the least developed western region (Guizhou and Qinghai) were purposely identified first, respectively. This was followed by convenient sampling of four metropolitan public tertiary hospitals and four rural county public hospitals in each participating province.

Clinical nurses who had direct patient contacts in the 48 sample hospitals were eligible for the survey. A sample size of 2,422 to 3,776 would enable detection of a difference of 2–2.5 percentage points should 25% respondents had a certain level of work-related accumulative fatigue (assuming an even distribution of respondents across the four levels of accumulative fatigue), with  $\alpha$  being set at 0.05 and statistical power ( $1-\beta$ ) being set at 0.80 (29). Therefore, we decided to recruit 80 nurses from each metropolitan tertiary hospital and 60 nurses from each rural county hospital.

TABLE 1 Classification of work-related accumulative fatigue.

Fatigue symptoms	Level of work burden			
	A (0)	B (1,2)	C (3–5)	D (6–15)
I (0–4)	low	low	a little high	high
II (5–10)	low	low	a little high	high
III (11–20)	low	a little high	high	very high
IV (21–39)	low	a little high	high	very high



TABLE 2 Characteristics of study participants ( $n = 2,918$ ).

Characteristics	Total <i>N</i> (%)	Region, <i>N</i> (%)				Hospital, <i>N</i> (%)		
		Eastern	Central	Western	<i>p</i>	Metropolitan	Rural country	<i>p</i>
Gender								
Male	105 (3.6)	61 (6.4)	11 (1.2)	33 (3.3)	<0.001	47 (2.7)	58 (5.0)	0.001
Female	2,813 (96.4)	895 (93.6)	943 (98.8)	975 (96.7)		1,719 (97.3)	1,094 (95.0)	
Age (years)								
<30	1,344 (46.1)	403 (42.2)	478 (50.1)	463 (45.9)	0.009	800 (45.3)	544 (47.2)	0.127
30–40	1,251 (42.9)	434 (45.4)	387 (40.6)	430 (42.7)		754 (42.7)	497 (43.1)	
>40	323 (11.1)	119 (12.4)	89 (9.3)	115 (11.4)		212 (12.0)	111 (9.6)	
Marital status								
Married	2,169 (74.3)	711 (74.4)	700 (73.4)	758 (75.2)	0.652	1,268 (71.8)	901 (78.2)	<0.001
Not married	749 (25.7)	245 (25.6)	254 (26.6)	250 (24.8)		498 (28.2)	251 (21.8)	
Qualification								
Associate degree	929 (31.8)	296 (31.0)	276 (28.9)	357 (35.4)	0.007	447 (25.3)	482 (41.8)	<0.001
Bachelor degree or above	1,989 (68.2)	660 (69.0)	678 (71.1)	651 (64.6)		1,319 (74.7)	670 (58.2)	
Professional title								
No title	383 (13.1)	163 (17.1)	93 (9.7)	127 (12.6)	<0.001	237 (13.4)	146 (12.7)	0.005
Junior	1,703 (58.4)	507 (53.0)	570 (59.7)	626 (62.1)		991 (56.1)	712 (61.8)	
Middle	734 (25.2)	251 (26.3)	255 (26.7)	228 (22.6)		467 (26.4)	267 (23.2)	
Senior	98 (3.4)	35 (3.7)	36 (3.8)	27 (2.7)		71 (4.0)	27 (2.3)	
Monthly salary (Yuan)								
<5,000	1,774 (60.8)	600 (62.8)	677 (71.0)	497 (49.3)	<0.001	893 (50.6)	881 (76.5)	<0.001
5,000–8,000	1,040 (35.6)	322 (33.7)	260 (27.3)	458 (45.4)		777 (44.0)	263 (22.8)	
>8,000	104 (3.6)	34 (3.6)	17 (1.8)	53 (5.3)		96 (5.4)	8 (0.7)	
Years of work experience								
<5	802 (27.5)	279 (29.2)	239 (25.1)	284 (28.2)	0.192	500 (28.3)	302 (26.2)	<0.001
5–10	1,283 (44.0)	403 (42.2)	447 (46.9)	433 (43.0)		720 (40.8)	563 (48.9)	
>10	833 (28.5)	274 (28.7)	268 (28.1)	291 (28.9)		546 (30.9)	287 (24.9)	
Total	2,918 (100)	956 (32.8)	954 (32.7)	1,008 (34.5)		1,766 (60.5)	1,152 (39.5)	

## Survey instrument

The questionnaire was developed in Chinese language, which contained two sections. The first section tapped into the sociodemographic characteristics of respondents, including gender (male, female), age (years), marital status (married, not married), qualification (associate degree, bachelor degree or above), professional title (no title, junior, middle, senior), monthly salary (<5,000, 5,000–8,000, >8,000 Yuan), and years of work experience.

The second section measured work-related accumulative fatigue using the “*Self-diagnosis Checklist for Assessment of Workers’ Accumulated Fatigue*” scale, which was developed by the Ministry of Health, Labor and Welfare of Japan, and had been adapted to the context of China and validated in a variety of settings (30–32). The scale contains 13 items measuring symptoms of fatigue (such as sleepy, irritation,

tiredness, anxiety, and difficult to focus) and 7 items measuring work burden (such as overwork, irregular schedule, night shift, and break time). The fatigue symptoms were rated on a three-point frequency scale (0 = rarely; 1 = sometimes; 3 = often), resulting in a summed score that categories fatigue into four grades: I (0–4); II (5–10); III (11–20); IV (21–39) (32). The work burden items were rated on a two- or three-point scale, ranging from low (0) to high (1 or 3) burdens (Supplementary Table S1). A summed score was then calculated to categorize work burden into four levels: A (0); B (1–2); C (3–5); and D (6–15) (32). The subscales of fatigue symptoms and work burden had a Cronbach’s alpha coefficient of 0.931 and 0.813, respectively, in this study, indicating good internal consistency.

The two subscales generated a matrix (Table 1) that classifies work-related accumulative fatigue into four levels: low, a little high, high, and very high (28).



TABLE 3 Fatigue symptoms and work burden reported by respondents ( $n = 2,918$ ).

	Total N (%)	Region, N (%)			<i>p</i>	Hospital, N (%)		<i>p</i>
		Eastern	Central	Western		Urban	Rural	
Fatigue symptoms								
I (0–4)	428 (14.7)	161 (16.8)	121 (12.7)	146 (14.5)	<0.001	274 (15.5)	154 (13.4)	0.381
II (5-10)	774 (26.5)	288 (30.1)	226 (23.7)	260 (25.8)		466 (26.4)	308 (26.7)	
III (11–20)	1,160 (39.8)	354 (37.0)	411 (43.1)	395 (39.2)		700 (39.6)	460 (39.9)	
IV (21–39)	556 (19.1)	153 (16.0)	196 (20.5)	207 (20.5)		326 (18.5)	230 (20.0)	
Work burden								
A (0)	645 (22.1)	222 (23.2)	186 (19.5)	237 (23.5)	0.001	415 (23.5)	230 (20.0)	<0.001
B (1-2)	585 (20.0)	189 (19.8)	171 (17.9)	225 (22.3)		382 (21.6)	203 (17.6)	
C (3-5)	894 (30.6)	295 (30.9)	291 (30.5)	308 (30.6)		525 (29.7)	369 (32.0)	
D (6-15)	794 (27.2)	250 (26.2)	306 (32.1)	238 (23.6)		444 (25.1)	350 (30.4)	

## Data collection

Data were collected from January to November 2018. Trained investigators visited the participating hospitals and invited the eligible nurses to self-complete the questionnaire. The survey was anonymous. On average, each survey took 5 to 10 min to complete. Implied informed consent was obtained from each participant prior to the survey. Participation in the survey was completely anonymous and voluntary. A total of 3,246 questionnaires were returned, with 2,918 (86.85%) containing no missing values and being included in data analysis.

## Statistical analysis

Data were entered into EpiData 3.0 and analyzed using SPSS 19.0. A two-side  $p$ -value of  $<0.05$  was considered statistically significant.

The characteristics of study participants were described through frequency distributions and compared between urban and rural settings and across the three regions using Chi-square tests. We tested the urban-rural and regional differences in the frequency distributions of fatigue symptoms and work burden in the study participants first using Chi-square tests (Supplementary Table S2), before presenting the levels of work-related accumulative fatigue by the characteristics of study participants. Multivariate ordinal regression models were established to determine the sociodemographic characteristics associated with work-related accumulated fatigue.

## Results

### Characteristics of respondents

The vast majority of respondents were women (96.4%), younger than 40 years (89.0%), married at the time of the survey

(74.3%), and obtained a university degree (68.2%). Most (58.4%) had a junior professional title, and earned  $< 5,000$  Yuan monthly salary (equivalent to 740 US dollar). About 44% had 5–10 years of work experience (Table 2).

The respondents from the more developed eastern region were older compared with their central and western counterparts. A higher percentage of male nurses from the eastern region and the rural setting participated in the survey. The rural participants were more likely to be married than their urban counterparts. The participants from the western region and the rural setting had lower levels of education and lower salary, although the rural participants had longer working experience (Table 2).

### Fatigue symptoms and work burden

About 19% of respondents reported grade IV fatigue symptoms. Those from the central and western regions ( $p < 0.001$ ) were more likely to report higher levels of fatigue (Table 3).

Similarly, 27.2% of respondents reported level D work burden. Those from the central region ( $p = 0.001$ ) and rural settings ( $p < 0.001$ ) were more likely to report higher levels of work burden (Table 3). Higher levels of fatigue symptoms were associated with higher levels of work burden (Supplementary Table S3).

### Work-related accumulative fatigue

About one third of respondents reported low work-related accumulative fatigue, while 23.1% reported high and 24.6% reported very high levels of work-related accumulative fatigue (Table 4). Female gender ( $p < 0.001$ ) and younger age ( $p = 0.002$ ) were associated with higher work-related accumulative fatigue. Those who were married ( $p = 0.001$ ), held a bachelor degree or above degree ( $p < 0.001$ ), and had a professional title

TABLE 4 Sociodemographic characteristics associated with work-related accumulative fatigue ( $n = 2,918$ ).

Characteristics	Work-related accumulative fatigue				<i>p</i>
	Low	A little high	High	Very high	
<b>Gender</b>					
Male	32 (30.5)	50 (47.6)	10 (9.5)	13 (12.4)	<0.001
Female	932 (33.1)	511 (18.2)	664 (23.6)	706 (25.1)	
<b>Age (years)</b>					
<30	483 (35.9)	242 (18.0)	299 (22.2)	320 (23.8)	0.002
30–40	358 (28.6)	257 (20.5)	304 (24.3)	332 (26.5)	
>40	123 (38.1)	62 (19.2)	71 (22.0)	67 (20.7)	
<b>Marital status</b>					
Married	673 (31.0)	432 (19.9)	515 (23.7)	549 (25.3)	0.001
Not married	291 (38.9)	129 (17.2)	159 (21.2)	170 (22.7)	
<b>Qualification</b>					
Associate degree	361 (38.9)	159 (17.1)	215 (23.1)	194 (20.9)	<0.001
Bachelor degree or above	603 (30.3)	402 (20.2)	459 (23.1)	525 (26.4)	
<b>Professional title</b>					
No title	190 (49.6)	54 (14.1)	78 (20.4)	61 (15.9)	<0.001
Junior	529 (31.1)	333 (19.6)	396 (23.3)	445 (26.1)	
Middle	219 (29.8)	151 (20.6)	168 (22.9)	196 (26.7)	
Senior	26 (26.5)	23 (23.5)	32 (32.7)	17 (17.3)	
<b>Monthly salary (Yuan)</b>					
<5,000	554 (31.2)	346 (19.5)	406 (22.9)	468 (26.4)	0.067
5,000–8,000	368 (35.4)	197 (18.9)	243 (23.4)	232 (22.3)	
>8,000	42 (40.4)	18 (17.3)	25 (24.0)	19 (18.3)	
<b>Years of work experience</b>					
<5	330 (41.1)	141 (17.6)	162 (20.0)	169 (21.1)	<0.001
5–10	355 (27.7)	260 (20.3)	316 (24.6)	352 (27.4)	
>10	279 (33.5)	160 (19.2)	196 (23.5)	198 (23.8)	
<b>Hospitals</b>					
Metropolitan	616 (34.9)	345 (19.5)	402 (22.8)	403 (22.8)	0.011
Rural county	348 (30.2)	216 (18.8)	272 (23.6)	316 (27.4)	
<b>Region</b>					
Eastern	331 (34.6)	206 (21.5)	201 (21.0)	218 (22.8)	<0.001
Central	265 (27.8)	185 (19.4)	221 (23.2)	283 (29.7)	
Western	368 (36.5)	170 (16.9)	252 (25.0)	218 (21.6)	
Total	964 (33.0)	561 (19.2)	674 (23.1)	719 (24.6)	

( $p < 0.001$ ) and over 5 years of work experience ( $p < 0.001$ ) were more likely to report higher levels of work-related accumulative fatigue. Higher levels of work-related accumulative fatigue were also reported by the respondents from the central region ( $p < 0.001$ ) and rural settings ( $p = 0.011$ ).

The ordinal logistic modeling confirmed that male respondents (AOR = 0.614,  $p = 0.005$ ) and those who had associate degree (AOR = 0.806,  $p = 0.007$ ), held a junior title (AOR = 0.644,  $p = 0.046$ ) or no title (AOR = 0.374,  $p < 0.001$ ), and worked in metropolitan hospitals (AOR = 0.816,  $p = 0.006$ ) had lower levels of work-related accumulative fatigue.

By contrast, an age between 30 and 40 years (AOR = 1.346,  $p = 0.034$ ), 5–10 years of work experience (AOR = 1.277,  $p = 0.034$ ), and working in the central region (OR = 1.276,  $p = 0.004$ ) were significant predictors of higher work-related accumulative fatigue (Table 5).

## Discussion

Over 47% of study participants in our study reported high or very high levels of work-related accumulative fatigue. Although

TABLE 5 Predictors of work-related accumulative fatigue-ordinal logistic regression modeling ( $n = 2,918$ ).

Variables	$\beta$	Standard deviation	Wald	$p$	Adjusted odds ratio (AOR)	95% confidence interval	
						Lower bound	Higher bound
Threshold							
(Low)	−0.692	0.272	6.470	0.011			
(A little high)	0.133	0.271	0.241	0.624			
(High)	1.190	0.272	19.085	<0.001			
Gender							
Men	−0.488	0.174	7.823	0.005	0.614	0.436	0.864
Women	Reference						
Age (years)							
<30	0.282	0.174	2.648	0.104	1.326	0.944	1.864
30–40	0.297	0.141	4.479	0.034	1.346	1.022	1.774
>40	Reference						
Marital status							
Married	−0.038	0.098	0.147	0.702	0.963	0.795	1.167
Not married	Reference						
Qualification							
Associate degree	−0.216	0.079	7.404	0.007	0.806	0.690	0.941
Bachelor degree or above	Reference						
Professional title							
No title	−0.985	0.249	15.660	<0.001	0.374	0.229	0.608
Junior	−0.441	0.221	3.979	0.046	0.644	0.417	0.992
Middle	−0.220	0.200	1.208	0.272	0.802	0.542	1.188
Senior	Reference						
Monthly salary (Yuan)							
<5,000	0.374	0.194	3.724	0.054	1.453	0.994	2.123
5,000–8,000	0.139	0.190	0.539	0.463	1.149	0.792	1.668
>8,000	Reference						
Years of work experience							
<5	−0.036	0.154	0.056	0.813	0.964	0.713	1.304
5–10	0.244	0.115	4.484	0.034	1.277	1.018	1.600
>10	Reference						
Hospitals							
Metropolitan	−0.203	0.073	7.676	0.006	0.816	0.707	0.942
Rural country	Reference						
Region							
Eastern	−0.001	0.084	<0.001	0.988	0.999	0.848	1.176
Central	0.244	0.084	8.347	0.004	1.276	1.082	1.506
Western	Reference						

this level is comparatively lower than that reported by medical doctors in China (28), it is higher than those reported by employees in other sectors, such as enterprise workers and lawyers (30, 33). Nurses provide continuous care for patients. They usually have night shifts and need to keep high levels of alertness day and night, which often lead to sleep problems (34, 35). Previous studies found that night shifts are associated with

increased fatigue (17, 36, 37). Mild fatigue may be imperceptible, but accumulative fatigue can have serious consequences, even death from overwork (38).

We found that female nurses experienced higher levels of work-related accumulative fatigue than male nurses. This result is consistent with the findings of previous studies (38). Worldwide, nursing workforce is dominated by women. The

gender difference is a serious issue of concern (39). Women also take disproportional burden of care for family members, not only for children, but also for the elderly (40–42).

It appears that the nurses in their mid-career, in particular those aged between 30 and 40 years, had 5–10 years of work experience, and held a professional title experienced higher levels of work-related accumulative fatigue than others. The results are consistent with the findings of other studies conducted in various hospital units in China (43–45). This is likely to be a reflection of high levels of responsibilities assigned to the nurses in these categories. Unlike their more senior colleagues, mid-career nurses continue to take frontline clinical duties in addition to supervision and management roles. A previous study found that senior nurses with a professional title reported high levels of stress in emergency management (46).

There is evidence that nursing staff shortage is associated with higher levels of work-related accumulative fatigue. In our study, those from the central region and rural settings reported higher levels of work-related accumulative fatigue. Despite rapid socioeconomic development in China, regional disparities remain a great concern. Financing accountability has been delegated to local governments in China. Although the central government has prioritized the least developed western region for central financial subsidies, the central developing region has been struggling with limited financial capacities (47). Rural county hospitals play a pivotal role in the Chinese healthcare system (48). They not only lead the three-tier healthcare delivery system for rural residents, but also serve as a liaising platform for tertiary hospitals (all metropolitan) to reach rural consumers (49). From 2010 to 2018, patient visits to country hospitals increased by 73.16%, but the number of staff in county hospitals only increased by 71.43%. Nursing shortage is particularly serious in rural settings. There were 5.08 registered nurses per 1,000 urban residents, compared with 1.80 for rural residents in 2018 (22).

Multi-faceted strategies are needed to manage work-related accumulative fatigue of nurses (50). An early warning system can be established to monitor the level of work-related accumulative fatigue experienced by nurses. A fine balance between work productivity and staff well-being needs to be maintained. Indeed, work life balance has become one of the major tasks of human resources management (51, 52). Additional support to mid-career female nurses can be prioritized if the choice of staffing increase is not available. Meanwhile, increasing central policy attention should be paid to addressing the inequalities across regions and between urban and rural settings. Strengthening primary care can also help reduce hospital burdens (53).

This study has several limitations. The study adopted a cross-sectional design and no causal relationships should be assumed. Self-reported data were collected, which are subject to recall bias. Further studies are needed to determine the impacts of the high level of work-related accumulative fatigue on the well-being of nurses and the safety of patients.

## Conclusion

High levels of work-related accumulative fatigue are evident in public hospital nurses in China, in particular in those in their mid-career. Although this problem is widespread across regions and in both urban and rural settings, significant regional disparities exist. Nursing shortage is most serious in the central region and rural settings, and their nurses have suffered a higher level of work-related accumulative fatigue than others. These call for urgent policy attention as work-related accumulative fatigue is not only a matter of staff well-being, but also a matter of patient safety and quality of patient care.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (No: IORG0003571). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

CT, CG, and CL designed the project. CT, XC, CG, and CL performed literature review and drafted the article. CT, XC, GG, and CG participated in data collection and data analyses. All authors have read and approved the final article.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.1019092/full#supplementary-material>

## References

- Ulrich B. Nurse fatigue: dangerous for nurses and patients. *Nephrol Nurs J.* (2018) 45:239. doi: 10.1097/NND.0000000000000449
- Zhan YX, Zhao SY, Yuan J, Liu H, Liu YF, Gui LL, et al. Prevalence and influencing factors on fatigue of first-line nurses combating with COVID-19 in china: a descriptive cross-sectional study. *Curr Med Sci.* (2020) 40:625–35. doi: 10.1007/s11596-020-2226-9
- McDowell SE, Ferner HS, Ferner RE. The pathophysiology of medication errors: how and where they arise. *Br J Clin Pharmacol.* (2009) 67:605–13. doi: 10.1111/j.1365-2125.2009.03416.x
- Garrett C. The effect of nurse staffing patterns on medical errors and nurse burnout. *AORN J.* (2008) 87:1191–204. doi: 10.1016/j.aorn.2008.01.022
- Cho H, Steege LM. Nurse fatigue and nurse, patient safety, and organizational outcomes: a systematic review. *West J Nurs Res.* (2021) 43:1157–68. doi: 10.1177/0193945921990892
- Celik S, Tasdemir N, Kurt A, Ilgezdi E, Kubalas O. Fatigue in intensive care nurses and related factors. *Int J Occup Environ Med.* (2017) 8:199–206. doi: 10.15171/ijoem.2017.1137
- Gander P, O'Keeffe K, Santos-Fernandez E, Huntington A, Walker L, Willis J. Fatigue and nurses' work patterns: an online questionnaire survey. *Int J Nurs Stud.* (2019) 98:67–74. doi: 10.1016/j.ijnurstu.2019.06.011
- Ganesan S, Magee M, Stone JE, Mulhall MD, Collins A, Howard ME, et al. The impact of shift work on sleep, alertness and performance in healthcare workers. *Sci Rep.* (2019) 9:4635. doi: 10.1038/s41598-019-40914-x
- McElroy SF, Olney A, Hunt C, Glennon C. Shift work and hospital employees: a descriptive multi-site study. *Int J Nurs Stud.* (2020) 112:103746. doi: 10.1016/j.ijnurstu.2020.103746
- Cho H, Sagherian K, Scott LD, Steege LM. Occupational fatigue, individualized nursing care, and quality of nursing care among hospital nurses. *J Nurs Scholarsh.* (2022) 54:648–57. doi: 10.1111/jnu.12768
- Kahriman I, Ozturk H. Evaluating medical errors made by nurses during their diagnosis, treatment and care practices. *J Clin Nurs.* (2016) 25:2884–94. doi: 10.1111/jocn.13341
- Wilson M, Permitt R, English A, Albritton S, Coogler C, Van Dongen H. Performance and sleepiness in nurses working 12-h day shifts or night shifts in a community hospital. *Accid Anal Prev.* (2019) 126:43–6. doi: 10.1016/j.aap.2017.09.023
- Kagamiyama H, Sumi N, Yoshida Y, Sugimura N, Nemoto F, Yano R. Association between sleep and fatigue in nurses who are engaged in 16 h night shifts in Japan: assessment using actigraphy. *Jpn J Nurs Sci.* (2019) 16:373–84. doi: 10.1111/jjns.12246
- Min A, Hong HC, Kim YM. Work schedule characteristics and occupational fatigue/recovery among rotating-shift nurses: a cross-sectional study. *J Nurs Manag.* (2022) 30:463–72. doi: 10.1111/jonm.13511
- Beggs-Yeager C, Sharts-Hopko N, McDermott-Levy R. The role of nurses in surveillance to enhance global health security: a delphi study. *Nurs Outlook.* (2021) 69:1021–9. doi: 10.1016/j.outlook.2021.05.011
- Hudspeth R. Staffing healthy workplaces: some global nursing shortage issues. *Nurs Adm Q.* (2013) 37:374–6. doi: 10.1097/NAQ.0b013e3182a2fa65
- Min A, Min H, Hong HC. Work schedule characteristics and fatigue among rotating shift nurses in hospital setting: an integrative review. *J Nurs Manag.* (2019) 27:884–95. doi: 10.1111/jonm.12756
- Zhang LF, You LM, Liu K, Zheng J, Fang JB, Lu MM, et al. The association of Chinese hospital work environment with nurse burnout, job satisfaction, and intention to leave. *Nurs Outlook.* (2014) 62:128–37. doi: 10.1016/j.outlook.2013.10.010
- Zhang W, Miao R, Tang J, Su Q, Aung L, Pi H, et al. Burnout in nurses working in China: a national questionnaire survey. *Int J Nurs Pract.* (2021) 27:e12908. doi: 10.1111/ijn.12908
- Wu Y, Wang J, Liu J, Zheng J, Liu K, Baggs JG, et al. The impact of work environment on workplace violence, burnout and work attitudes for hospital nurses: a structural equation modelling analysis. *J Nurs Manag.* (2020) 28:495–503. doi: 10.1111/jonm.12947
- Rennie TW, Hunter CJ. Contributing to health training in low and middle income countries-global health programmes' responsibility to be sustainable and impactful. *J Glob Health.* (2020) 10:10310. doi: 10.7189/jogh.10.010310
- Commission NH. *China Health Statistics Yearbook 2019*. Beijing: Peking Union Medical College Press (2019).
- Liu C, Legge D. Challenges in China's health system reform: lessons from other countries. *Aust J Prim Health.* (2017) 23:i–ii. doi: 10.1071/PYv23n4\_ED
- Data WB. Available online at: [https://data.worldbank.org/indicator/SH.MED.NUMW.P3?end=2019&name\\_desc=false&start=2010&view=chart](https://data.worldbank.org/indicator/SH.MED.NUMW.P3?end=2019&name_desc=false&start=2010&view=chart)
- Commission NH. *China Health Statistics Yearbook 2021*. Beijing: Peking Union Medical College Press (2021).
- Hou J, Ke Y. Addressing the shortage of health professionals in rural china: issues and progress comment on "have health human resources become more equal between rural and urban areas after the new reform?" *Int J Health Policy Manag.* (2015) 4:327–8. doi: 10.15171/ijhpm.2015.57
- Sun Z, Wang S, Barnes SR. Understanding congestion in China's medical market: an incentive structure perspective. *Health Policy Plan.* (2016) 31:390–403. doi: 10.1093/heapol/czv062
- Tang C, Liu C, Fang P, Xiang Y, Min R. Work-related accumulated fatigue among doctors in tertiary hospitals: a cross-sectional survey in six provinces of China. *Int J Environ Res Public Health.* (2019) 16:3049. doi: 10.3390/ijerph16173049
- Faul F, Erdfelder E, Lang AG, Buchner A. G\*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods.* (2007) 39:175–91. doi: 10.3758/BF03193146
- Huang H, Geng D, Chou J. Accumulated fatigue measurement and overwork prevention. *Hum Resour Dev China.* (2009) 2009:35–7. doi: 10.16471/j.cnki.11-2822/c.2009.08.006
- Cui X, Lu X, Hisada A, Fujiwara Y, Katoh T. The correlation between mental health and multiple chemical sensitivity: a survey study in Japanese workers. *Environ Health Prev Med.* (2015) 20:123–9. doi: 10.1007/s12199-014-0434-2
- Tsuchiya M, Mori E, Sakajo A, Iwata H, Maehara K, Tamakoshi K. Cross-sectional and longitudinal validation of a 13-item fatigue scale among Japanese postpartum mothers. *Int J Nurs Pract.* (2016) 22(Suppl 1):5–13. doi: 10.1111/ijn.12434
- Wang D. Evaluation and empirical study of labor overwork in China. *Economic Jingwei.* (2011) 86–90. doi: 10.15931/j.cnki.1006-1096.2011.02.009
- Chang WP, Wang CH. Influence of sleep fragmentation and fatigue on turnover of female nurses working rotating shifts. *J Clin Nurs.* (2021). doi: 10.1111/jocn.16184

35. Chang WP, Li HB. Influence of shift work on rest-activity rhythms, sleep quality, and fatigue of female nurses. *Chronobiol Int.* (2022) 39:557–68. doi: 10.1080/07420528.2021.2005082
36. Barker LM, Nussbaum MA. Fatigue, performance and the work environment: a survey of registered nurses. *J Adv Nurs.* (2011) 67:1370–82. doi: 10.1111/j.1365-2648.2010.05597.x
37. Smith-Miller CA, Shaw-Kokot J, Curro B, Jones CB. An integrative review: fatigue among nurses in acute care settings. *J Nurs Adm.* (2014) 44:487–94. doi: 10.1097/NNA.000000000000104
38. Thompson BJ. Fatigue and the female nurse: a narrative review of the current state of research and future directions. *Womens Health Rep.* (2021) 2:53–61. doi: 10.1089/whr.2020.0107
39. Jang HJ, Kim O, Kim S, Kim MS, Choi JA, Kim B, et al. Factors affecting physical and mental fatigue among female hospital nurses: the Korea nurses' health study. *Healthcare.* (2021) 9:201. doi: 10.3390/healthcare9020201
40. Shui Y, Xu D, Liu Y, Liu S. Work-family balance and the subjective well-being of rural women in Sichuan, China. *Bmc Womens Health.* (2020) 20:1. doi: 10.1186/s12905-019-0871-6
41. Loerbroks A, Ding H, Han W, Wang H, Wu JP, Yang L, et al. Work stress, family stress and asthma: a cross-sectional study among women in China. *Int Arch Occup Environ Health.* (2017) 90:349–56. doi: 10.1007/s00420-017-1201-7
42. Huang Y, Xu H, Liu H, Yu W, Yu X. The impact of family care for the elderly on women's employment from the perspective of bargaining power. *Int J Environ Res Public Health.* (2021) 18:5905. doi: 10.3390/ijerph18115905
43. Qian W, Zhang Y, Qian Q. Analysis of occupational fatigue status and influencing factors of nurses in operating rooms of tertiary and first-class hospitals. *Chin Nurs Res.* (2022) 22:238–44.
44. Wang L, He W, Du X, Li Q, Meng Y, Song C. Status and influencing factors of alarm fatigue among nurses in intensive care unit. *Chongqing Med.* (2022) 51:1951–7.
45. Wu C, Ge Y, Xu C, Zhang X, Lang H. A correlation study of emergency department nurses' fatigue, perceived stress, social support and self-efficacy in grade III a hospitals of Xi'an. *Medicine.* (2020) 99:e21052. doi: 10.1097/MD.00000000000021052
46. Mo Y, Deng L, Zhang L, Lang Q, Liao C, Wang N, et al. Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. *J Nurs Manag.* (2020) 28:1002–9. doi: 10.1111/jonm.13014
47. Chen T, Lu H, Chen R, Wu L. The impact of marketization on sustainable economic growth-evidence from West China. *Sustainability-Basel.* (2021) 13:3745. doi: 10.3390/su13073745
48. Yin G, Ning J, Peng Y, Yue J, Tao H. Configurational paths to higher efficiency in county hospital: evidence from qualitative comparative analysis. *Front Public Health.* (2022) 10:918571. doi: 10.3389/fpubh.2022.918571
49. Cheng Z, Tao H, Cai M, Lin H, Lin X, Shu Q, et al. Technical efficiency and productivity of Chinese county hospitals: an exploratory study in Henan province, China. *BMJ Open.* (2015) 5:e7267. doi: 10.1136/bmjopen-2014-007267
50. Farag A, Scott LD, Perkhounkova Y, Saeidzadeh S, Hein M. A human factors approach to evaluate predictors of acute care nurse occupational fatigue. *Appl Ergon.* (2022) 100:103647. doi: 10.1016/j.apergo.2021.103647
51. Haar J, Mowat RM. Are human resource practices the key to managing job burnout in New Zealand nurses? Testing a path model. *J Clin Nurs.* (2022) 31:2574–83. doi: 10.1111/jocn.16077
52. Rodriguez-Sanchez JL, Gonzalez-Torres T, Montero-Navarro A, Gallego-Losada R. Investing time and resources for work-life balance: the effect on talent retention. *Int J Environ Res Public Health.* (2020) 17:1920. doi: 10.3390/ijerph17061920
53. Lim AY, Tan CS, Low BP, Lau TC, Tan TL, Goh LG, et al. Integrating rheumatology care in the community: can shared care work? *Int J Integr Care.* (2015) 15:e31. doi: 10.5334/ijic.1990





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# Epidemiological characteristics and survival analysis on patients with occupational pneumoconiosis in Zhejiang Province from 1987 to 2019

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**Objective:** To evaluate risk factors affecting survival in patients diagnosed with pneumoconiosis and propose strategies to improve the quality of life in these patients.

**Methods:** The basic patient information was obtained from the pneumoconiosis report card. Disease types, regions, and industry distribution of pneumoconiosis were analyzed. The Kaplan-Meier survival curves and the Cox proportional risk regression model was used for survival analysis.

**Results:** A total of 13,812 patients were diagnosed with pneumoconiosis in Zhejiang province from 1987 to 2019. The overall survival rate at the end of life table analysis was 83%. Kaplan-Meier analyses showed that there were significant differences between survival curves depending on the stage of first diagnosis, age at first diagnosis, type of pneumoconiosis, industry, and duration of dust exposure ( $P < 0.05$ ). The results of Cox proportional hazards regression analysis showed that pneumoconiosis stage of first diagnosis, age at first diagnosis, industry, and duration of dust exposure were risk factors affecting patient survival ( $P < 0.05$ ).

**Conclusions:** The patients with high stage of pneumoconiosis at first diagnosis, older age, and long duration of dust exposure should be followed up and monitored as key population, and the industries with high incidence of pneumoconiosis such as mining and construction should be supervised as key industries.

## KEYWORDS

occupational disease, pneumoconiosis, dust-exposure, survival analysis, Kaplan-Meier

## Introduction

Pneumoconiosis is the most widely distributed occupational disease worldwide. Pneumoconiosis is characterized by diffuse fibrosis of the lung tissue that is caused by long-term inhalation and retention of productive mineral dust in the lungs during occupational activities. According to the Global Burden of Disease Study 2017, the number of confirmed cases of pneumoconiosis was increased from 36,186 cases in 1990 to 60,055 in 2017 (1). In 2017, silicosis was the most common type of pneumoconiosis worldwide, followed by coal worker pneumoconiosis (CWP). In recent decades, with the rapid economic development, accelerated urban construction, and increased demand for mineral resources in China, a large number of enterprises with backward production technology, incomplete protective equipment, and inadequate health management have emerged in small mines and small smelting industries. Meanwhile, with the increase in migrant workers, the probability of people who are employed in related industries in China to suffer from pneumoconiosis has increased. There are ~26,000–28,000 newly reported cases of pneumoconiosis in China every year (2). According to the Report on Occupational Disease Prevention and Control issued by the Ministry of Health of China from 2010 to 2018, pneumoconiosis ranks first in incidence among occupational diseases every year, accounting for more than 70% of the cases (3), making it the leading occupational disease in China.

The main clinical manifestations of pneumoconiosis include dyspnea, cough, expectoration, and chest pain. Currently, there is no effective treatment for lung injury caused by pneumoconiosis (4). Even if the patients are no longer exposed to the dust, lung function damage gradually worsens as the disease progresses, and complications such as tuberculosis, cor pulmonale, and chronic obstructive pulmonary disease (COPD) may occur. Currently, the main treatments include symptomatic and rehabilitation treatments. Patients are being followed up and reexamined regularly, and the treatment plan is adjusted according to the patient's condition (5). In addition, patients are advised to strengthen nutrition, perform physical exercise, and maintain a healthy lifestyle to alleviate symptoms, delay disease progression, prolong survival time, and reduce the incidence of complications. As a lifelong occupational disease, pneumoconiosis shortens the survival time in patients, reduces their ability to work, and causes great loss to their health and economy.

To prevent pneumoconiosis, the International Labor Organization (ILO) and the World Health Organization (WHO) jointly launched a global pneumoconiosis elimination plan, aiming at eradicating pneumoconiosis worldwide by 2030. In 2016, China issued the National Occupational Disease Control Program (2016–2020) to promote the construction of healthy China and further protect laborer rights and interests. The governance of occupational pneumoconiosis

is a key task in this program (6). This study aimed to evaluate the incidence of pneumoconiosis and its influencing factors in the context of the living conditions in patients in Zhejiang Province. Further, this study aimed to develop strategies to prevent the occurrence and development of pneumoconiosis, reduce associated complications, prolong the survival, and improve the quality of life in patients. To this end, the newly reported occupational pneumoconiosis patients in Zhejiang Province from 1987 to 2019 were followed up. The epidemiological characteristics of pneumoconiosis and patient survival were analyzed, with the aim to provide a scientific basis for the prevention and treatment of pneumoconiosis in Zhejiang Province.

## Materials and methods

### Study population

Patients who were diagnosed with pneumoconiosis according to the Diagnosis of Occupational Pneumoconiosis (GBZ70-2015) should be reported in the national occupational disease report card by occupational disease diagnosis agencies promptly (7). The national occupational disease report card contained the general information (e.g., name, sex, age, job, industry, and years exposed to dust) and disease information (e.g., date of diagnosis, and the type and stage of pneumoconiosis). Through the report card, patients diagnosed with pneumoconiosis in Zhejiang Province from 1987 to 2019 were included in this study. The survival situation of these patients was obtained from the police system which took charge of census register. The insurance, e.g., basic medical insurance, employment injury insurance, and employer compensation, these patients had was obtained from social security departments, medical security departments, civil affairs departments, and human resources departments. The patients' underlying causes of death were obtained through the residential cause of death surveillance system. All information was checked by telephone follow-up. The study protocol was approved by the ethics committee of the Zhejiang Center for Disease Control and Prevention, China (approval reference number: 2022-026-01).

All cases were divided into two categories: death cases and censored cases. The following classification criteria were used: death cases corresponded to the patients who died of pneumoconiosis and its complications (such as chronic obstructive pulmonary disease, tuberculosis, emphysema, etc.); censored cases corresponded to either those who survived after follow-up, or died of other causes unrelated to pneumoconiosis (such as accidents, diabetes, leukemia, etc.) during the follow-up period, or were lost to follow-up. The survival time in patients with pneumoconiosis in this study was defined as the time period between the year of first diagnosis and year of death.

## Diagnosis of occupational pneumoconiosis

According to the pneumoconiosis diagnostic criteria in China—Diagnosis of Occupational Pneumoconiosis (GBZ70-2015), experts in occupational disease diagnosis should make the diagnosis after taking many elements into consideration such as the occupational history exposed to mineral dust, clinical manifestation, posterior-anterior chest X-ray radiographs, epidemiological survey data on pneumoconiosis, the working environment, etc. The small opacity and pleural plague were the typical characteristics of X-ray image of pneumoconiosis. Comparing to a diagnostic standard radiograph for pneumoconiosis, the conclusion could be drawn about whether occupational pneumoconiosis was present and the type and stage of pneumoconiosis. It could be grouped into three stages based on the X-ray image: Stage I, Stage II, and Stage III. The increase in grade represented the progression of pneumoconiosis. Patients could progress from Stage I to Stage II, from Stage II to Stage III, or directly from Stage I to Stage III.

## Statistical analysis

Excel 2016 was used to build the patient database. Descriptive and survival analyses were performed using SPSS 21.0. Continuous variables were presented as mean with standard deviation, and categorical variables were presented as proportions. Analysis of variance was used to compare continuous variables between different groups and chi-square test was used for categorical variables. The Kaplan-Meier survival curves were plotted and the log-rank test was used to compare the survival curves of different groups. With outcome and survival times being the dependent variables and the potential risk factors being the independent variables, the univariate Cox regression model was conducted firstly for screening, and then the multivariate Cox regression model was conducted to analyze the influencing factors for patient survival. The  $P < 0.05$  was considered significant.

## Results

### Epidemiological characteristics

#### General information

A total of 13,812 patients were diagnosed with pneumoconiosis in Zhejiang province from 1987 to 2019. Among them, 96.7% (13,356) were men and 3.3% (456) women. As shown in Figure 1, the number of confirmed pneumoconiosis cases in 2013 and 2014 was higher than that in other years. Among all the confirmed pneumoconiosis cases, there were

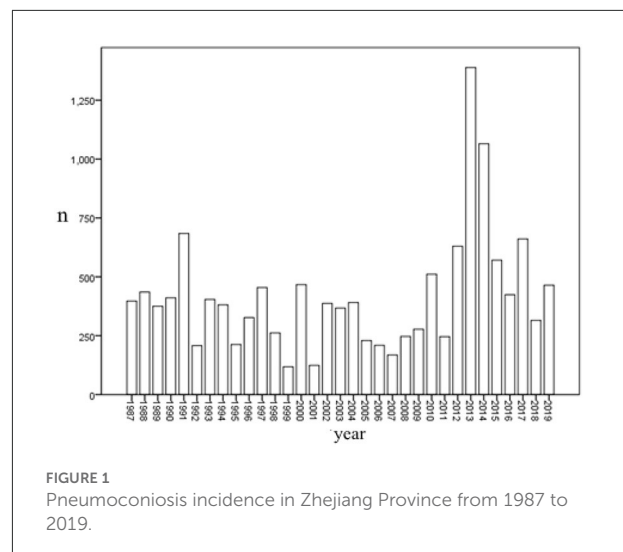


FIGURE 1  
Pneumoconiosis incidence in Zhejiang Province from 1987 to 2019.

TABLE 1 Stage distribution of different types of pneumoconiosis cases in Zhejiang Province from 1987 to 2019.

Types of pneumoconiosis	Stage of pneumoconiosis			Total
	I	II	III	
Silicosis	4,838	1,779	2,279	8,896
CWP	1,873	701	261	2,835
Graphite pneumoconiosis	22	4	1	27
Carbon black pneumoconiosis	11	3	1	15
Asbestosis	110	14	1	125
Talc pneumoconiosis	5	5	2	12
Cement pneumoconiosis	658	33	8	699
Mica pneumoconiosis	1	4	0	5
Pottery worker's pneumoconiosis	39	6	6	51
Aluminosis	14	7	0	21
Welder's pneumoconiosis	273	22	3	298
Founder pneumoconiosis	78	5	4	87
Others	515	155	71	741
Total	8,437	2,738	2,637	13,812

CWP, coal worker pneumoconiosis.

8,437 cases (61.1%) in Stage I, 2,738 cases (19.8%) in Stage II, and 2,637 cases (19.1%) in Stage III. Table 1 shows that silicosis was the most common type (8,896 cases, 64.4%) among all types of pneumoconiosis, followed by CWP (2,835 cases, 20.5%).

### Progressed stages of pneumoconiosis

There were totally 894 progressed cases of pneumoconiosis from 1987 to 2019. There were statistically significant differences in the average period of pneumoconiosis progression between progression from Stage I to Stage II, progression from Stage

TABLE 2 Disease progression between stages among patients with different types of pneumoconiosis in Zhejiang Province from 1987 to 2019.

Stage of pneumoconiosis	<i>n</i>	years	Silicosis	CWP	Others	<i>F</i>	<i>P</i>
I–II	534	7.01 ± 6.34	7.33 ± 5.94	6.79 ± 7.13	6.14 ± 5.57	1.035	0.356
II–III	158	7.84 ± 7.14	7.35 ± 6.69	9.81 ± 8.82	7.00 ± 4.06	1.555	0.214
I–III	202	9.04 ± 6.74	7.83 ± 5.85	13.05 ± 7.99	10.86 ± 7.62	11.352	<0.001

CWP, coal worker pneumoconiosis.

II to Stage III, and progression from Stage I to Stage III ( $F = 7.141$ ,  $P = 0.001$ ). It took an average of ( $7.01 \pm 6.34$ ) years for pneumoconiosis patients at Stage I to progress to Stage II, which was not statistically different ( $P > 0.05$ ) from the average period ( $7.84 \pm 7.14$  years) of pneumoconiosis progression from Stage II to Stage III. There was also no significant difference in the average period of pneumoconiosis progression between progression from Stage II to Stage III and progression from Stage I to Stage III. As a contrast, it took much longer for pneumoconiosis patients to progress from I to III than it did to progress from I to II ( $t = -3.719$ ,  $P < 0.001$ ). The progression of pneumoconiosis stages among the different types is shown in Table 2. For the progression from I to II and from II to III, there was no significant difference between the types of pneumoconiosis ( $P > 0.05$ ). For the progression from I to III, there was a significant difference between different types of pneumoconiosis ( $F = 11.352$ ,  $P < 0.001$ ).

### Regional distribution

The top three cities reporting the most cases of pneumoconiosis from 1987 to 2019 were Quzhou (3,048 cases, 22.5%), Taizhou (3,038 cases, 21.5%), and Huzhou (1,706 cases, 16.4%), accounting for 56.4% of all pneumoconiosis cases in Zhejiang. In addition, in Quzhou and Huzhou, the CWP cases were most frequently reported among all cases, while silicosis cases were most frequently reported in other regions (Table 3).

### Industry distribution

From 1987 to 2019, the non-metallic mineral processing industry (3,972 cases, 28.76%), coal mining (2,503 cases, 18.13%), public administration, social security, and social organization (1,632 cases, 11.81%), non-metallic mineral products industry (1,561 cases, 11.30%), and construction industry (770 cases, 5.57%) ranked the top five among all industries, accounting for 75.2% of the total pneumoconiosis cases. A total of 6,814 people were confirmed in the coal mining industry, accounting for 49.3% of the total pneumoconiosis cases (Table 4).

The pneumoconiosis at Stage I had the highest constituent ratio in all industries. In the mining industry, Stage I, II and III accounted for 60.3% (3,678 cases), 19.1% (1,493 cases) and

TABLE 3 Regional distribution of pneumoconiosis cases reported in Zhejiang Province from 1987 to 2019.

Cities	Silicosis ( <i>n</i> )	CWP ( <i>n</i> )	Others ( <i>n</i> )	Total
Hangzhou	1,233	196	128	1,557
Ningbo	828	3	512	1,343
Wenzhou	1,300	11	86	1,397
Jiaxing	127	5	73	205
Huzhou	713	843	150	1,706
Shaoxing	190	0	59	249
Jinhua	502	47	101	650
Quzhou	562	1,708	778	3,048
Zhoushan	112	1	46	159
Taizhou	2,969	7	62	3,038
Lishui	360	14	86	460
Total	8,896	2,835	2,081	13,812

CWP, coal worker pneumoconiosis.

20.6% (1,643 cases) of total pneumoconiosis cases, respectively (Table 5).

### Dust-exposed working years

Table 6 shows the dust-exposed working years for different types of pneumoconiosis. From 1987 to 2019, the average dust-exposed working years among pneumoconiosis patients in Zhejiang was ( $13.9 \pm 8.6$ ) years, the median exposure time was 12.6 years, and the longest dust-exposed working years was 45.3 years. Pottery worker's pneumoconiosis had the longest mean years of dust exposure ( $17.5 \pm 9.3$  years), and mica pneumoconiosis had the shortest mean dust exposure ( $9.6 \pm 0.9$  years). Talc pneumoconiosis had the shortest median exposure to dust (i.e., 6.8 years). There were significant differences in years of dust exposure between the different types of pneumoconiosis ( $F = 12.276$ ,  $P < 0.001$ ). Among all confirmed cases, those with dust-exposed working years between 5 and 10 years had the highest rate (21.1%), while there were only 87 cases (0.6%) with dust-exposed working years  $\geq 40.0$ , as shown in Table 7.

### Age distribution

As shown in Table 8, the average age at first diagnosis of these patients was 52.4 years, and the median age was 52.0

**TABLE 4** Industry distribution of pneumoconiosis cases reported in Zhejiang Province from 1987 to 2019.

Industry type	Silicosis (n)	CWP (n)	Other (n)	Total
Mining				
Coal mining and washing	392	2,055	56	2,503
Non-metallic mining	3,695	169	63	3,927
Other mining industries	363	12	9	384
Manufacturing				
Manufacture of non-metallic mineral product	659	122	780	1,561
Other manufacturing industries	1,340	195	729	2,264
Construction	603	9	158	770
Public administration, social organization and social security	1,283	222	127	1,632
Other industries	561	51	159	771
Total	8,896	2,835	2,081	13,812

**TABLE 5** Industry distribution of pneumoconiosis of each stage at first diagnosis in Zhejiang Province from 1987 to 2019.

Industry type	I (n)	II (n)	III (n)	Total
Mining				
Coal mining and washing	1,620	621	262	2,503
Non-metallic mining	1,821	770	1,336	3,927
Other mining industries	237	102	45	384
Manufacturing				
Manufacture of non-metallic mineral product	1,282	176	103	1,561
Other manufacturing industries	1,676	371	217	2,264
Construction	546	157	67	770
Public administration, social organization and social security	775	362	495	1,632
Other industries	480	179	112	771
Total	8,437	2,738	2,637	13,812

years. At first diagnosis, the patients with various types of pneumoconiosis were mostly in the 40- and the 50-year-old age groups, accounting for 27.8 and 33.9%, respectively. The average age of patients first diagnosed with Stage I, II, and III pneumoconiosis was ( $51.0 \pm 11.3$ ), ( $54.5 \pm 10.6$ ), and ( $55.8 \pm 8.9$ ) years, respectively. There was a statistically significant difference in the age at first diagnosis of pneumoconiosis patients at different stages ( $F = 241.78$ ,  $P < 0.001$ ).

### Medical insurance for the confirmed cases

Among the patients, 93.2% had basic medical insurance, 58.7% had serious disease insurance, and 139 (1.4%) patients had no insurance (Table 9). There was no statistically significant difference in the medical insurance coverage in patients with pneumoconiosis at different stages ( $\chi^2 = 2.523$ ,  $P = 0.283$ ), but there were significant differences in the coverage of employment injury insurance ( $\chi^2 = 289.524$ ,  $P < 0.001$ ) and employer compensation ( $\chi^2 = 150.080$ ,  $P < 0.001$ ) in patients with pneumoconiosis at different stages (Table 10).

## Survival and influencing factors analyses

### Survival analysis

Among the 13,812 confirmed pneumoconiosis patients in Zhejiang Province, 9,754 were still alive, 3,285 died, and 773 were lost to follow-up. The average age at death was 68.1 years (range, 26.0–100.0). A total of 873 patients died of

pneumoconiosis and associated complications, accounting for 26.6% of the deaths, with an average course of 11.0 years.

Among the patients with occupational pneumoconiosis from 1987 to 2019, the shortest survival time was <1 year, and the longest 33 years. The survival rates in patients with occupational pneumoconiosis 10, 20, and 30 years after diagnosis were 95, 92, and 84%, respectively. Finally, the cumulative survival rate was 83%. The cumulative survival curves in patients are shown in Figure 2.

### Analysis of factors influencing survival in pneumoconiosis patients

#### Impact of pneumoconiosis stage at first diagnosis on the survival time

According to the pneumoconiosis stage at first diagnosis, patients were divided into three groups: stage I, II, and III, with an average survival time of 31.6, 28.9, and 25.8 years, respectively. There was a significant difference in survival between the different stages at the first diagnosis ( $\chi^2 = 863.673$ ,  $P < 0.001$ ). The survival curves of the patients are shown in Figure 3.

#### Impact of age at first diagnosis on survival time

Based on the age at first diagnosis of pneumoconiosis, patients were divided into three groups:  $\leq 30$  years old, 31–60 years old, and  $\geq 61$  years old, and their average survival time were 32.7 years, 31.2 years, and 26.2 years, respectively. There was a significant difference in survival curves between the



**TABLE 6** Dust-exposed working years for different types of pneumoconiosis in Zhejiang Province from 1987 to 2019.

Type of pneumoconiosis	Dust-exposed working years		
	<i>n</i>	Mean $\pm$ SD	Median
Silicosis	8,896	14.2 $\pm$ 8.7	13
CWP	2,835	13.5 $\pm$ 8.2	13
Graphite pneumoconiosis	27	15.0 $\pm$ 8.8	12.8
Carbon black pneumoconiosis	15	12.6 $\pm$ 8.0	9
Asbestosis	125	14.8 $\pm$ 7.3	13.2
Talc pneumoconiosis	12	9.7 $\pm$ 7.0	6.8
Cement pneumoconiosis	699	11.1 $\pm$ 7.8	10.2
Mica pneumoconiosis	5	9.6 $\pm$ 0.9	9.5
Pottery worker's pneumoconiosis	51	17.5 $\pm$ 9.3	18.6
Aluminosis	21	9.9 $\pm$ 5.5	11
Welder's pneumoconiosis	298	11.4 $\pm$ 7.2	9.7
Founder pneumoconiosis	87	16.6 $\pm$ 9.5	15
Other	713	14.2 $\pm$ 9.2	11.4
Total	13,812	13.9 $\pm$ 8.6	12.6

CWP, coal worker pneumoconiosis.

**TABLE 7** Dust-exposed working years of confirmed pneumoconiosis cases in Zhejiang Province from 1987 to 2019.

Dust-exposed working years	<i>n</i>	%
<5.0	2,332	16.9
5.0~	2,912	21.1
10.0~	2,676	19.4
15.0~	2,643	19.1
20.0~	1,680	12.2
25.0~	780	5.6
30.0~	533	3.9
35.0~	169	1.2
$\geq 40.0$	87	0.6
Total	13,812	100

different age groups ( $\chi^2 = 414.302$ ,  $P < 0.001$ ). The survival curves of the patients are shown in [Figure 4](#).

#### Impact of industry on the survival time

According to the industry, patients were divided into five groups: mining, manufacturing, construction, public administration and social organization and social security, and other industries. Their average survival times in these industries were 29.9, 32.0, 31.4, 28.6, and 31.8 years, respectively. There was a significant difference in survival time between the different industries ( $\chi^2 = 57.266$ ,  $P < 0.001$ ). The corresponding survival curves of the patients are shown in [Figure 5](#).

**TABLE 8** Age distribution at first diagnosis in patients with various types of pneumoconiosis in Zhejiang Province from 1987 to 2019.

Age(year)	Silicosis		CWP		Others		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<30	148	1.7	39	1.4	71	3.4	258	1.9
30	687	7.7	289	10.2	450	21.6	1,426	10.3
40	2,129	23.9	958	33.8	749	36	3,836	27.8
50	3,290	37	913	32.2	483	23.2	4,686	33.9
60	2,014	22.6	514	18.1	252	12.1	2,780	20.1
70	562	6.3	112	4	68	3.3	742	5.4
$\geq 80$	66	0.7	10	0.4	8	0.4	84	0.6
Total	8,896	100	2,835	100	2,081	100	13,812	100

CWP, coal worker pneumoconiosis.

**TABLE 9** Insurance for prevalent cases of occupational pneumoconiosis.

Type of insurance	Pneumoconiosis patients	Covered by insurance	
		<i>n</i>	%
Employment injury insurance	9,754	3,037	31.1
Employer compensation		1,669	17.1
Basic medical insurance		9,089	93.2
Serious disease insurance		5,722	58.7
Other		1,869	19.2
No insurance		139	1.4

#### Impact of pneumoconiosis types on the survival time

Patients were divided into three groups according to the type of pneumoconiosis: silicosis, CWP, and other pneumoconiosis. Their corresponding average survival times were 30.1, 30.9, and 31.9 years, respectively. There were statistically significant differences in survival times between the groups with different pneumoconiosis types ( $\chi^2 = 76.229$ ,  $P < 0.001$ ). The survival curves of the patients are shown in [Figure 6](#).

#### Impact of dust-exposed working years on the survival time

According to the dust-exposed working years, patients were divided into three groups:  $<10.0$ ,  $10.0-19.9$ , and  $\geq 20.0$  years. The average survival times in these three groups were 30.9, 30.5, and 30.3 years, respectively. There were statistically significant differences in survival times between the groups with different years of dust exposure ( $\chi^2 = 10.288$ ,  $P = 0.006$ ). The survival curves of the patients are shown in [Figure 7](#).



TABLE 10 Insurance for prevalent cases of occupational pneumoconiosis at various stages.

Insurance	Stage of pneumoconiosis			$\chi^2$	P
	I	II	III		
Basic medical insurance					
Yes	5,572	1,738	1,179		
No	429	152	84	2.523	0.283
Employment injury insurance					
Yes	2,203	533	301		
No	3,798	1,357	1,563	289.524	<0.001
Employer compensation					
Yes	1,198	327	144		
No	4,803	1,563	1,719	150.08	<0.001

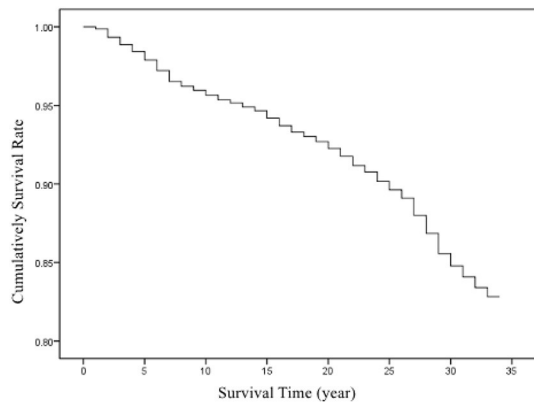


FIGURE 2 Cumulative survival curves in patients with confirmed cases of pneumoconiosis in Zhejiang Province from 1987 to 2019.

## The Cox regression analyses

Table 11 shows the results of Cox regression analysis. Based on the available data, there were six potential risk factors influencing the survival in patients including sex, pneumoconiosis stage at first diagnosis, age at first diagnosis, industry, type of pneumoconiosis, and dust-exposed working years. The univariate Cox regression analyses between patient survival and each factor showed that there was no significant difference of the effect on patient survival between males and females ( $P = 0.351$ ). The multivariate Cox regression analysis for the remaining five factors showed that pneumoconiosis stage at first diagnosis, age at first diagnosis, industry, and dust-exposed working years were the risk factors influencing the survival time of pneumoconiosis patients, while type of pneumoconiosis was not statistically significant in this model ( $P > 0.05$ ). Patients with higher stage at first diagnosis, older age at first diagnosis, longer duration of dust exposure, or from

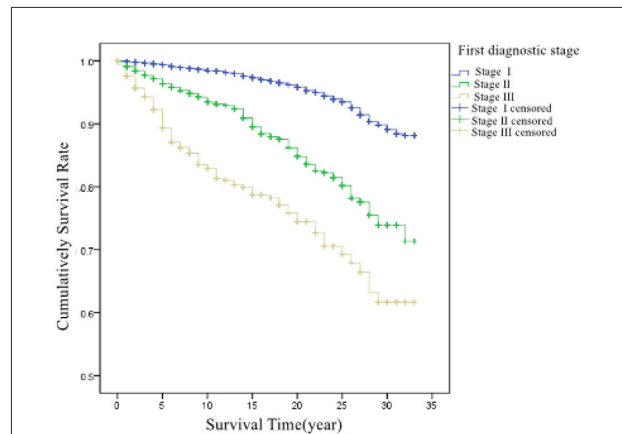


FIGURE 3 Cumulative survival rate in patients at different stages at first diagnosis.

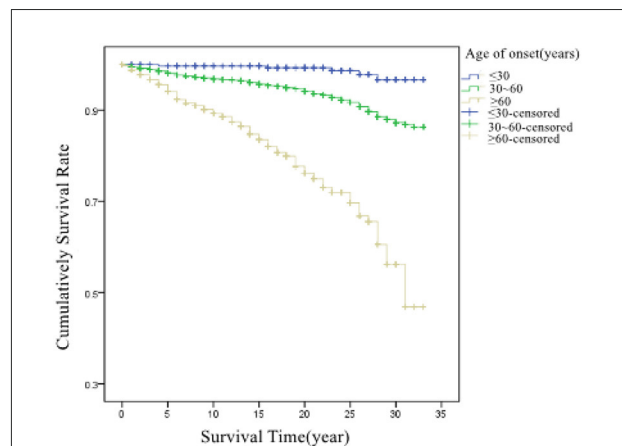


FIGURE 4 Cumulative survival rate in patients at different ages at first diagnosis.

mining and public administration and social organization and social security industries had higher hazard ratio of death.

## Discussion

Presently, pneumoconiosis is the leading occupational disease in China. There is no effective cure for this condition, which means it is a lifelong disease. Pneumoconiosis seriously endangers the health of the occupational population and poses a great burden on society. Studies have shown that due to differences in enterprise types and scales, protective measures, government supervision, health education, and so on, the epidemiological characteristics of pneumoconiosis in different regions are also different.

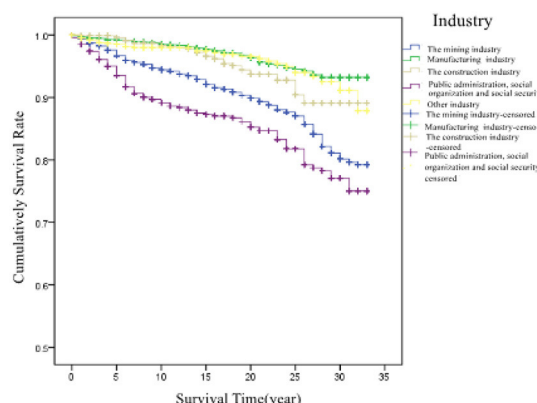


FIGURE 5  
Cumulative survival rate in patients in different industry.

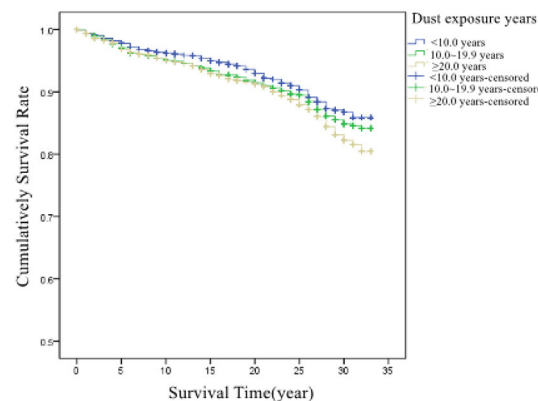


FIGURE 7  
Cumulative survival rate in patients with different years of dust exposure.

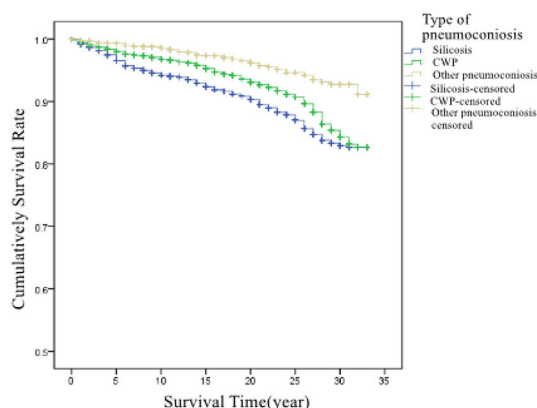


FIGURE 6  
Cumulative survival rate in patients with different pneumoconiosis types.

The type of pneumoconiosis in Zhejiang Province was mainly silicosis, followed by CWP. This was different from the distribution of the main pneumoconiosis types in Guangdong Province (8), Hunan Province, Xinjiang Uygur Autonomous Region, and Tianjin. Silicosis ranked first in Guangdong Province, followed by welder pneumoconiosis and other pneumoconiosis. CWP was the leading type of pneumoconiosis in Hunan Province and Xinjiang Uygur Autonomous Region, followed by silicosis. Silicosis and caster pneumoconiosis were the main types of pneumoconiosis in Tianjin. These could be attributed to the local industrial structure and distribution of natural resources. There were a large number of shipbuilding enterprises in Guangdong Province, leading to many cases of welder's pneumoconiosis. Hunan and Xinjiang were main distribution areas of coal mines in China, and CWP was the leading pneumoconiosis type there. Tianjin was a city with

developed processing industries and had no mining resources, as a result of which CWP was not the main type of pneumoconiosis. In Zhejiang Province, there were coal resources dominated by non-ferrous and non-metallic mines, therefore silicosis had the largest number of cases. Coal resources in Zhejiang were mainly distributed in Quzhou and Huzhou, which agreed with the results of this study. The results showed that most silicosis cases came from industries that produced silicium dust during production and operation, such as non-metallic mineral processing, non-metallic mineral products, and construction industries. Furthermore, 72.5% of CWP cases came from the coal mining and washing industry. These results agree with the findings of a national study that silicosis cases were common in the railway industry, building materials industry, non-ferrous metal industry, and metallurgy industry, and CWP was common in the coal mining and washing industry (9).

This study found that the highest number of new cases was in 2013 and 2014. The possible reasons include: (1) According to the relevant requirements of the Notice on Standardized Construction of Occupational Disease Diagnosis and Identification in Zhejiang Province [(2012) No.93] formulated by the Health Department of Zhejiang Province, in the second half of 2012, cities and counties began to allocate more staff and equipment for occupational disease diagnosis and strengthen personnel training, carry out publicity and training in hospitals, and actively cultivate third-party intermediaries with detecting qualifications; (3) In 2013, the Ministry of Health formulated Administrative Measures for Diagnosis and Identification of Occupational Diseases (Order No.91 of the Ministry of Health). In 2014, the Zhejiang Provincial Health and Health Commission revised and improved the original regulations and formulated the Working Regulations for Occupational Disease Identification in Zhejiang Province, which was distributed to all cities and counties. Similar

TABLE 11 The Cox regression analysis.

Variables	Groups	Univariate Cox regression				Multivariate Cox regression			
		$\beta$	<i>P</i>	Exp ( $\beta$ )	95.0% CI	$\beta$	<i>P</i>	Exp ( $\beta$ )	95.0% CI
Sex	Male*								
	Female	−0.189	0.351	0.828	0.556–1.232				
Stage at first diagnosis	Stage I*								
	Stage II	1.201	<0.001	3.322	2.785–3.964	1.034	<0.001	2.813	2.347–3.370
	Stage III	2.136	<0.001	8.465	7.196–9.959	1.908	<0.001	6.741	5.656–8.034
Age at first diagnosis	≤30 years*								
	~60 years	1.630	<0.001	5.105	2.116–12.314	1.549	0.001	4.708	1.948–11.377
	>60 years	2.980	<0.001	19.694	8.124–47.740	2.710	<0.001	15.025	6.177–36.551
Industry	Others*								
	Mining	0.908	<0.001	2.479	1.706–3.603	0.965	<0.001	2.624	1.794–3.839
	Manufacturing	−0.196	0.347	0.822	0.547–1.236	0.431	0.041	1.539	1.017–2.328
	Construction	0.219	0.387	1.245	0.758–2.044	0.562	0.027	1.755	1.067–2.888
	Public administration, social organization and social security	1.416	<0.001	4.121	2.779–6.110	1.349	<0.001	3.853	2.592–5.728
Type of pneumoconiosis	Others *								
	Silicosis	1.007	<0.001	2.736	2.146–3.490	0.211	0.117	1.234	0.948–1.607
	CWP	0.697	<0.001	2.007	1.542–2.611	0.207	0.167	1.230	0.917–1.649
Dust-exposure years	<10.0 years*								
	<20.0 years	0.184	0.021	1.202	1.028–1.405	0.140	0.088	1.150	0.980–1.350
	≥20 years	0.271	0.002	1.311	1.103–1.559	0.231	0.010	1.260	1.056–1.504

\* Reference group; CI, confidence interval; CWP, coal worker pneumoconiosis.

observations were reported by other studies in which the results were affected by these policies (10).

This study found that patients working in the mining industry had a worse survival than those working in other industries. The proportions of stage II and stage III pneumoconiosis at first diagnosis in the mining industry were higher than those in other industries, which may have been due to the fact that dust exposure in the mining industry was more than in other industries and led to faster progression of the disease (11). In addition, “public administration, social security and social organizations,” non-metallic mineral products industry, and construction industry were associated with a high number of confirmed pneumoconiosis cases. This may be attributed to the fact that patients used to work in dust-exposed posts in their early careers. A number of mining enterprises have been successively shut down in the past 30 years in Zhejiang Province. Due to the long incubation period of pneumoconiosis, workers were uniformly organized by the government for health examination after the

enterprises were shut down or went bankrupt, and workers diagnosed with pneumoconiosis were recorded and reported. The results suggest that the local government should pay attention to the prevention and control of occupational diseases and strengthen the supervision and management of enterprises.

The progression from stage I to stage III took longer than that from stage I to stage II. Factors affecting the degree of dust exposure and type of dust, such as dust exposure duration, type of work, and personal protection, could influence the time of progression. Generally, the more dust exposure, the faster the disease progresses, and the shorter the time of progression. This study found that it took shorter for silicosis to progress from stage I to stage III than CWP and other types of pneumoconiosis. This may be attributed to the higher content of free silica and more harm to health for silicious dust than other dusts. Relevant studies also showed that the survival in silicosis patients was worse than that in patients with other types of pneumoconiosis (12, 13).

The results of Cox regression analyses in this study showed that dust-exposure working years was an important risk factor affecting the survival time in patients, which was similar to the results of other studies (14). It is reported that dust exposure could affect the death of patients (15), which may be because the long-term employment in the dust-exposed industries increases the cumulative dust exposure of the workers. Related studies have also shown that even dust with relatively small damage to humans could cause great loss to the health in patients when cumulative dust exposure is large (16). It is necessary to carry out regular physical examinations to detect pneumoconiosis as early as possible. In addition, the results also showed that from 1987 to 2019, 16.9% of these cases were diagnosed with pneumoconiosis only after a short-term exposure to dust for <5 years, demonstrating the need to strengthen the protection for dust-exposed workers in Zhejiang Province.

There are still some deficiencies in the system construction and coverage of social insurance for occupational disease patients in China, which leads to the failure to implement protection for some patients (17). Among the confirmed cases in Zhejiang Province, although most people were covered by basic medical insurance, the coverage of employment injury insurance and employer compensation was still not comprehensive, let alone the fact that there were 139 patients without any type of insurance. This implied that the coverage was not comprehensive enough, which indirectly aggravated the difficulty in pneumoconiosis prevention and control (18). Therefore, occupational disease management needs to be further strengthened. Our results showed that there were statistically significant differences in the coverage rate of employment injury insurance and employer compensation between stage I, II, and III pneumoconiosis, which was consistent with the research results of Li et al. (19). This may indicate that patients with insurance could receive a better financial support and more actively go to hospitals for diagnosis or treatment to delay the progression of diseases. This study also found that there was no difference in the basic medical insurance coverage among patients in different stages. Meanwhile, relevant research showed that the concurrent rate of pneumoconiosis complications was lower in patients with employment injury insurance than in those without. This may indicate that compared with basic medical insurance, employment injury insurance and employer compensation were more important economic support for patients with pneumoconiosis. Wang et al. (20) found that poor economic status was an important influencing factor leading to pneumoconiosis patients not seeking medical services. Therefore, it is necessary to improve insurance coverage and strengthen the economic support for patients.

Related research (21, 22) showed that the life expectancy in Zhejiang Province in 1998, 2003, 2008, 2010, 2013, and 2015 were 73.9, 75.9, 76.7, 77.3, 77.8, and 77.7 years, respectively,

and the average age at death in pneumoconiosis patients in the corresponding years were 65.2, 61.0, 66.3, 68.4, 70.3, and 70.4 years, respectively. The survival time in patients with pneumoconiosis was shorter than that in the general population. This study also found that with an increase in the stage of pneumoconiosis, the stage of first diagnosis, and the age at first diagnosis, the survival time in pneumoconiosis patients decreased, which agrees with the results of a study conducted in a coal mine in Jiangsu (23). A study found that the older the pneumoconiosis patients were, the higher the stage of pneumoconiosis was, and the more complications were developed in the pneumoconiosis patients, and eventually the survival time in patients was affected (24). It can be concluded that as the disease progresses, the damage caused by pneumoconiosis to health becomes increasingly serious. Therefore, it is necessary to conduct timely intervention and treatment for patients with pneumoconiosis to delay the disease progression and prevent potential infections and complications.

Currently, there has been no survival analysis in pneumoconiosis patients conducted in Zhejiang Province, and this study filled the gap in related knowledge. Based on the discussion of epidemiological characteristics, this study adopted the Kaplan-Meier method and Cox proportional risk regression model to conduct survival analysis. Compared with the analysis of epidemiological characteristics that can only observe the distribution characteristics of patients, survival analysis can explore the risk factors affecting the survival time in patients. The limitation of this study is that it is a retrospective follow-up survey, which may lead to inaccurate data for certain patients. In addition, this study does not investigate the factors that may affect the survival in patients, such as the type of work, enterprise type, enterprise scale, cigarette smoking, regular exercise, and other respiratory toxins.

## Conclusion

In summary, 13,812 pneumoconiosis cases were reported in Zhejiang Province from 1987 to 2019. Some patients had been exposed to dust for <5.0 years, suggesting that there were short-term dust-exposed patients in Zhejiang Province. Therefore, the occupational health management of key industries and working types should be strengthened. Industries with a high incidence of pneumoconiosis, such as mining, construction, and other industries should be supervised. In addition, providing financial support for patients and promoting further improvement of occupational disease insurance are also necessary to improve patient survival and quality of life. Patients with higher stage of pneumoconiosis at first diagnosis, older age, and longer duration of dust exposure had a higher hazard ratio of death.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation. Requests to access the datasets should be directed to [hzou@cdc.zj.cn](mailto:hzou@cdc.zj.cn).

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of Zhejiang Provincial Center for Disease Control and Prevention. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

HZ: investigation, formal analysis, and writing—original draft. ZS: formal analysis and visualization. YixZ: investigation and data curation. JZ: investigation. XF and YijZ: methodology and investigation. YH: formal analysis. XL: conceptualization and funding acquisition. LZ: writing—review and editing and supervision. All

authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

1. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. (2018) 392, 1789–858. doi: 10.1016/S0140-6736(18)32279-7
2. Zhao JQ, Li JG, Zhao CX. Prevalence of pneumoconiosis among young adults aged 24–44 years in a heavily industrialized province of China. *J Occup Health*. (2019) 61:73–81. doi: 10.1002/1348-9585.12029
3. JP NA, Imanaka M, Suganuma N. Japanese workplace health management in pneumoconiosis prevention. *J Occup Health*. (2017) 59:91–103. doi: 10.1539/joh.16-0031-RA
4. Sun Y, Wang Y, Yu W, Zhuo Y, Yuan Q, Wu X. Association of dose and frequency on the survival of patients on maintenance of hemodialysis in China: a kaplan-meier and cox-proportional hazard model analysis. *Med Sci Monit*. (2018) 24:5329–37. doi: 10.12659/MSM.909404
5. Bukovitz B, Meiman J, Anderson H, Brooks EG. Silicosis: diagnosis and medicolegal implications. *J Forensic Sci*. (2019) 64:1389–98. doi: 10.1111/1556-4029.14048
6. Reilly MJ, Timmer SJ, Rosenman KD. The burden of silicosis in Michigan, 1988–2016. *Ann Am Thorac Soc*. (2018) 15:1404–10. doi: 10.1513/AnnalsATS.201802-117OC
7. NHC National Health Commission of China. National occupational health standards of the People's Republic of China: diagnosis of occupational pneumoconiosis GBZ 70-2015 (2015). <http://www.nhc.gov.cn/ewebeditor/uploadfile/2015/12/20151229111557175.pdf>
8. Chen M, Wang H, Zhang J, Yu C, Liu W, Xu Y. Distribution of asbestos enterprises and asbestosis cases - China, 1997–2019. *China CDC Wkly*. (2020) 2:305–9. doi: 10.46234/ccdcw2020.078
9. Li Y, Xian W, Xu H, Sun J, Han B, Liu H. Time trends and future prediction of coal worker's pneumoconiosis in opencast coal mine in China based on the APC model. *BMC Public Health*. (2018) 18:1010. doi: 10.1186/s12889-018-5937-0
10. Aryal A, Morley C. Call for a global ban policy on and scientific management of asbestos to eliminate asbestos-related diseases. *J Public Health Policy*. (2020) 41:279–85. doi: 10.1057/s41271-020-00223-4
11. Zhao H, Xie Y, Wang J, Li X, Li J. Pulmonary rehabilitation for pneumoconiosis: protocol for a systematic review and meta-analysis. *BMJ Open*. (2019) 9:e025891. doi: 10.1136/bmjopen-2018-025891
12. Tse LA, Yu I, Hong Q, Leung CC. Joint effects of smoking and silicosis on diseases to the lungs. *PLoS ONE*. (2014) 9:e104494. doi: 10.1371/journal.pone.0104494
13. Han B, Yan B, Zhao N, Zhang J, Sun J, Lei X, et al. The influence of the functional capacity on subjective well-being and quality of life of patients with silicosis. *Aging Ment Health*. (2013) 17:707–13. doi: 10.1080/13607863.2013.788996
14. Matrat M, Rado L, Févotte J, Guida F, Céné S, Cyr D, et al. Occupational exposure to wood dust and risk of lung cancer: the ICARE study. *Occup Environ Med*. (2019) 76 901–7. doi: 10.1136/oemed-2019-105802
15. Chen W, Liu Y, Wang H, Hnizdo E, Sun Y, Su L. Long-term exposure to silica dust and risk of total and cause-specific mortality in Chinese workers: a cohort study. *PLoS Med*. (2012) 9:e1001206. doi: 10.1371/journal.pmed.1001206
16. Hoy RF, Chambers DC. Silica-related diseases in the modern world. *Allergy*. (2020) 75:2805–17. doi: 10.1111/all.14202
17. Han B, Liu H, Zhai G, Wang Q, Liang J, Zhang M, et al. Estimates and predictions of coal workers' pneumoconiosis cases among redeployed coal workers of the fuxin mining industry group in China: a historical cohort study. *PLoS ONE*. (2016) 11:e0148179. doi: 10.1371/journal.pone.0148179
18. Wang HQ, Jia JJ, Jia ZQ, Jin Q, Li DX, Ling RJ, et al. Analysis of health service utilization and its influencing factors among patients with pneumoconiosis in China. *Biomed Environ Sci*. (2021) 34:83–8. doi: 10.3967/bes2021.011
19. Li Y, Liu GQ, Yan W, Zhang XH, Yang L, Yu YX, et al. Analysis of the diagnostic results and complications of pneumoconiosis patients with

different insurance types. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*. (2020) 38:736–8. doi: 10.3760/cma.j.cn121094-20190927-00461

20. Wang HQ, Chen G, Li Y, Cui P, Liu GF, Lv XP, et al. Hospitalized but not admitted and influencing factors for pneumoconiosis patients. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*. (2019) 37:696–702. doi: 10.3760/cma.j.issn.1001-9391.2019.09.016

21. Fei FR, Zhong JM, Yu M, Gong WW, Wang M, Pan J, et al. Impact of injury-related mortality on life expectancy in Zhejiang, China based on death and population surveillance data. *BMC Public Health*. (2017) 18:24. doi: 10.1186/s12889-017-4566-3

22. Zhou MG, Li YC, Wang HD, Zeng XY, Wang LJ, Liu SW, et al. Analysis on life expectancy and healthy life expectancy in China, 1990–2015. *Zhonghua Liu Xing Bing Xue Za Zhi*. (2016) 37:1439–43. doi: 10.3760/cma.j.issn.0254-6450.2016.11.001

23. Han L, Gao Q, Yang J, Wu Q, Zhu B, Zhang H, et al. Survival analysis of coal workers' pneumoconiosis (CWP) patients in a state-owned mine in the East of China from 1963 to 2014. *Int J Environ Res Public Health*. (2017) 14:489. doi: 10.3390/ijerph14050489

24. Dai WR, Li X, Tang BY, Chen G. Analysis of 6344 cases of hospitalized migrant workers with pneumoconiosis. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*. (2020) 38:679–82. doi: 10.3760/cma.j.cn121094-20190927-00423





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# Associations between professional identity and turnover intent in prehospital emergency physicians: The mediating effect of burnout

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**Context:** The prehospital emergency system is essential for reducing mortality and disability in emergency patients. However, the high turnover rate of prehospital emergency physicians (PEPs) remains the most prominent problems in the prehospital emergency system. Turnover intent (TI) is predictive of actual turnover behavior; however, previous studies have mainly focused on sociodemographic factors and job characteristics, ignoring many other potential psychological factors, such as professional identity (PI) and job burnout (JB).

**Objectives:** To measure the level of PI, JB, and TI of PEPs in Beijing, China. We analyze the distribution of TI in different social demography PEPs and then further explore the influence of PI and JB on TI, to provide a reference and suggestions for government departments to reduce the TI of PEPs.

**Methods:** An online questionnaire was distributed to 552 PEPs in Beijing, and a total of 533 valid questionnaires were included. *T*-test and variance analysis were used to examine the differences in the distribution of TI among different sociodemographic PEPs. Pearson's correlation analysis was used to test the correlation between PI, JB, and TI. The SEM was used to analyze the relationships among PI, JB, and TI.

**Results:** Univariate analysis showed that age, marital status, education, professional title, work experience, department and hukou were significantly associated with TI. Pearson's correlation analysis showed that PI was negatively associated with JB and TI, and JB was positively associated with TI. Professional treatment identity (PTI,  $\beta = -0.24$ , 95% CI:  $-0.38 \sim -0.11$ ), professional meaning identity (PMI,  $\beta = -0.12$ , 95% CI:  $-0.23 \sim 0.03$ ), and emotional exhaustion (EE,  $\beta = 0.40$ , 95% CI:  $0.28 \sim 0.51$ ) seem to have direct impacts on TI. Given the mediating role played by EE, PTI may have an indirect negative effect on TI ( $\beta = -0.24$ , 95% CI:  $-0.32 \sim 0.16$ ).

**Conclusion:** PI and JB of PEPs in China are closely related to TI, which may have unexpected effects on government departments to stabilize the team of PEPs through a series of control measures. According to the above results, the

professional treatment of PEPs needs to be improved, and external learning opportunities should be increased. Legalization of medical rescue workers should also be on the agenda.

#### KEYWORDS

job burnout, professional identity, mediation effect model, turnover intent, prehospital emergency care

## Introduction

### Background

Prehospital emergency refers to emergency first aid provided to patients suffering from various life-threatening emergencies, such as trauma, poisoning, disasters and accidents suffered before arriving at the hospital (1). This work is essential for reducing mortality and disability in emergency patients (2). On the one hand, the study of the Lancet showed that with the change in disease spectrum, stroke and cardiovascular diseases have become the main causes of death in Chinese residents (3). The treatment of stroke and cardiovascular diseases is a race against time, which makes the establishment and improvement of a prehospital emergency care system become very important, and has been widely considered by the society. On the other hand, the global ecological environmental changes, resulting in a variety of public health emergencies and sudden disaster accidents, also show a growing trend, and the prehospital emergency care system has become an important part of the urban security system and public health emergency treatment system (4).

However, high turnover rates and insufficient numbers of prehospital emergency physicians (PEPs) remain the most prominent problems in the prehospital emergency system (4). Studies have shown that PEPs are more likely than other professionals to leave their profession, either by retiring or by pursuing nonemergency clinical practice, management, research, or teaching (5). A study in France showed that the turnover rates of PEPs ranged from 12 to 21.4%, and excessive turnover eventually led to a mass exodus of PEPs (6). One study indicated that the attrition rate for PEPs in the United States within 2 years of completing training was 6.5%, with an estimated average attrition rate of 1.7% PEPs per year (7). Similar results were found in Taiwan, China, where the annual turnover rate of PEPs was 1.83% (8). The prehospital emergency talent team is the foundation of the rapid development of prehospital emergency capabilities, so the establishment and stability of the prehospital emergency team is very important (9). The characteristics of prehospital emergency work (a heavy workload, emergency work, quick transitions, the constant need to perform better and more quickly when

dealing with limited resources, uncertainty, a lack of recognition, frustration, and interpersonal conflict) result in PEPs being subjected to tremendous pressure, which can lead to resignation (10). Due to the lack of staff, existing PEPs have to work at full capacity or even overload, which further leads to a high turnover rate, forming a vicious circle (11). Moreover, the grim situation of PEPs shortages led to the prehospital emergency medical services not running a sufficient number of vehicles on duty. Without enough vehicles on duty, it is impossible to set up a tight and reasonable emergency station network covering all areas, resulting in the phenomenon that emergency vehicles arrive at the scene slowly or even have no vehicles to send, which cannot meet the needs of prehospital medical emergency services (4). Therefore, it is urgent to effectively reduce the turnover rate of PEPs and realize the stability of the prehospital emergency physician team.

As early as the early 20th century, some scholars began to study the demission behavior of employees. At present, the concept of demission behavior is divided into a broad sense and a narrow sense. The broad sense refers to “the change of the individual’s status as an organization member” (12). In the narrow sense, demission emphasizes that the individual and the organization terminate the labor relationship and leave from the organization, which can be divided into active demission, passive demission and natural demission. Most of the demission behaviors studied by scholars refer to the active demission of employees (13). Turnover intent (TI) refers to the attitude and idea generated by employees to voluntarily leave the organization, which can be used to measure the degree to which employees want to voluntarily leave the organization (14). Mobley believes that to pay attention to the turnover behavior of employees, it is necessary to study their TI first (15). Moreover, TI has appropriate predictability and intervention for actual turnover behavior, and its research value is higher than that of actual turnover behavior (16). Therefore, effectively reducing TI among PEPs is highly important. Previous studies have found that gender, age, education level, work experience, salary and work-family conflicts are all related stress factors for PEPs, which can eventually lead to resignation (17). However, these studies have mainly focused on sociodemographic factors and job characteristics, ignoring many other potential factors. Mobley pointed out that turnover is determined by some basic factors,

such as the employee's age and qualification, expectation of the current job, job satisfaction, expectation of other jobs, etc. These factors influence each other and jointly affect individual attitude variables, and attitude variables eventually lead to turnover (18). Therefore, this study included two attitude variables, professional identity (PI) and job burnout (JB), to explore their impact on TI.

PI refers to a person's views concerning a number of factors, such as the social value and goal of the work or task in which he or she is engaged, and this term indicates his or her recognition and understanding of the content, nature and value of this occupation (19). Niemi believes that PI is the self-concept of employees, which refers to the understanding of the nature, content and value of the occupation in the process of long-term engagement in a certain occupation. It is the psychological basis for employees to complete their own work (20). Schein believes that PI is an individual's understanding of his or her occupation and his or her recognition of self-ability development and professional value (21). Foster K et al. noted that PI is crucial to doctors' career development and personal growth (22). Some studies have shown that there is a significant negative correlation between PI and TI, and the higher the degree of PI is, the weaker the TI (23, 24).

Freudenberger was the first to propose JB. He believed that JB is most likely to appear in the helping industry, which is a kind of physical, emotional and behavioral exhaustion caused by long-term work (25). Currently, there are many definitions of JB. Maslach et al. believe that JB is a psychological syndrome that is an emotional expression and response of people to long-term work (26). Most researchers also prefer Maslach's multifaceted definition of JB. Maslach believes that JB includes three dimensions: emotional exhaustion (EE), depersonalization (DP), and low personal achievement (LPA). In the past, JB has been understood as a descriptive disorder; however, it is now recognized in the recently updated International Classification of Diseases, 10th revision, code Z73.0 (27). Multiple studies have shown that JB is closely related to TI, and the higher the degree of JB, the stronger the TI. Failure to identify and solve the underlying causes of JB may lead to health damage and staff shortages of PEPs and may have a negative impact on patient care (27–29).

Therefore, both PI and JB are potential influencing factors affecting the TI of PEPs. However, current studies have mostly focused on the relationships among PI, JB, and job satisfaction (30). Alternatively, studies have explored the factors influencing PI, JB (31) and TI (32), but less attention has been given to the relationships between PI, JB, and TI, especially in the context of prehospital emergency care. A few studies have explored the impact of PI on TI or the impact of JB on TI, but the path analysis of the effects of the two on TI remains to be explored (24, 33). Accordingly, the relationship between PI, JB, and TI was explored by developing a structural equation model (SEM) in this study.

## Goals of this research

The first objective of this study was to understand the current status of the PI, JB, and TI of PEPs in Beijing, China. The second objective was to explore the distribution of TI among different populations of PEPs. The third objective is to explore the relationship between PI, JB, and TI to provide a reference and suggestions for government departments to reduce the TI of PEPs and stabilize the prehospital emergency team in the future.

## Literature review and hypothesis

### PI and TI

Tajfel (34) introduced the concept of “social identity,” which refers to an individual's knowledge of belonging to a certain social group as well as the emotional and value significance of group membership (35). According to SI theory, employees constantly seek ways to improve their self-esteem and self-image through the groups and organizations to which they belong. If an employee does not feel that the organization helps improve his or her self-perception, then at best the employee will try to change the organization, and at worst the employee will quit (36). In addition, studies have shown that there is a significant negative correlation between PI and TI, and the higher the degree of PI is, the lower the rate of TI (24). Based on this, we propose the following hypothesis:

H1: PI negatively affects TI.

Professional treatment identification (PTI) refers to the identification of physicians on the matching degree between their efforts and gains in the current occupation, including patient identity, work reward, working environment, etc. Adam believes that employees' working attitude depends on effort-reward, longitudinal comparison between themselves and others (37). Adam Smith's economic exchange theory holds that obtaining the use value and economic value from the exchange process is the premise of exchange behavior, and only when the exchange process achieves a win-win situation can the balance be achieved. The essence of exchange is the social exchange of rewards and efforts. Rewards-efforts=result; rewards includes nonmaterial return (awards, honors, status) and material return (income, dividends), and efforts include physical effort and intellectual effort. If both sides of the equation are positive, the exchange relationship is maintained; otherwise, the equilibrium is broken (38). Therefore, if PEPs feel effort-reward imbalance or their income is lower than that of the reference staff, they may produce TI. Based on this, we propose the following hypothesis:

H1a: PTI negatively affects TI.

Professional meaning identification (PMI) is the opposite emotional experience to EE and DP. It is the positive perception of the purpose and value of work. Compared with other occupations, PEPs have irregular working hours, a heavy workload, and great physical and mental pressure, which lead to the excessive burden of family roles and work roles. The original purpose of PEPs is to treat critically ill patients. They hope to obtain more social recognition like that received by medical staff in hospitals. They may be inclined to leave their current job when they feel that the job is not meeting their expectations, that the job is not valuable, and that it is difficult to obtain the corresponding respect (39). Therefore, we propose the following hypothesis:

H1b: PMI negatively affects TI.

Professional ability identification (PAI) refers to physicians' recognition of their knowledge and skills in the medical profession. The career progression of PEPs is the same as that of in-hospital physicians, but the job content is different. Therefore, PEPs are unable to compare with in-hospital physicians in terms of scientific research ability and paper writing ability, and it is more difficult to promote their professional titles, which can easily lead to doubts and negative attitudes in their cognition and evaluation of self-professional value and decrease their enthusiasm for work, thus affecting their on-the-job willingness. Research shows that, in an organization, the higher the degree of self-respect of employees, the greater they think they have important and valuable significance in the organization to which they belong, endowing individuals with inner strength and sense of value and full of confidence and pride in their work to improve job satisfaction and reduce TI (40, 41). Therefore, we propose the following hypothesis:

H1c: PAI negatively affects TI.

## JB and TI

COR theory posits that employee pressure, performance, burnout and other problems are caused by an imbalance between individual resource input and output. When individuals invest a large amount of original resources, such as time, energy, and social relations, but cannot obtain a comparable replenishment of resources, burnout intent occurs (42). Pines found that the most serious consequence of JB for an organization is the loss of employees (43). Maslach found that among the negative effects of JB, the ultimate and most serious is the increase in employees' TI and the turnover behavior that may result from it. Based on the above views, this study believes that when PEPs are enthusiastic about helping others and have a positive working attitude and constantly invest time, energy, knowledge and technology to provide emergency services but

cannot feel their own value in the work, there is a serious imbalance between the effort and reward. The original resource of positive emotions, such as self-efficacy, optimism, positive personality traits resources suffered loss, EE, DP and LPA symptoms of JB, to avoid itself to the "spiral loss," action must be taken to prevent resources from continuing to be damaged, by giving up current career (44). Therefore, we propose the following hypothesis:

H2: JB positively affects TI.

EE is when a practitioner becomes exhausted by excessive physical and emotional exhaustion and is unable to relax and restore physical and mental exhaustion. It is the most direct response to work stress and major changes at work and is also the core of JB, which can reduce the job satisfaction of practitioners and produce TI (45). Therefore, we propose the following hypothesis:

H2a: EE positively affects TI.

LPA refers to the practitioners' evaluation of their work ability, work performance, and work value. When workers' personal sense of accomplishment is reduced, they will lack confidence in their work and feel that their prospects are slim (45). The need for achievement theory was put forward by American professor David McClelland in the 1950's. McClelland pointed out that in addition to basic physiological needs, there are three kinds of human needs, namely, the need for power, the need for belonging and the need for achievement. Among them, the need for achievement refers to the need to strive to do the best and succeed. People with the need for achievement have a strong desire for success, desire challenges, and want to obtain the satisfaction of success by achieving certain difficult goals. Generally, those who need high achievement are mostly middle class, intellectuals and so on. The subjects of this study are PEPs, most of whom are highly educated. Combined with the previous investigation and research, it is found that their achievement needs are strong. They are willing to do their best work and eager to use what they have learned to help every patient in crisis. Therefore, the high achievement motivation of PEPs is very consistent with the achievement needs theory. When their achievement needs are not met, they will have TI and then seek new jobs. Therefore, we propose the following hypothesis:

H2b: LPA positively affects TI.

## PI and JB

Furthermore, studies have found that the more an employee PI with his or her current job, the lower the level of JB (46). Positive PI can improve personal satisfaction and reduce JB,

thus reducing turnover rates (47). Therefore, we propose the following hypothesis:

H3: PI negatively affects JB.

PTI is an important reason for the TI of PEPs. PEPs have high workload and pressure. When much effort is not satisfied with the reward, it will lead to the formation of negative and indifferent work attitudes of PEPs (48). In addition, in China, especially in Beijing, the capital city, housing loans and children's education expenses and other life pressures are high. If the professional treatment of PEPs cannot meet the needs of life, it will lead to the reduction of personal sense of the accomplishment of PEPs, and then the TI occurs. Therefore, we propose the following hypothesis:

H3a: PTI negatively affects EE.

H3b: PTI negatively affects LPA.

PMI refers to the degree to which physicians identify with the personal meaning and value brought by their current career. According to Miller, when individuals feel respected and proud of their profession, it will have a positive impact on work behavior. This indicates that when the positive value and social evaluation of an individual's career decrease, it will have a negative impact on work attitude and cause a change in career persistence intention. PEPs are under great pressure. If they are unable to perceive the value and significance of their work and obtain a high sense of personal achievement, it is easy to cause excessive physical and psychological consumption, resulting in EE (49). Therefore, we propose the following hypothesis:

H3c: PMI negatively affects EE.

H3d: PMI negatively affects LPA.

The dimension of PAI refers to the judgment of practitioners on their competence and confidence in business execution, which is the "inner maturity" of individuals and the evaluation of their overall sense of competence related to their career. When individuals think that their own ability is not competent for the current job, promotion expectations are difficult to meet or development space is limited, which will reduce their career development expectations and career achievement, leading to the weakening of work passion, and the strengthening of JB. Therefore, we propose the following hypothesis:

H3e: PAI negatively affects TI, and EE plays a mediating role.

H3f: PAI negatively affects TI, and LPA plays a mediating role.

Thus, the hypothesis framework of this study has been formed, as shown in Figure 1.

## Materials and methods

### Setting and participants

The questionnaire was sent to the mobile phones of respondents in the form of a hyperlink in September 2019. After providing informed consent, respondents completed the questionnaire online. According to the structural equation model, the sample size of a survey should be 10–15 times the number of questionnaire items. Thirty-two items were included in this study (9 items for sociodemographic variables, 11 items for PI, 11 items for JB, and 1 item for TI), so the required sample size was 480. Taking into account the possibility of nonresponses, incomplete questionnaires and lost samples, the sample size was increased by 15% for a final minimum acceptable sample size of 552; thus we conducted a cross-sectional survey of 552 PEPs in Beijing by purposive sampling, and a total of 533 valid questionnaires were collected, with a recovery rate of 96.56%.

### Patient and public involvement

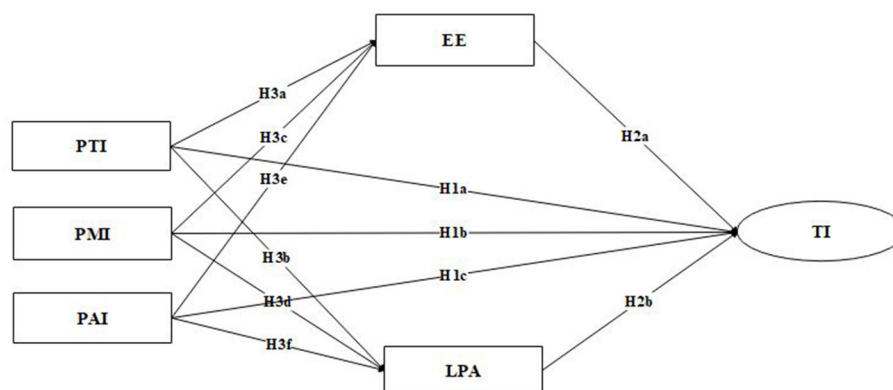
Patients or the public were not involved in this study as this research focused solely on PEPs.

## Measurements

### Sociodemographic data

In this study, the following sociodemographic characteristics were assessed: gender (male, female), age ( $\leq 30$ , 31–40, 41–50,  $\geq 51$ ), education (below Undergraduate, undergraduate, postgraduate), marital status (married, unmarried), work experience ( $\leq 5$ , 6–10,  $\geq 11$ ), and professional title (primary, medium, senior). In addition, employment type is a kind of employment system that determines the basic personnel relationship between employer and employees in the form of contract, that is, the identity attribute of employee in the unit is determined by signing an employment contract with the unit. In our study, the employment type included permanent and temporary, permanent means once the worker is transferred or assigned to its unit, the worker becomes the unit for life. Temporary means the employee and the employer signed a certain period of labor contract, the employee and the employer have equal labor relations, and both the employee and employer can voluntarily terminate the contract. Hukou refers to the legal document made by the administrative organ in charge of household administration to record and retain the basic information of the household population. In our study, Hukou includes Beijing (Urban), Beijing (Suburban), and Non-Beijing. Department refers to the work unit, including Beijing Emergency Medical Center (hereinafter referred to as 120)





**FIGURE 1**  
Theoretical model. PTI, professional treatment identity; PMI, professional meaning identity; PAI, professional ability identity; EE, emotional exhaustion; LPA, low personal achievement; TI, turnover intent.

and Beijing Red Cross Emergency Rescue Center (hereinafter referred to as 999) in this study.

### PI scale

This study used the revised PI scale developed by Chen Jing (50). The scale included a total of 13 questions divided into three parts: PTI, PMI, and PAI, with the scale as a whole using a 4-level scoring system. From “strongly disagree” to “strongly agree,” a higher score indicates a higher level of PI. The Cronbach’s  $\alpha$  values of PTI, PMI, PAI, and the whole scale were 0.859, 0.878, 0.707, and 0.856, respectively, indicating that the reliability of the questionnaire was good. The Kaiser-Meyer-Olkin (KMO) test scores of the PTI, PMI, PAI, and the whole scale were 0.832, 0.722, 0.638, and 0.847, respectively, which indicated that the structural validity of this questionnaire was acceptable.

### JB scale

In this study, a burnout scale developed by Chaoping Li was used, featuring a total of 15 questions divided into three parts: EE, DP, and LPA, with the scale as a whole using a 7-level scoring system (51). From “never” to “every day,” higher scores indicate higher levels of JB. According to participatory observation and in-depth interviews, Chinese PEPs generally exhibited severe EE and LPA. Therefore, we adopted EE and LPA to measure burnout in PEPs in this study. The Cronbach’s  $\alpha$  values of EE, LPA, and the whole scale were 0.846, 0.816, and 0.835, respectively, indicating that the reliability of the questionnaire was good. The KMO scores of EE and LPA, overall, were 0.803, 0.841, and 0.8465, respectively, which indicated that the questionnaire had good structural validity.

### TI

In this questionnaire, given the number of questions and the response effect, we asked a direct question, “Have you considered leaving this work?”, to determine PEPs turnover intent. Studies have shown that the use of one question was a better means of reflecting turnover intent (52). The options used a 4-level scoring system, 1= never, 2= rarely, 3= occasionally, 4= often.

### Data collection and analysis

The Questionnaire Star platform was used to conduct this survey. Participants in the study completed the questionnaire independently and anonymously after encountering the QR code *via* “sweeping” on WeChat.

SPSS 25.0 and Mplus 8.0 were used to analyze the data. Descriptive analysis was used to analyze the sociodemographic characteristics of respondents, and Student’s *t* test and analyses of variance were conducted to test for significant differences in PI, JB, and TI score across different subgroups. Pearson’s test was used to analyze the correlations among PI, JB, and TI. SEM was used to examine the mediating effect of JB, including a bootstrap test with 5,000 repeated samplings with respect to the significance test of mediating effects, with  $p < 0.05$  indicating that the differences were statistically significant. We took TI as the dependent variable; sociodemographic variables as the control variables (dummy variables were set for unordered multicategorical variables); PI (PTI, PMI, PAI) as the independent variable; and JB (EE, LPA) as the mediating variable to establish a structural equation model. The maximum likelihood (ML) method was used to estimate the assumed model parameters, and the model was



modified by combining Pearson correlation analysis results and modification indexes (MI). To assess overall model fit, four parameters were used: CFI, TLI, RMSEA, SRMR. If the CFI and TLI values were above 0.90 and the RMSEA and SRMR values were below 0.08, the model fit was acceptable (53).

In addition, since the variables measured in this study were all from the same subjects, it was a self-reported single-source cross-sectional study, so there may be common methodological variation (CMV). In this regard, two measures were adopted to control CMV in this study, namely process control and statistical control. The first is process control; this study used different scale endpoints and formats for the predictor and criterion measures. This reduces method biases caused by commonalities in scale endpoints and anchoring effects (54). A 4-level scoring system was used in the PI scale, a 7-level scoring system in the JB scale and a 4-level scoring system in the TI. At the same time, reverse scoring questions were set in the JB scale to reduce the consistency, deviation and perfunctory answers (55). The second is statistical control. In this study, controlling for the effects of a single unmeasured latent method factor was chosen to examine the degree of CMV in the current data, which was recommended by Widaman (56). This technique models the effect of the method factor on the measures rather than on the latent constructs they represent. The specific operation is to add a first-order factor with all of the measures as indicators to the theoretical model of this study, and this method has been used in many studies (57).

## Results

### Sociodemographic information

A total of 533 people were included in the study, of whom 392 (73.5%) were unmarried; 346 were males (64.9%); 250 (46.9%) were aged 31–40; 311 (58.3%) had a bachelor's degree; 351 (65.9%) had a junior professional title; 324 (60.8%) were temporary staff; 297 (55.7%) had <5 years of work experience; and 311 (58.3%) were non-Beijing hukou (Table 1).

### Controlling for the effects of a single unmeasured latent method factor

As mentioned in the methods section, in this study we controlled for the effects of a single unmeasured latent method factor to examine the extent of CMV in the current data. In this approach, a multifactor measurement model was tested ( $\chi^2 = 828.542$ ,  $P < 0.001$ , CFI = 0.901, TLI = 0.884, RMSEA = 0.073,  $df = 82$ ), and a measurement model with an additional method factor was tested ( $\chi^2 = 441.305$ ,  $P < 0.001$ ,

**TABLE 1** Respondent distribution by demographics and work situations.

Variables	N (%)
<b>Gender</b>	
Male	346 (64.90)
Female	187 (35.10)
<b>Age (year)</b>	
≤30	190 (35.60)
31–40	250 (46.90)
41–50	83 (15.60)
≥51	10 (1.90)
<b>Marital status</b>	
Married	392 (73.50)
Unmarried	141 (26.50)
<b>Education</b>	
Below undergraduate	193 (36.20)
Undergraduate	311 (58.30)
Postgraduate	29 (5.40)
<b>Professional title</b>	
Primary	351 (65.90)
Medium	164 (30.80)
Senior	18 (3.40)
<b>Employment type</b>	
Permanent	209 (39.20)
Temporary	324 (60.80)
<b>Work experience (year)</b>	
≤5	297 (55.70)
6–10	122 (22.90)
≥11	114 (21.40)
<b>Department</b>	
120	364 (68.30)
999	169 (31.70)
<b>Hukou</b>	
Beijing (Urban)	75 (14.10)
Beijing (Suburban)	147 (27.60)
Non-Beijing	311 (58.30)

CFI = 0.960, TLI = 0.948, RMSEA = 0.049,  $df = 104$ ).  $\Delta\chi^2 < \chi^2(\Delta df, 0.95)$  (Chi-square Critical Value), the results from these analyses indicated that the method factor did not improve the model fit. The results of these tests suggest that CMV is not a pervasive problem in this study.

### Descriptive analysis of PI, JB, and TI

As shown in Table 2, the average PI score was  $27.63 \pm 5.17$ , including  $9.77 \pm 3.12$  for PTI,  $9.38 \pm 1.43$  for PMI and  $8.48 \pm 2.09$  for PAI. The average JB score was  $49.67 \pm 19.60$ , the average

TABLE 2 Mean values of PI, JB, and TI.

Variables	Mean $\pm$ SD
PI	27.63 $\pm$ 5.17
PTI	9.77 $\pm$ 3.12
PMI	9.38 $\pm$ 1.43
PAI	8.48 $\pm$ 2.09
JB	24.84 $\pm$ 9.80
EE	27.53 $\pm$ 12.54
LPA	22.14 $\pm$ 11.39
TI	2.66 $\pm$ 1.02

PI, professional identity; PTI, professional treatment identity; PMI, professional meaning identity; PAI, professional ability identity; JB, job burnout; EE, emotional exhaustion; LPA, low personal achievement; TI, turnover intent.

EE score was  $27.53 \pm 12.54$ , and the average LPA score was  $22.14 \pm 11.39$ . The average TI score was  $2.66 \pm 1.02$ .

## Single factor analysis of TI

As seen from Table 3, gender had no significant difference in TI, and the highest TI was found between 31 and 40 years old ( $P < 0.001$ ), PEPs who were married had a higher TI than those who were unmarried ( $P < 0.001$ ), PEPs with postgraduate degrees had the highest TI ( $P < 0.001$ ), the TI of PEPs with medium titles was higher than that of PEPs with primary and senior titles ( $P < 0.001$ ), employment type had no significant difference in TI, PEPs with more than 11 years of work experience had the highest TI ( $P < 0.001$ ), the TI of 120 PEPs was higher than that of 999 PEPs, and PEPs with hukou in Beijing (suburban) had the highest TI ( $P < 0.05$ ).

## Correlation analysis of PI, JB, and TI

Table 4 shows the correlation coefficients among TI, PI and JB in PEPs. Overall, all of these coefficients were statistically significant at the  $P < 0.01$  level. Specifically, PI was negatively associated with both JB and TI. Additionally, JB was positively associated with TI, indicating a prerequisite for mediating effect analysis.

## Mediation effect

The results of the mediation model showed that  $\chi^2 = 655.245$ ,  $P < 0.001$ , TLI = 0.915, CFI = 0.928, RMSEA = 0.062, SRMR = 0.072, and all fitting indexes were ideal, indicating that the mediation model was acceptable. Figure 2 shows the model path diagram with standardized coefficients, and Table 5 depicts the overall, direct, and indirect

TABLE 3 Single factor analysis of TI.

Variables	TI	t/F	P
<b>Gender</b>		0.28	0.779
Male	2.67 $\pm$ 1.02		
Female	2.64 $\pm$ 1.01		
<b>Age</b>		19.79	<0.001
$\leq 30$	2.24 $\pm$ 1.03		
31–40	2.94 $\pm$ 0.89		
41–50	2.78 $\pm$ 1.01		
$\geq 51$	2.40 $\pm$ 1.27		
<b>Marital status</b>		6.11	<0.001
Married	2.82 $\pm$ 0.97		
Unmarried	2.22 $\pm$ 1.00		
<b>Education</b>		11.28	<0.001
Below Undergraduate	2.39 $\pm$ 1.01		
Undergraduate	2.79 $\pm$ 1.00		
Postgraduate	3.00 $\pm$ 0.89		
<b>Professional title</b>		10.83	<0.001
Primary	2.53 $\pm$ 1.02		
Medium	2.96 $\pm$ 0.95		
Senior	2.39 $\pm$ 0.92		
<b>Employment type</b>		0.381	0.703
Permanent	2.68 $\pm$ 1.03		
Temporary	2.68 $\pm$ 1.01		
<b>Work experience</b>		7.25	<0.001
$\leq 5$	2.51 $\pm$ 1.03		
6–10	2.82 $\pm$ 0.89		
$\geq 11$	2.87 $\pm$ 1.04		
<b>Department</b>		8.64	<0.001
120	2.90 $\pm$ 0.94		
999	2.13 $\pm$ 0.97		
<b>Hukou</b>		3.06	0.048
Beijing (Urban)	2.73 $\pm$ 1.06		
Beijing (Suburban)	2.81 $\pm$ 0.98		
Other	2.57 $\pm$ 1.02		

TI, turnover intent.

effects of the model path. The significance of all effects was tested with a 95% CI estimate.

When testing the structural model of the sample, we decided to exclude the control variables from the model, since the addition of control variables did not cause substantial changes either in model fitting or in parameter estimates and significance. Additionally, to present the data more intuitively, only statistically significant paths are shown in Figure 2. As seen from the figure, EE ( $\beta = 0.40$ , 95% CI: 0.28~0.51), PTI ( $\beta = -0.24$ , 95% CI:  $-0.38 \sim -0.11$ ) and PMI ( $\beta = -0.12$ , 95% CI:  $-0.23 \sim -0.03$ ) had a significant direct impact on TI, while PAI and LPA had no significant direct impact on TI. In

TABLE 4 Correlations among TI, PI, and JB.

Variables	M	SD	EE	LPA	PTI	PMI	PAI	TI
<b>JB</b>								
EE	27.53	12.54	1					
LPA	22.14	11.39	0.340**	1				
<b>PI</b>								
PTI	9.77	3.12	−0.601**	−0.380**	1			
PMI	9.38	1.43	−0.240**	−0.342**	0.143**	1		
PAI	8.48	2.09	−0.517**	−0.485**	0.523**	0.415**	1	
TI	2.66	1.02	0.606**	0.364**	−0.579**	−0.167**	−0.480**	1

\*\*p<0.01; PTI, professional treatment identity; PMI, professional meaning identity; PAI, professional ability identity; EE, emotional exhaustion; LPA, low personal achievement; TI, turnover intent.

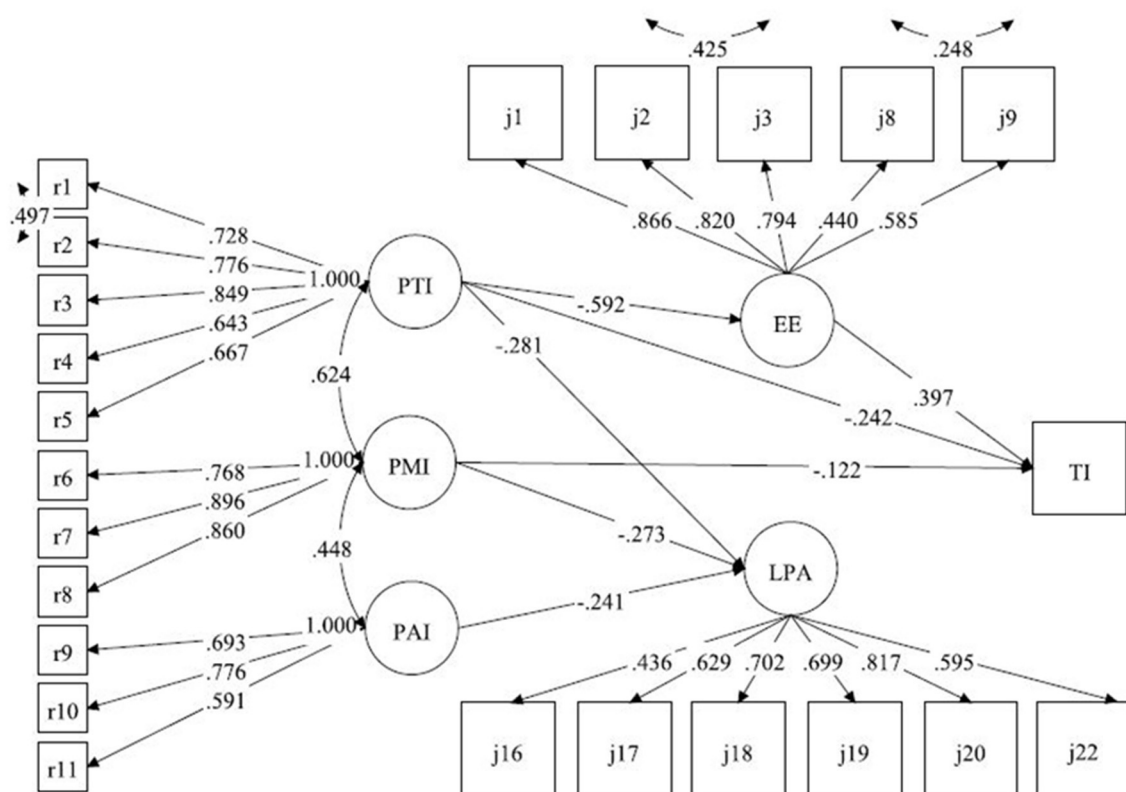


FIGURE 2

Model paths and standardized coefficients pertaining to the synthesized relationships among PI, JB, and TI. PTI, professional treatment identity; PMI, professional meaning identity; PAI, professional ability identity; EE, emotional exhaustion; LPA, low personal achievement; TI, turnover intent.

terms of indirect effects, PTI ( $\beta = -0.24$ , 95% CI:  $-0.32 \sim -0.16$ ) mediated the effect of EE on TI.

## Discussion

PEPs are an important aspect of the human resource requirements of prehospital emergency services, and a shortage

of healthy, well-trained PEPs can negatively impact the lives and health of patients (28). Therefore, the tasks of effectively reducing TI among PEPs and stabilizing the prehospital emergency team play a very important role with respect to providing high-quality patient care. This study conducted quantitative research concerning the relationships among PI, JB, and TI. PI was divided into three dimensions, PTI, PMI and PAI, and JB was divided into two dimensions, EE and LPA. Then,

TABLE 5 Standardized effects of model paths.

Model paths	Estimates	95% CI	P
PTI → TI	−0.24	−0.38, −0.11	<0.001
PMI → TI	−0.12	−0.23, −0.03	0.017
PAI → TI	0.03	−0.07, 0.11	0.497
PTI → EE	−0.59	−0.71, −0.46	<0.001
PMI → EE	−0.15	−0.28, 0.02	0.053
PAI → EE	−0.08	−0.19, 0.05	0.202
PTI → LPA	−0.28	−0.40, −0.15	<0.001
PMI → LPA	−0.27	−0.40, −0.12	<0.001
PAI → LPA	−0.24	−0.38, −0.10	0.001
EE → TI	0.40	0.28, 0.51	<0.001
LPA → TI	0.07	−0.04, 0.23	0.168
PTI → EE → TI	−0.24	−0.32, −0.16	<0.001
PTI → LPA → TI	−0.02	−0.05, 0.01	0.208
PMI → EE → TI	−0.06	−0.12, 0.00	0.059
PMI → LPA → TI	−0.02	−0.058, 0.00	0.213
PAI → EE → TI	−0.03	−0.08, 0.02	0.218
PAI → LPA → TI	−0.02	−0.05, 0.00	0.224

PTI, Professional treatment identity; PMI, professional meaning identity; PAI, professional ability identity; EE, emotional exhaustion; LPA, low personal achievement; TI, turnover intent.

a mediation model was used to conduct path analysis. Overall, the results of this study showed that 64.7% of PEPs reported a moderate or higher level of TI. Consistent with the literature, our study showed that higher levels of PI among PEPs can reduce TI and that higher JB aggravates TI (5).

## The influence of sociodemographic variables on TI

Univariate analysis showed that the more work experience PEPs had, the higher their TI rates were ( $P < 0.001$ ). McClelland believed that after people's basic needs are met, they pursue high-level needs such as a sense of accomplishment. Therefore, the more work experience PEPs had, the more highly they valued career promotion opportunities. When their current job could not provide promotion opportunities, certain older workers would consider leaving (58). Similarly, PEPs aged 31–40 years ( $P < 0.001$ ) and those who had medium professional titles ( $P < 0.001$ ) pursued career development most avidly and correspondingly exhibited the highest TI rates. In addition, highly educated PEPs usually had relatively high expectations regarding their social status. If their current emergency work could not meet their expectations regarding social status improvement, certain individuals would experience TI ( $P < 0.001$ ). A study by Yi-fang Wu noted that emergency doctors who are married and have children are less likely to

leave their jobs, which may be explained by the fact that financial responsibilities related to career change have an excessive impact on family and children, which makes individuals choose to remain in their current jobs (5). In this study, TI among married doctors was significantly higher than that among unmarried doctors ( $P < 0.001$ ). One possible explanation for this result is that married PEPs put their families first, but emergency work often leads to work-family conflict. Multiple studies have shown that work-family conflict is significantly associated with TI and that employees who have greater control over their working hours and more flexibility are less likely to quit (59). Simultaneously, there are essential differences between TI and actual turnover behavior; high TI does not necessarily entail that an individual will leave his or her current career.

## The direct influence of PI on TI

Many scholars have confirmed that PI has a significant negative impact on TI. The lower the level of PI is, the higher TI rates are (60). In this study, PI was divided into three dimensions: PTI, PMI and PAI. There was no significant effect of PAI on TI ( $\beta = 0.03$ , 95% CI:  $-0.07 \sim 0.11$ ), indicating that PEPs in Beijing recognized their ability to engage in prehospital emergency work and believed that they had sufficient professional knowledge and skills to meet the needs of prehospital emergency work. PTI had a significant negative impact on TI ( $\beta = -0.24$ , 95% CI:  $-0.38 \sim -0.11$ ), and PTI had the lowest score among the three dimensions of PI, indicating that current PEPs were not satisfied with their salaries. Based on their excess contributions to the work of the organization, employees were eager to obtain a reward appropriate to their efforts. When their expectations are not met, their satisfaction with salary, the professional promotion system and the incentive system are reduced, which can lead to resignation, supporting hypothesis H1a (61). PMI had a significant negative influence on TI ( $\beta = -0.12$ , 95% CI:  $-0.23 \sim -0.03$ ), supporting hypothesis H1b. The preliminary study found that most PEPs in Beijing were medical college graduates with medical qualifications, and they hoped to obtain more social recognition and better career development opportunities. However, the content of their work mostly consisted of simple, routine medical activities, and they found it difficult to sense the value of their work, which can result in resignation.

## The negative influence of PI on JB

The results showed that PMI ( $\beta = -0.27$ , 95% CI:  $-0.40 \sim -0.12$ ) had a direct negative effect on LPA, supporting hypothesis H3d. LPA refers to low productivity and low

self-esteem. Studies have pointed out that although LPA is often excluded from medical burnout surveys, LPA among physicians is prevalent and may worsen (62, 63). In this study, PEPs in both 120 and 999 units showed moderate or higher levels of LPA. A low level of social recognition and a lack of cooperation among relevant social personnel and organizations leads to a decline in the PMI of PEPs. At the same time, as the general population ages, the number of empty nesters and old persons who live alone is increasing, so demand for patient transport is also increasing. However, 120 is the only institution in Beijing that employs (with its own funds) approximately 50 stretcher-bearers to carry out first aid tasks and provide carrying services, while 999 employs no stretcher-bearers (4). Therefore, the task of carrying patients is often the responsibility of PEPs, even though this task is inconsistent with their original intention in choosing emergency work. They originally took up their job of providing prehospital emergency work due to the achievement satisfaction that they could experience through saving the dying and healing the wounded. When they are required to engage in simple transportation and lifting work, it is difficult for these PEPs to meet their personal achievement needs.

The results showed that PTI ( $\beta = -0.28$ , 95% CI:  $-0.40 \sim -0.15$ ) had a direct negative effect on LPA, which was consistent with the views of previous scholars, supporting hypothesis H3a. Siegrist believes that employees who receive less than they give can experience work-related stress, resulting in a sense of effort-reward imbalance. The effort dimension includes the time and energy spent by employees in their work, and the reward dimension includes aspects such as career prospects, job security and income (64). When PEPs feel that their excess efforts have not been reasonably rewarded, they will experience a sense of loss, and their needs for personal achievement cannot be satisfied effectively (60).

The results showed that PAI ( $\beta = -0.24$ , 95% CI:  $-0.38 \sim -0.10$ ) had a direct negative effect on LPA, supporting hypothesis H3f. Herzberg's dual-factor theory proposes that incentives such as income security can only eliminate dissatisfaction at work, while incentives such as job development can improve work enthusiasm (65). However, the nature of prehospital emergency care requires that PEPs can only observe the development of and change in patients' conditions over a short period of time, and they cannot track the long-term outcomes of disease treatment or the intervention effects of drugs and other treatment methods. Therefore, it is difficult for the knowledge level and technical skills of PEPs to keep pace with developments in modern medicine due to their long-term involvement in prehospital emergency work (66). Especially under the current professional title promotion system in China, the professional title promotion of PEPs is difficult, the development space is limited, and the personal value is not reflected, resulting in LPA.

## The mediating role of EE on TI

EE refers to feelings of mental or cognitive exhaustion caused by work and is characterized by feelings of fatigue and low emotional energy (67). The results of this study showed that PTI could indirectly affect TI through EE ( $\beta = -0.24$ , 95% CI:  $-0.32 \sim -0.16$ ). According to COR theory, the mobilization of individual energy and other resources to meet long-term needs leads to a phenomenon of "spiral loss," which affects resource reserves. When individuals suffer from unmet long-term needs, their energy resources deplete over time, eventually leading to EE (42). The meta-analysis of Lee and Ashforth further confirmed that needs were positively correlated with EE, while resources, such as various types of support and intrinsic motivation at work, were negatively correlated with EE (68). In addition, according to goal-setting theory, resources increase external motivation at work by promoting the achievement of goals. Therefore, when there are insufficient resources to meet the long-term demands of the work, this situation can hinder the achievement of the work goals. When employees are frustrated by difficulties with respect to achieving their work goals, leaving their current job becomes an important self-protection mechanism (69). Self-determination theory also suggests that a lack of resources associated with human needs may encourage disengagement from an intrinsically unsatisfactory career (70). In other words, when faced with great work pressure, if professional treatment fails to provide effective incentives, it is likely that employees will decrease their external motivation, produce EE, and eventually lead to their departure from their current position.

## Implications for PEPs management

Most studies of burnout and turnover in emergency care contexts have focused on solutions that require individual physician action (e.g., meditation, yoga, or physical exercise) (71). While individualized interventions, such as mindfulness and mental health programs, can be palliative, this individual-focused approach can inadvertently shift the blame onto the victim. Moreover, changes at the organizational level can simultaneously affect more prehospital responders and have a greater positive impact. Therefore, it is necessary to find meaningful and lasting solutions at the organizational and systematic levels (28). Through this study exploring the three dimensions of PI (PTI, PMI and PAI), JB in two dimensions (EE and LPA) and the effects of the relationships among PI, JB, and TI, the following conclusions are drawn. First, PTI has a direct negative effect on TI and LPA, and can indirectly affect TI through EE. It is suggested that government departments should improve the work treatment and establish a special subsidy policy for PEPs to improve the PTI and



reduce the TI of PEPs and stabilize the prehospital emergency medical team. Second, PMI has a direct negative impact on LPA. In this regard, we suggest that the Chinese government should actively explore the establishment of a development model for medical rescue workers and issue relevant laws and regulations to ensure the legalization of medical rescue workers with certificates. In this way, the medical rescue workers could undertake the transport and lifting work, and the PEPs could undertake the wounded rescue work to improve the PMI of the PEPs and achieve the improvement of their personal sense of achievement of the PEPs. Finally, PAI has a direct negative impact on LPA. In view of this result, we suggest that the relevant prehospital emergency care institutions should provide PEPs with standardized training, provide them with external learning opportunities, and improve their professional skills and abilities in various aspects to enhance both the PAI of PEPs and their personal sense of accomplishment.

## Limitations

The study faces several limitations. First, the design of cross-sectional studies limits the possibility of establishing causal relationships among study variables. In the future, researchers can conduct longitudinal in-depth studies on PEPs to further verify the results of this study and provide a reference for stabilizing the prehospital emergency team.

Second, the scope of this survey was limited to Beijing. Beijing is the capital of China, and its economic level and policy sensitivity are higher than those of other regions in China. Therefore, in the case of limited time and energy, this study selected Beijing as the research site to understand the core situation of PEPs in China. However, at present, China's prehospital emergency care model is based on the structural attribute classification of the executive body emergency care center, which is mainly divided into four types, namely command type, dependent type, independent type and comprehensive type (72). In addition, the development level of prehospital emergency work is not balanced across the country, and a variety of prehospital emergency care models coexist, and even a variety of systems exist in some provinces and cities (with different ownership of institutions). In the future, it is worth further exploring whether the different modes of prehospital emergency care among different regions will affect the TI of PEPs. Therefore, the results of this study need to be replicated with a more representative cross-sectional sample in other areas in the future.

Third, in this research we controlled for the effects of a single unmeasured latent method factor control to test the CMV. Although controlling for the effects of a single unmeasured latent method factor controls for any systematic variance among

the items that is independent of the covariance due to the constructs of interest, it does not permit the researcher to identify the specific cause of the method bias. Indeed, the factor may reflect not only different types of CMV but also variance due to relationships between the constructs other than the one hypothesized. Another disadvantage is that this technique assumes that the method factor does not interact with trait factors. Therefore, although this technique can control CMV, it cannot completely eliminate the influence of CMV.

## Conclusion

In this study we found that PTI and PMI have a direct negative effect on TI, and EE has a direct positive influence on TI. PTI, PMI and PAI have a direct negative impact on LPA, and PTI indirectly affects TI through EE. It is suggested that PI and JB may be the potential ways to reduce the TI of PEPs. In view of the above results, efforts should be made by the government departments to develop strategies to decrease the TI of PEPs and stabilize the prehospital emergency team, such as improving the working treatment of PEPs, providing them with external learning opportunities, and actively exploring and establishing the development model of medical rescue workers.

## Data availability statement

The datasets presented in this article are not readily available because confidentiality of pre-hospital emergency worker information. Requests to access the datasets should be directed to [mengkai@ccmu.edu.cn](mailto:mengkai@ccmu.edu.cn).

## Ethics statement

The study was approved by the Ethical Review Committee of the Capital Medical University (Z2019SY057). Participation in the survey was completely voluntary and written consent was obtained from participants.

## Author contributions

XF took charge of the formal analysis and wrote the original draft. YuW took care of the methodology part. PJ was responsibility for the data collection and curation. YaW was responsibility for the data collection and field research. ZG was responsible for the project administration and resources. KM designed the project and took responsibility for the paper as a whole. All authors contributed substantially to article



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## References

1. Yi D, Pan P. Prospects on pre-hospital emergency medical service in the three gorges reservoir area. *Hosp Adm J Chin Peoples Lib Army*. (2011) 18:45–7. doi: 10.3969/j.issn.1008-9985.2011.01.024
2. Jiang G. Theory and practice of emergency medicine. *Chin J Emerg Med*. (2004) 13:5–6. doi: 10.3760/j.issn.1671-0282.2004.01.001
3. Zhou M, Wang H, Zeng X, Yin P, Zhu J, Chen W, et al. Mortality, morbidity, and risk factors in China and its provinces, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. (2019) 394:1145–58. doi: 10.1016/S0140-6736(19)30427-1
4. Cui X, Wang X, Yang N, Cao X. Current situation of first-aid personnel in Beijing Emergency Medical Center and countermeasure analysis. *China J Emerg Resuscitation Disaster Mcd*. (2015) 10:1034–7. doi: 10.3969/j.issn.1673-6966.2015.11.008
5. Wu YF, Wang PC, Chen YC. Gender differences and work-family conflicts among emergency physicians with intention to leave. *Emerg Med Int*. (2018) 2018:3919147. doi: 10.1155/2018/3919147
6. Estryn-Behar M, Doppia MA, Guetarni K, Fry C, Machet G, Pelloux P, et al. Emergency physicians accumulate more stress factors than other physicians—results from the French SESMAT study. *Emerg Med J*. (2011) 28:397–410. doi: 10.1136/emj.2009.082594
7. Ginde AA, Sullivan AF, Camargo CA Jr. Attrition from emergency medicine clinical practice in the United States. *Ann Emerg Med*. (2010) 56:166–71. doi: 10.1016/j.annemergmed.2009.11.002
8. Lee YK, Lee CC, Chen CC, Wong CH, Su YC. High risk of 'failure' among emergency physicians compared with other specialists: a nationwide cohort study. *Emerg Med J*. (2013) 30:620–2. doi: 10.1136/emmermed-2012-201440
9. He M, Ma M, Xv L, Liu Y. Research on job stress, job satisfaction and industry evaluation of pre-hospital emergency personnel in Changsha. *Chin Gen Pract Nurs*. (2016) 14:1162–4. doi: 10.3969/j.issn.1674-4748.2016.11.039
10. Sende J, Jbeili C, Schvahn S, et al. Facteurs de stress et conséquences du stress en médecine d'urgence: enquête nationale. *Ann Francaises de Méd d'urgence*. (2012) 2:224–31. doi: 10.1007/s13341-012-0210-4
11. Anonymity. Beijing Emergency Center has a 40% Shortage of Doctors. *Contemp Nurses (Comprehensive Edition)*. (2009) 9:32.
12. Erlckson E. The Study of turnover. *J Nurs Adm*. (1978) 8:31. doi: 10.1097/00005110-197811000-00013
13. Xiao Z. *Correlation analysis of hardy personality, professional identity and turnover intention of operating room nurses* (Master's thesis). Suzhou University, Jiangsu, China (2019).
14. Pi X. *The influence of colleague's turnover on employee's turnover intention: A study of job opportunity perspective* (Doctor's thesis). Zhejiang University, Zhejiang, China (2017).
15. March JG, Simon HA. *Organizations*. New York, NY: Wiley (1958).
16. Krausz M, Koslowsky M, Shalom N, Elyakim N. Predictors of intentions to leave the ward, the hospital, and the nursing profession: a longitudinal study. *J Organ Behav*. (1995) 16:277–88. doi: 10.1002/job.4030160308
17. Chen S. Investigation of separation factors of pre-hospital emergency physician team and suggestions for countermeasures. *China Health Hum Resour*. (2016) 74–9. doi: 10.3969/j.issn.1008-7370.2016.09.022
18. H MW. Intermediate linkages in the relationship between job satisfaction and employee turnover. *J Appl Psychol*. (1977) 62:237. doi: 10.1037/0021-9010.62.2.237
19. Nixon J. Professional identity and the restructuring of higher education. *Stud High Educ*. (1996) 21:5–16. doi: 10.1080/03075079612331381417
20. Che W. *Encyclopedia of Counseling*. Zhejiang: Zhejiang Science and Technology Press (2001).
21. H SE. *Career Dynamics: Matching Individual and Organizational Needs*. Boston, MA: Addison Wesley Publishing Company (1978).
22. Foster K, Roberts C. The Heroic and the Villainous: a qualitative study characterising the role models that shaped senior doctors' professional identity. *BMC Med Educ*. (2016) 16:206. doi: 10.1186/s12909-016-0731-0
23. Sabanciogullari S, Dogan S. Effects of the professional identity development programme on the professional identity, job satisfaction and burnout levels of nurses: A pilot study. *Int J Nurs Pract*. (2015) 21:847–57. doi: 10.1111/ijn.12330
24. Zhang W, Meng H, Yang S, Liu D. The influence of professional identity, job satisfaction, and work engagement on turnover intention among township health inspectors in China. *Int J Environ Res Public Health*. (2018) 15:988. doi: 10.3390/ijerph15050988
25. Freudenberg HJ. Staff burn-out. *J Soc Issues*. (1974) 30:159–65. doi: 10.1111/j.1540-4560.1974.tb00706.x
26. Maslach C, Jackson SE. The measurement of experienced burnout. *J Organ Behav*. (1981) 2:99–113. doi: 10.1002/job.4030020205
27. Lacy BE, Chan JL. Physician burnout: the hidden health care crisis. *Clin Gastroenterol Hepatol*. (2018) 16:311–7. doi: 10.1016/j.cgh.2017.06.043
28. Crowe RP, Fernandez AR, Pepe PE, Cash RE, Rivard MK, Wronski R, et al. The association of job demands and resources with burnout among emergency medical services professionals. *J Am Coll Emerg Phys Open*. (2020) 1:6–16. doi: 10.1002/emp2.12014
29. Moukarzel A, Michelet P, Durand AC, Sebbane M, Bourgeois S, Markarian T, et al. Burnout syndrome among emergency department staff: prevalence and associated factors. *Biomed Res Int*. (2019) 2019:6462472. doi: 10.1155/2019/6462472
30. Scanlan JN, Hazelton T. Relationships between job satisfaction, burnout, professional identity and meaningfulness of work activities for occupational therapists working in mental health. *Aust Occup Ther J*. (2019) 66:581–90. doi: 10.1111/1440-1630.12596

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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31. Devery H, Scanlan JN, Ross J. Factors associated with professional identity, job satisfaction and burnout for occupational therapists working in eating disorders: a mixed methods study. *Aust Occup Ther J.* (2018) 65:523–32. doi: 10.1111/1440-1630.12503
32. Hämmig O. Explaining burnout and the intention to leave the profession among health professionals - a cross-sectional study in a hospital setting in Switzerland. *BMC Health Serv Res.* (2018) 18:785. doi: 10.1186/s12913-018-3556-1
33. Wang E, Hu H, Mao S, Liu H. Intrinsic motivation and turnover intention among geriatric nurses employed in nursing homes: the roles of job burnout and pay satisfaction. *Contemp Nurse.* (2019) 55:195–210. doi: 10.1080/10376178.2019.1641120
34. Tajfel H. *The Context of Social Psychology.* London: Academic (1972).
35. Israel J, Tajfel H. The context of social psychology: a critical assessment. *Contemp Sociol.* (1975) 4:296–7. doi: 10.2307/2063236
36. Turner JC, Brown RJ, Tajfel H. Social comparison and group interest in ingroup favouritism. *Eur J Soc Psychol.* (1979) 9:187–204. doi: 10.1002/ejsp.2420090207
37. Yin L. The guiding effect of equity theory on enterprise compensation management. *Econ Trade Pract.* (2018) 277–9.
38. Zhou J. *A study on the relationship between job satisfaction, organizational commitment and turnover intention of employees in petrochemical enterprises* (Master's thesis). Zhejiang University, Zhejiang, China (2005).
39. Shi X, Li Y, Zhang C. Correlation among job-esteem, job burnout and turnover intention in nurses employee turnover. *Chin Nurs Res.* (2021) 35:2654–60. doi: 10.12102/j.issn.1009-6493.2021.15.005
40. Ma D. Social construction and discontentment of nursing as soft technique: a qualitative survey on nurses' labor process. *J Wuhan Univ Technol.* (2019) 32:33–40. doi: 10.3963/j.issn.1671-6477.2019.05.005
41. Fagermoen MS. Professional identity: values embedded in meaningful nursing practice. *J Adv Nurs.* (1997) 25:434–41. doi: 10.1046/j.1365-2648.1997.1997025434.x
42. Hobfoll SE. Conservation of resources. A new attempt at conceptualizing stress. *Am Psychol.* (1989) 44:513–24. doi: 10.1037/0003-066X.44.3.513
43. Pines A, Aronson E. *Career Burnout: Causes and Cures.* New York, NY: London: Free Press (1998).
44. Hobfoll SE, Freedy J. *Conservation of Resources: A General Stress Theory Applied to Burnout.* Professional Burnout: Recent Developments in Theory and Research. (1993). p. 115–29.
45. Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol.* (2001) 52:397–422. doi: 10.1146/annurev.psych.52.1.397
46. Chen H, Liu F, Pang L, Liu F, Fang T, Wen Y, et al. Are you tired of working amid the pandemic? The role of professional identity and job satisfaction against job burnout. *Int J Environ Res Public Health.* (2020) 17:9188. doi: 10.3390/ijerph17249188
47. Siebens K, Casterlé BD, Abraham I, Dierckx K, Braes T, Darras E, et al. The professional self-image of nurses in Belgian hospitals: a cross-sectional questionnaire survey. *Int J Nurs Stud.* (2006) 43:71–82. doi: 10.1016/j.ijnurstu.2005.04.004
48. Chen T, Weng W, Huang W, Sun H. Related factors of occupational stress and effort-reward imbalance among nurses in Class? grade a hospitals. *Chin Ment Health J.* (2017) 31:862–4. doi: 10.3969/j.issn.1000-6729.2017.11.006
49. Guo R, Ren L, Meng X, Zhang C, Jia L, Wang Y. Study on the mechanism of psychological empowerment between job burnout and turnover intention of newly recruited nurses. *Chin Evid Based Nurs.* (2022) 8:359–63. doi: 10.12102/j.issn.2095-8668.2022.03.015
50. Chen J, Xv D, Zhang C, Wu J. Analysis of professional identity among physicians in two tertiary public hospitals. *Chin J Hosp Adm.* (2012) 28:904–7. doi: 10.3760/cma.j.issn.1000-6672.2012.12.008
51. Li C, Shi K, Luo Z, Li L, Yang Y. An Investigation on job burnout of doctor and nurse. *Chin J Clin Psychol.* (2003) 11:170–2. doi: 10.3969/j.issn.1005-3611.2003.03.004
52. Wanous JB, Reichers AE, Hudy MJ. Overall job satisfaction: how good are single-item measures? *J Appl Psychol.* (1997) 82:247–52. doi: 10.1037/0021-9010.82.2.247
53. Quintana SM, Maxwell SE. Implications of recent developments in structural equation modeling for counseling psychology. *Couns Psychol.* (1999) 27:485–527. doi: 10.1177/0011000099274002
54. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol.* (2003) 88:879–903. doi: 10.1037/0021-9010.88.5.879
55. Zhu H, Li C. Is the common method variant a “deadly plague”? - Debate, new knowledge and response. *Adv Psychol Sci.* (2019) 27:587–99. doi: 10.3724/SP.J.1042.2019.00587
56. Widaman K. Hierarchically nested covariance structure models for multitrait-multimethod data. *Appl Psychol Meas.* (1985) 9:1–26. doi: 10.1177/014662168500900101
57. Carlson DS, Kacmar KM. Work-family conflict in the organization: Do life role values make a difference? *J Manage.* (2000) 26:1031–54. doi: 10.1177/014920630002600502
58. Li Y, Chen Y, Zhang Y, Lei S, Tan M, Gao H. Analysis on Turnover Intention of Rural Pre-hospital Emergency Staff from the Perspective of Effort-reward Imbalance. *Med Soc.* (2021) 34:85–9. doi: 10.13723/j.yxysh.2021.10.016
59. Greenhaus JH, Parasuraman S, Collins KM. Career involvement and family involvement as moderators of relationships between work-family conflict and withdrawal from a profession. *J Occup Health Psychol.* (2001) 6:91–100. doi: 10.1037/1076-8998.6.2.91
60. Zhang P. Analysis of the causes of low professional identity in pre-hospital emergency care and exploration of management paths. *Hum Resour Manag.* (2017) 10:282–3. doi: 10.3969/j.issn.1673-8209.2017.10.237
61. Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention among hospital physicians in Taiwan: does income matter? *BMC Health Serv Res.* (2016) 16:667. doi: 10.1186/s12913-016-1916-2
62. Shanafelt TD, Boone S, Tan L, Dyrbye LN, Sotile W, Satele D, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med.* (2012) 172:1377–85. doi: 10.1001/archinternmed.2012.3199
63. Shanafelt TD, Hasan O, Dyrbye LN, Sinsky C, Satele D, Sloan J, et al. Changes in burnout and satisfaction with work-life balance in physicians and the general US working population between 2011 and 2014. *Mayo Clin Proc.* (2015) 90:1600–13. doi: 10.1016/j.mayocp.2015.08.023
64. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol.* (1996) 1:27–41. doi: 10.1037/1076-8998.1.1.27
65. Yu W. *Modern Incentive Theory and Application.* Da Lian: Dongbei University of Finance and Economics Press (2014).
66. Tian J, Wang J, Gu X, Gu L, Guo Y. Analysis of current situation of health personnel in pre-hospital emergency system in Shanghai. *China Health Resour.* (2011) 14:431–2. doi: 10.3969/j.issn.1007-953X.2011.06.035
67. Jourdain G, Chênevert D. Job demands-resources, burnout and intention to leave the nursing profession: a questionnaire survey. *Int J Nurs Stud.* (2010) 47:709–22. doi: 10.1016/j.ijnurstu.2009.11.007
68. Lee RT, Ashforth BE. A meta-analytic examination of the correlates of the three dimensions of job burnout. *J Appl Psychol.* (1996) 81:123–33. doi: 10.1037/0021-9010.81.2.123
69. Latham GP, Locke EA. A theory of goal setting and task performance. *Acad Manag Rev.* (1991) 50:212–47.
70. Ryan RM, Deci EL. *Overview of Self-determination Theory: An Organismic Dialectical Perspective, Handbook of Self-Determination Research.* Rochester: University of Rochester Press (2004).
71. Gensimore MM, Maduro RS, Morgan MK, McGee GW, Zimbardo KS. The effect of nurse practice environment on retention and quality of care via burnout, work characteristics, and resilience: a moderated mediation model. *J Nurs Adm.* (2020) 50:546–53. doi: 10.1097/NNA.0000000000000932
72. Li J. Analysis of prehospital emergency treatment system and network construction present situation. *Chin J Emerg Med.* (2007) 16:1334–5. doi: 10.3760/j.issn.1671-0282.2007.12.029



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# The compensation incentive effect of athletes: A structural equation model

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This study explores the compensation incentive effect of athletes. Based on the related literature, we proposed theoretical hypotheses on the compensation incentive effect and established an assessment index system of the compensation incentive effect for athletes. A structural equation model was used to test the survey data of 352 athletes in six provinces to discover the truth of the compensation incentive effect. The results suggested that direct economic compensation satisfaction, direct non-economic compensation satisfaction, and indirect non-economic compensation satisfaction had significant positive effects on the compensation incentive effect of athletes, while indirect economic compensation satisfaction showed no significant effect. Moreover, the evaluation results of athletes' compensation incentive effect showed that direct economic compensation satisfaction contributed the most to the influence factor of the compensation incentive effect. Therefore, the evaluation of athletes' compensation incentive effect should focus on variables of direct economic compensation satisfaction, i.e., basic compensation satisfaction, bonus income satisfaction, and subsidy satisfaction. Finally, some strategies and recommendations were suggested to improve the compensation design for athletes.

## KEYWORDS

athlete, salary structures, compensation satisfaction, compensation incentive effect, structural equation model

## Introduction

China is transforming from a large sports country to a strong sports country, as evidenced by its glorious developing course from the breakthrough of zero gold medals at the 1984 Los Angeles Olympic Games in the United States to the leap to the top of medal ranking at the 2008 Beijing Olympic Games and then to the success in the 2022 Beijing Winter Olympic Games. A key to improving the level of sports in China, a competitive country in the field of sports, is to solve the income distribution problem for athletes,

especially in terms of salary incentives. The evolution of the athletes' remuneration system in China can be divided into two stages: during the planned economy, the state implemented the athletes' remuneration system with the standard salary as the income source under the influence of "egalitarianism"; during the market economy when the state gradually implemented the salary distribution method based on the distribution of labor, athletes' remuneration system was improved with the deepening reform of the sports system.

Although athletes' compensation mechanism in China tends to be rationalized, with improved salary structures and increased compensation levels, there are still some shortcomings in the overall design of the compensation system. The most obvious deficiencies are reflected in the excessive income gap among athletes (Zou and Cui, 2014), unreasonable bonus distribution, and inadequate welfare systems such as social security and commercial insurance. Therefore, how to optimize the salary structure of athletes, improve the salary distribution system and motivate them to train has become the core problem that needs to be solved. Based on the literature review and field research, this paper introduces the structural equation modeling method to evaluate athletes' compensation incentive effect, thus providing theoretical reference and a practical basis for scientifically and reasonably reconstructing athletes' salary structure in China.

## Literature review

Compensation is considered to be the sum of various monetary incomes and benefits that employees receive from their employers (Milkovich and Newman, 2004). With the diversified development of compensation forms, compensation includes not only the material rewards paid to employees by the organization but also non-material rewards such as development and promotion opportunities, social status, and career achievements (Steinberger, 2018; Tan et al., 2019). The compensation structure has changed from single "monetary compensation" to compound "comprehensive compensation." Comprehensive compensation usually refers to economic compensation, including direct and indirect economic compensation (Gulyani and Sharma, 2018). Direct economic compensation includes basic salary, performance, allowance, incentive salary, etc. (Bai and Luo, 2016), while indirect economic compensation refers to welfare reflected in endowment insurance, housing, transportation subsidies and clothing. The overall compensation structure includes not only economic compensation in the form of money but also non-economic compensation (Xing et al., 2017). Non-economic remuneration can be divided into direct and indirect non-economic compensation. Direct non-economic compensation is embodied in social status, interpersonal relationships, leadership, working environment, etc. Indirect non-economic compensation includes personal development and promotion opportunities, job achievements, and employee respect (Yang, 2010; Liu, 2011).

Currently, research on compensation incentives mainly focuses on the methods and effects. Compensation incentives mostly start with the comprehensive compensation structure, and studies show that fixed salaries, benefits (Dale-Olsen, 2006), allowances, career achievement, training conditions (Cui and Zou, 2013), job satisfaction, social status (Hulkko-Nyman et al., 2012), commercial insurance, and performance pay (Johnston, 2020) have emerged as effective ways to motivate employees. The compensation incentive effect can be measured based on employees' feelings of motivation, effort, willingness to resign, feelings of motivation and career satisfaction (Jiang and Du, 2014). Therefore, the types of research objects must be considered in future research to select the most appropriate measurement of the compensation incentive effect.

## Theoretical hypotheses and index selection

### Theoretical hypotheses

Incentive theory indicates that managers should try their best to meet the diversified needs of the managed individuals and achieve salary incentives by improving salary design in salary management. As a special group, athletes are characterized by pragmatism, patriotism, development, enjoyment, aggressiveness, and cooperation. These personality characteristics determine their diversified needs, such as the desire for good salaries and benefits, the need to satisfy the professional demand for national glory and independent training, and the hope to obtain good development opportunities and harmonious interpersonal relationships. The diversity of demand characteristics determines the comprehensiveness of the pay structure.

Therefore, this study further clarifies that the compensation defined in the evaluation of athletes' compensation incentive effect is comprehensive compensation, including direct economic compensation, indirect economic compensation, direct non-economic compensation, and indirect non-economic compensation. Specifically, direct economic compensation includes basic remuneration, bonus income, and subsidies; indirect economic compensation consists of retirement placement, health insurance, and other welfare policies; direct non-economic compensation includes social status, leadership attention, favorable training environment and sound interpersonal relationships; indirect non-economic compensation includes athletes' career fulfillment, training autonomy and sufficient opportunities for development and promotion. It is difficult to accurately measure the performance generated by athletes in the study of the compensation incentive effect for athletes. Thus, the compensation incentive effect of athletes is analyzed based on incentive theory, including pay incentive feelings and effects. According to the relevant research results of behavioral science,



the compensation incentive effect is positively correlated with compensation satisfaction (Yang et al., 2017) and willingness to work hard (Ji and Cui, 2021). It is believed that the greater the compensation satisfaction of athletes, the stronger their willingness to train hard and the higher the compensation incentive effect.

The theoretical hypotheses for the compensation incentive effects of athletes are proposed, as shown in Table 1.

## Selection of evaluation indexes

According to the theoretical hypotheses, the compensation incentive effect of athletes ( $\eta$ ) is affected by athlete's direct economic compensation satisfaction ( $\zeta_1$ ), indirect economic compensation satisfaction ( $\zeta_2$ ), direct non-economic compensation satisfaction ( $\zeta_3$ ), and indirect non-economic compensation satisfaction ( $\zeta_4$ ). Therefore, according to the needs of athletes, 12 indicators covering four forms of compensation ( $X_1$ – $X_{12}$ ) were selected as the specific evaluation indicators of athletes' compensation incentive effect. Additionally, we added two measurement indicators ( $Y_1$  and  $Y_2$ ) of the compensation incentive effect. An evaluation index system of athletes' compensation incentive effect was established, with five latent variables and 14 measurement indicators. Detailed items can be found in the Appendix A.

Based on the evaluation indexes of athletes' compensation incentive effect, data of each variable were tested for Kaiser–Meyer–Olkin (KMO) and Bartlett's sphericity, where  $KMO=0.786$ , and the approximate chi-square value was large with  $p<0.001$  (Table 2). This result indicated a significant correlation among the evaluation indicators of athletes' compensation incentive effect, which is suitable for factor analysis. When extracting the common factor for the measurement indicators of athletes' compensation incentive effect, it was found that the common degree of the interpersonal relationship ( $X_9$ ) was  $0.344<0.7$ . Thus, the variable was deleted. Finally, an evaluation index system of athletes' compensation incentive effect with five latent variables and 13 measurement indicators was formed.

TABLE 1 Theoretical hypotheses of athletes' compensation incentive effect.

Number	Hypothetical content
H1	Athletes' direct economic compensation satisfaction exerts a significant positive impact on compensation incentive effects.
H2	Athletes' indirect economic compensation satisfaction exerts a significant positive impact on compensation incentive effects.
H3	Athletes' direct non-economic compensation satisfaction exerts a significant positive impact on compensation incentive effects.
H4	Athletes' indirect non-economic compensation satisfaction exerts a significant positive impact on compensation incentive effects.

TABLE 2 Test results of Kaiser–Meyer–Olkin and Bartlett on theoretical indicators for the evaluation of athletes' compensation incentive effect.

KMO value	Bartlett's sphericity test		
	Approximate chi-square value	df	p
0.786	2088.47	91	<0.001

## Research process and methods

### Questionnaire design

The questionnaire was designed based on scientific, systematic, easily accessible and non-oriented principles and was combined with changes in the salary structure of athletes in China. The questionnaire consisted of two parts: (a) basic personal information; (b) athletes' perceptions and satisfaction with their salaries. In the first part, basic personal information included name, gender, age, training years, level, program, monthly income and region. According to relevant sources (Wen, 2006; Chen, 2010; Lazear, 2018), the second part contained 14 items of satisfaction measurement. A 5-point Likert scale was used to measure athletes' salary satisfaction, with "1" (strongly dissatisfied), "2" (somewhat dissatisfied), "3" (neither satisfied nor dissatisfied), "4" (somewhat satisfied), and "5" (strongly satisfied).

### Data collection and processing

#### Data collection

To ensure the recovery rate and efficiency of questionnaires, they were distributed and collected at the Chenggong Training Base and Ridge Training Base in Kunming, Yunnan, China; Ersha Sports Training Center and CBA Training Venue in Guangzhou, Guangdong, China. A total of 400 questionnaires were distributed, and 390 were collected. Among them, 38 invalid questionnaires were excluded, and 352 valid questionnaires were eventually collected, with a recovery rate of over 90%. Due to the regional differences in China's economic development level, athletes from Guangdong, Liaoning, Hunan, Jilin, Gansu and Yunnan provinces, representing the eastern, central and western regions, were selected as the subjects of the survey. The sports investigated included athletics, fencing, cycling, swimming, gymnastics, badminton, table tennis, basketball and soccer.

#### Research methods

The association between the analyzed variables cannot be verified simply by traditional regression analysis methods because they cannot be measured directly. Therefore, in this study, SPSS26.0 software and AMOS24.0 software were used to test and evaluate the validity of the scale and the overall model by structural equation modeling (Youssef et al., 2017; Wang et al., 2022).

## Results

### Demographic statistics

The information distribution of the samples is shown in [Appendix B](#). Male athletes (60.5%) are more than female athletes (39.5%). Their age is mainly concentrated between 19 and 24 years old, accounting for 66.7% of the total. The years of training are more evenly distributed. From the perspective of level, national-level athletes and master sportsmen account for 45.7 and 44.9%, respectively. In terms of projects, athletics is regarded as the basic sport, with the highest proportion of 45.7%. Additionally, 66.7% of samples have a monthly income of 2001–4,000 yuan. In terms of region, athletes from the eastern region occupy the highest percentage (72.4%). The distribution of sample objects is reasonable.

### Model construction

#### Model specification

Based on research hypotheses, a structural equation model of factors that determines athletes' compensation incentive effect was developed. The model possesses 5 latent variables and 13 observed items, as indicated in [Figure 1](#). The athletes' compensation incentive effect ( $\eta$ ) is assumed to be determined by four dimensions of the compensation structure: direct economic compensation satisfaction ( $\zeta_1$ ), indirect economic compensation satisfaction ( $\zeta_2$ ), direct non-economic compensation satisfaction ( $\zeta_3$ ), and indirect non-economic compensation satisfaction ( $\zeta_4$ ). In addition,  $\eta$ ,  $\zeta_1$ ,  $\zeta_2$ ,  $\zeta_3$ , and  $\zeta_4$  are latent variables that cannot be directly measured.  $X_1$ – $X_{12}$  (except  $X_9$ ) and  $Y_1$ – $Y_2$  are the observed variables that can be directly measured, i.e., items in the questionnaire.

#### Model identification

In this paper, the t-rule is used for identifying the equation model. In the initial model,  $p = 11$ ,  $q = 12$ , and the

number of distinct parameters to be estimated are 36. Then,  $\frac{1}{2}(p+q)(p+q+1) = 91$ ,  $df = \frac{1}{2}(p+q)(p+q+1) - t = 55 > 0$

, indicating that the model can be identified and is over-identified.

### Model fitness test

#### Reliability and validity analysis

In the factor analysis approach in SEM, we first used confirmatory factor analysis to examine the construct validity. The scale of all variables was included in the confirmatory factor analysis. The method uses Cronbach's Alpha coefficient and composite reliability (CR) to determine the reliability of the questionnaire and the internal consistency between variables ([Shi et al., 2022](#); [Wang et al., 2022](#)). If the alpha value is greater than 0.7, a combined reliability of more than 0.6 indicates internal consistency between the observed and latent variables. Validation shows that both Cronbach's alpha and CR values exceed 0.7 ([Table 3](#)), which means its internal consistency is suitable. Then, when evaluating the validity of the scales, we used the factor loading (FL) and the average variance extracted (AVE) of each variable, where FL was greater than 0.6, and the AVE was  $>0.5$  ([Hair et al., 2011](#); [Wen et al., 2019](#); [Luque-Reca et al., 2022](#)). The validation data showed that the FL and AVE of each variable were higher than the standard values ([Table 3](#)), indicating that the questionnaire had good convergent validity and passed the validity test.

#### Overall model fit analysis

On the basis of testing the reliability and validity of the measurement model, we used the model fit index to judge the consistency between our hypothesis model and survey data. Generally, the ratio of the chi-square to the degrees of freedom ( $\chi^2/df$ ), GFI (goodness of fit index), AGFI (adjusted goodness of fit index), RMSEA (root mean square residual), NFI (normed fit index), CFI (comparative fit index), etc. were considered ([Zito et al., 2019](#)). The closer the GFI and AGFI are to 1, the better the model fit is, and their acceptance criteria are above 0.9 ([Li et al., 2021](#)). Other acceptance criteria for the goodness-of-fit are

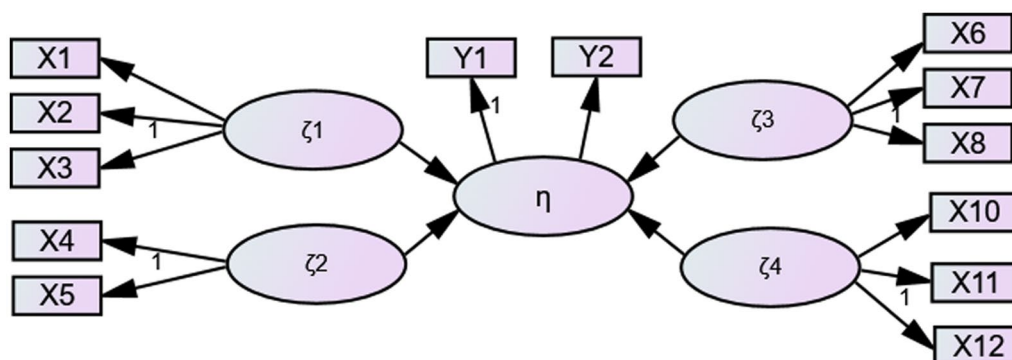


FIGURE 1  
The model of athletes' compensation incentive effect.



TABLE 3 Results of confirmatory factor analysis.

Variable	FL	Cronbach's $\alpha$	Ave	CR
Direct economic compensation satisfaction ( $\zeta_1$ )		0.768	0.568	0.795
Basic salary ( $X_1$ )	0.600			
Bonus income ( $X_2$ )	0.825			
Subsidy assistance ( $X_3$ )	0.814			
Indirect economic compensation satisfaction ( $\zeta_2$ )		0.735	0.631	0.767
Retirement placement ( $X_4$ )	0.937			
Medical insurance ( $X_5$ )	0.620			
Direct non-economic compensation satisfaction ( $\zeta_3$ )		0.836	0.631	0.837
Social status ( $X_6$ )	0.828			
Leadership attention ( $X_7$ )	0.788			
Training condition ( $X_8$ )	0.765			
Indirect non-economic compensation satisfaction ( $\zeta_4$ )		0.880	0.717	0.884
Career achievement ( $X_{10}$ )	0.825			
Training autonomy ( $X_{11}$ )	0.836			
Development and promotion opportunity ( $X_{12}$ )	0.879			
Compensation incentive effect ( $\eta$ )		0.834	0.720	0.837
Salary incentive feeling ( $Y_1$ )	0.797			
Effort will ( $Y_2$ )	0.897			

FL, factor loading; CR, composite reliability; Ave, average variance extracted.

TABLE 4 Fitting coefficients of the model indicators.

	( $\chi^2/\text{df}$ )	GFI	AGFI	RMSEA	NFI	CFI	IFI
Judgment standard	1–3	>0.9	>0.9	<0.08	>0.9	>0.9	>0.9
Measured value	2.14	0.953	0.922	0.057	0.942	0.968	0.968
Acceptance level	Good	Very good	Very good	Good	Very good	Very good	Very good

detailed in Table 4. The results showed that the fit coefficients of the model indicators all exceeded the acceptance criteria, indicating that the overall model fit was good, i.e., the theoretical model and the data obtained in this study could be adapted.

### Validation of model hypotheses

As shown in Table 5 and Figure 2, direct economic compensation and direct non-economic compensation show the greatest influence on compensation incentives (confidence level, 0.001). Indirect non-economic compensation positively impacts compensation incentives (confidence level, 0.01). Thus, the research hypotheses H1, H3, and H4 are supported. However, the impact of indirect economic compensation on compensation incentives has not reached a statistically significant level. Therefore, hypothesis “H2” is not supported.

### Determination of the weight coefficient

The structural equation model mentioned above clearly reflects the path coefficients between the latent and observed variables. The path coefficients are normalized to calculate the weight coefficients of the relevant variables. The weight coefficient

determines the contribution of the influence factor. Therefore, analyzing weight coefficients can determine the main reasons affecting the level of compensation incentive effect and provide a realistic basis for scientifically formulating countermeasures to improve the compensation system for athletes. Based on the analysis, the path coefficients that have passed the hypothesis validation variables in the evaluation model—three latent variables ( $\zeta_1$ ,  $\zeta_3$ , and  $\zeta_4$ ) and nine observation variables ( $X_1$ ,  $X_2$ ,  $X_3$ ,  $X_6$ ,  $X_7$ ,  $X_8$ ,  $X_{10}$ ,  $X_{11}$ , and  $X_{12}$ )—are normalized (Table 6). The normalization method is to add the standardized path coefficients of each dimension above and then divide the standardized path coefficients of each dimension by the sum of the dimension coefficients to obtain the corresponding weight coefficients (Zhang, 2015).

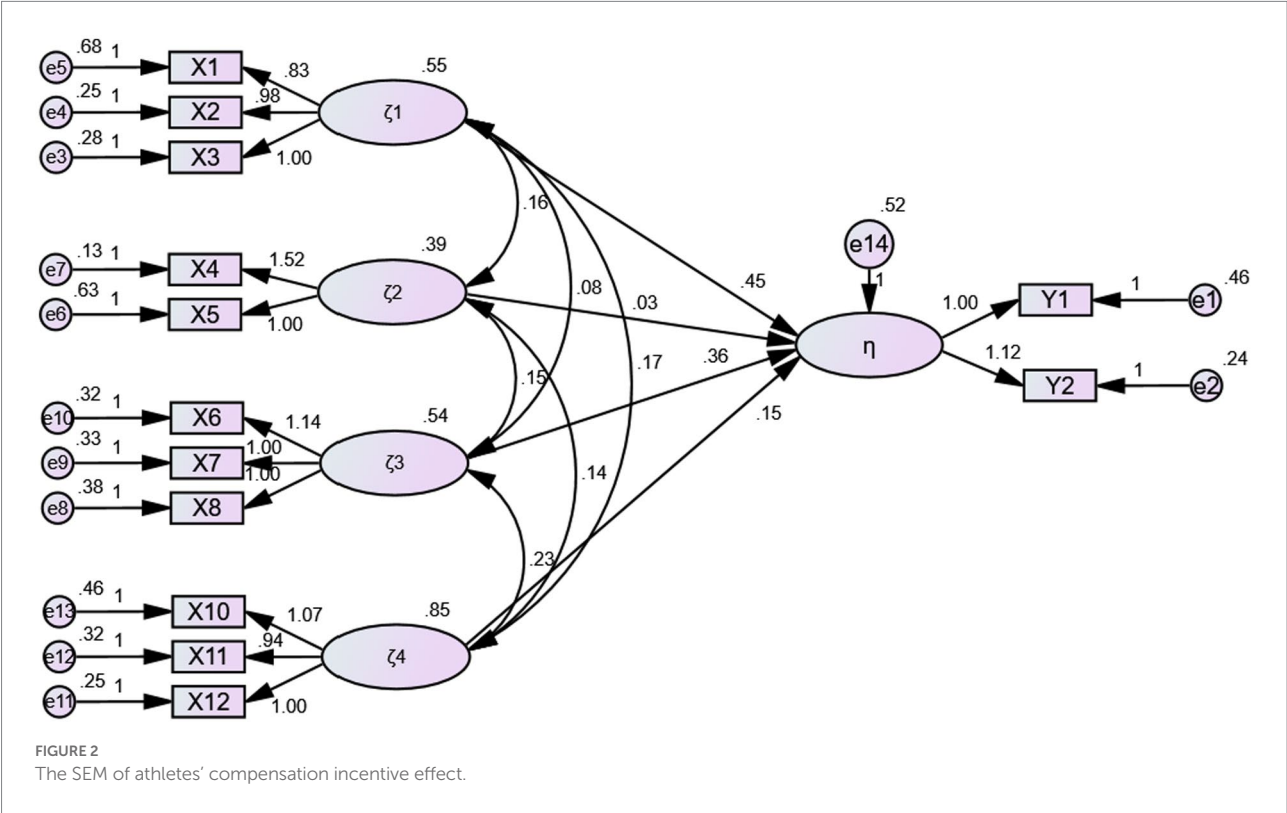
### Conclusion and discussion

The primary objective of the study is to determine the factors of the compensation incentive effect on athletes and to evaluate the compensation incentive effect produced by the current athlete pay system in the management implementation process. However, the impact of indirect economic compensation on compensation

TABLE 5 Model path coefficient of structural equation model and hypothesis test results.

The path	Nonstandardized coefficient	Standardized coefficient	S.E.	C.R.	P	Results
H1: $\eta < -\zeta_1$	0.447	0.371	0.081	5.517	***	support
H2: $\eta < -\zeta_2$	0.027	0.019	0.088	0.311	0.756	nonsupport
H3: $\eta < -\zeta_3$	0.361	0.297	0.080	4.519	***	support
H4: $\eta < -\zeta_4$	0.146	0.150	0.058	2.499	**	support
$Y_1 < -\eta$	1.000	0.797				
$Y_2 < -\eta$	1.118	0.897	0.097	11.502	***	
$X_3 < -\zeta_1$	1.000	0.814				
$X_2 < -\zeta_1$	0.983	0.825	0.076	12.926	***	
$X_1 < -\zeta_1$	0.828	0.600	0.079	10.464	***	
$X_5 < -\zeta_2$	1.000	0.620				
$X_4 < -\zeta_2$	1.515	0.937	0.253	5.978	***	
$X_8 < -\zeta_3$	1.000	0.765				
$X_7 < -\zeta_3$	0.998	0.788	0.072	13.774	***	
$X_6 < -\zeta_3$	1.142	0.828	0.081	14.113	***	
$X_{12} < -\zeta_4$	1.000	0.879				
$X_{11} < -\zeta_4$	0.939	0.836	0.051	18.448	***	
$X_{10} < -\zeta_4$	1.070	0.825	0.059	18.180	***	

\*\*Significance level < 0.01 (two-tailed); \*\*\*Significance level < 0.001.



incentives has not reached a statistically significant level. Given that the hypothesis that indirect economic compensation satisfaction has a significant effect on the pay incentive effect was not verified, the athlete compensation incentive effect was evaluated in terms of direct economic compensation, direct

non-economic compensation, and indirect non-economic compensation.

In this study, direct economic compensation satisfaction was found to be the most important factor of the compensation incentive effect on athletes, with the value of its standardized

TABLE 6 Weight coefficients of each index of athletes' compensation incentive effect.

Primary indicators	Secondary indicators		Three indicators	
	Variables	Weight	Indicators	Weight
$\eta$	$\zeta_1$	0.454	Basic salary ( $X_1$ )	0.268
			Bonus income ( $X_2$ )	0.369
			Subsidy assistance ( $X_3$ )	0.364
	$\zeta_3$	0.362	Social status ( $X_6$ )	0.348
			Leadership attention ( $X_7$ )	0.331
			Training condition ( $X_8$ )	0.321
	$\zeta_4$	0.184	Career achievement ( $X_{10}$ )	0.325
			Training autonomy ( $X_{11}$ )	0.329
			Development and promotion opportunity ( $X_{12}$ )	0.346

regression weight being 0.454 ( $p < 0.01$ ). This result is consistent with the findings of the Goksu and Oz (2010) and Hauret and Williams (2019). Therefore, to enhance athletes' compensation incentive effect, managers should focus on  $\zeta_1$ , i.e., the improvement of direct economic compensation satisfaction. For the weight coefficients of the three obvious variables that affect the satisfaction of athletes' direct economic compensation, the effect of bonus income and subsidy assistance on direct economic salary satisfaction are relatively close. Both are higher than the influence of basic salary. Since the basic salary of athletes is only the basic guarantee of their lives, their main economic income actually comes from subsidies from the state and government and bonus income from various competitions. Therefore, managers should conduct sufficient market research when formulating the basic salary standard of athletes, link their basic salary to the local minimum wage line, and strengthen the allocation of diversified bonuses and allowances on the basis of ensuring their basic living needs. Managers should avoid a simple "one-size-fits-all" approach to supply but formulate detailed and reasonable bonuses for athletes, impartially and comprehensively considering various factors such as athlete's age, length of service, level, athletic performance and effort.

In this study, direct non-economic compensation satisfaction was found to be the second most important factor of compensation incentive effect on athletes with a weight coefficient of 0.355, second only to the influence of  $\zeta_1$ . Therefore, managers who improve the direct economic compensation structure of athletes also need to pay extra attention to the optimization of direct non-economic pay mechanisms to improve athletes' compensation satisfaction. However, it is worth noting that  $\zeta_3$  is not a single-dimensional concept but a multidimensional construct determined by many factors such as social status, leadership importance, and training conditions. Social status, leadership importance and training condition have a great impact on the weights of the three variables reflecting athletes' direct non-financial compensation satisfaction ( $\zeta_3$ ). Therefore, managers should pay full attention to them and improve the social status of athletes through the effect of public opinion to enhance their sense of collective honor in the practice of salary management. In

addition, they should fully respect the will of individual athletes, adopt their opinions and suggestions, and strive to create a good external environment for their hard work and training by building a sound training environment.

The results of the weight coefficient show that indirect non-economic compensation satisfaction ( $\zeta_4$ ) is the third important structure. It also has a significant effect on the compensation incentive effect of athletes. This result supports the study of the Hilliard and Boulton (2012), McConnell (2017), and Huang et al. (2022). Theoretically, the influence of  $\zeta_4$  on  $\eta$  is minimal. However, in practice, it is found that the effect of  $\zeta_4$  cannot be underestimated, especially for athletes with a strong sense of autonomy and independence and a sense of collective honor for the country. For athletes with a strong sense of autonomy and independence and a sense of collective honor for their country, the effect of  $\zeta_4$  is sometimes even stronger than economic compensation. Therefore, in designing and optimizing the compensation structure of athletes, managers should not neglect to improve the satisfaction of indirect non-economic compensation ( $\zeta_4$ ). The  $\zeta_4$  is greatly impacted by the weight coefficients of three significant variables reflecting athletes' satisfaction with indirect non-financial compensation, i.e., satisfaction with career achievement, satisfaction with training autonomy and satisfaction with promotion criteria. Therefore, government departments should strengthen public opinion and propaganda to enhance athletes' professional achievement and autonomy to train actively for their country. Additionally, they should refine the athlete promotion evaluation system and comprehensively evaluate the athletes from multiple aspects, such as their cultural level and ideological and moral quality evaluation, to reshape the promotion evaluation system and promote the all-round development of the athletes' quality, thus enhancing the athletes' compensation incentive effect.

## Limitations and future research

This paper has two limitations. On the one hand, the data samples and sources are limited. This paper contains many details

specific to the situation in China and the effects of the remuneration system on incentivizing athletes. Hence the recommendations are somewhat situational. Although the sample included athletes from different provinces and regions of China to increase the generalizability of the study, the number of samples can be increased and extended beyond athletes of the same country. On the other hand, athletes' compensation incentive effect is influenced by multidimensional factors. When selecting latent and measurement variables, it is inevitable that some variables are difficult to quantify and are not included in the model, such as the fairness factor. Therefore, future research should focus on investigating the inclusion of more variables into the model and then improve the structural equation model.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

HZ: writing-original draft. HZ and ZL: design and/or conceptualization of the study. HZ, SZ, and FX: analysis and/or interpretation of the data. ML, RL, CX, and LZ: drafting and/or revising the manuscript. All authors contributed to the article and approved the submitted version.

## References

- Bai, G. Y., and Luo, R. D. (2016). Study on the relationship between knowledge-based employee welfare incentives and innovation performance. *Shandong. Soc. Sci.* 5, 175–179. doi: 10.14112/j.cnki.37-1053/c.2016.05.029
- Chen, T. (2010). A study on compensation incentive effect assessment of science and technology personnel in corporate: the SEM analysis based on the survey data. *Sci Sci Manag T.* 31, 163–169.
- Cui, G. W., and Zou, Y. H. (2013). Analysis on China's professional athletes' remuneration. *J Chengdu Sport Univ.* 39, 22–26. doi: 10.15942/j.jcsu.2013.08.007
- Dale-Olsen, H. (2006). Wages, fringe benefits and worker turnover. *Labour Econ.* 13, 87–105. doi: 10.1016/j.labeco.2004.03.005
- Goksu, N., and Oz, B. (2010). Investigation of a theoretical model of antecedents and consequences of pay satisfaction of bank employees: the case of Kahramanmaraş. *İktisat İslahat Ve Finans.* 25, 55–76. doi: 10.3848/iif.2010.296.2767
- Gulyani, G., and Sharma, T. (2018). Total rewards components and work happiness in new ventures: the mediating role of work engagement. *Evid-Based HRM Glob Forum Empir Scholarsh.* 6, 255–271. doi: 10.1108/EBHRM-12-2017-0063
- Hair, J. F., Ringle, C. M., and Sarstedt, M. (2011). PLS-SEM: indeed a silver bullet. *J. Mark. Theory Pract.* 19, 139–152. doi: 10.2753/MTP1069-6679190202
- Hauret, L., and Williams, D. R. (2019). Relative income and pay satisfaction: further evidence on the role of the reference group. *J. Happiness Stud.* 20, 307–329. doi: 10.1007/s10902-017-9950-2
- Hilliard, T. M., and Boulton, M. L. (2012). Public health workforce research in review a 25-year retrospective. *Am. J. Prev. Med.* 42, S17–S28. doi: 10.1016/j.amepre.2012.01.031
- Huang, X., Chen, H., Gao, Y., Wu, J., Ni, Z., Wang, X., et al. (2022). Career calling as the mediator and moderator of job demands and job resources for job satisfaction in health workers: a cross-sectional study. *Front. Psychol.* 10:856997. doi: 10.3389/fpsyg.2022.856997
- Hulkko-Nyman, K., Sarti, D., Hakonen, A., and Sweins, C. (2012). Total rewards perceptions and work engagement in elder-care organizations. *Int. Stud. Manag. Organ.* 42, 24–49. doi: 10.2753/IMO0020-8825420102
- Ji, D., and Cui, L. (2021). Relationship between Total rewards perceptions and work engagement among Chinese kindergarten teachers: organizational identification as a mediator. *Front. Psychol.* 12, 1–8. doi: 10.3389/fpsyg.2021.648729
- Jiang, J. Q., and Du, P. (2014). The study of the motivational effects of internal and external pay on primary and secondary school teachers. *Shanghai Researchon Education.* 4, 18–22. doi: 10/gqp23f
- Johnston, A. C. (2020). *Teacher Preferences, Working Conditions, and Compensation Structure*. Institute of Labor Economics (IZA): IZA Discuss Pap, 1–48.
- Lazear, E. P. (2018). Compensation and incentives in the workplace. *J. Econ. Perspect.* 32, 195–214. doi: 10.1257/jep.32.3.195
- Li, C. F., Xu, D. T., and Zhang, S. S. (2021). Satisfaction measurement of civilized service in the industry based on structural equation model. *Stat Decis.* 37, 81–84. doi: 10.13546/j.cnki.tjyjc.2021.18.018
- Liu, Z. Y. (2011). AHP-based research on the incentive effect of compensation in electric power enterprises. *China Electr Power Educ.* 36, 33–34.
- Luque-Reca, O., Garcia-Martinez, I., Pulido-Martos, M., Lorenzo Burguera, J., and Maria, A.-L. J. (2022). Teachers' life satisfaction: a structural equation model analyzing the role of trait emotion regulation, intrinsic job satisfaction and affect. *Teach. Teach. Educ.* 113:103668. doi: 10.1016/j.tate.2022.103668
- McConnell, J. R. (2017). A model for understanding teachers' intentions to remain in STEM education. *Int J Stem Educ.* 4:7. doi: 10.1186/s40594-017-0061-8
- Milkovich, G., and Newman, J. M. (2004). *Compensation*. New York: McGraw-Hill Higher Education.
- Shi, S., Zhang, Z. Z., Wu, H. T., and Zhang, X. M. (2022). Private kindergarten teachers' intention to remain: a comparison between the effects of organizational and individual psychological factors. *Front. Psychol.* 8:912608. doi: 10.3389/fpsyg.2022.912608

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1034855/full#supplementary-material>

- Steinberger, B. Z. (2018). Redefining 'employee' in the gig economy: shielding workers from the Uber model. *Fordham J. Corp. Financ. Law*. 23, 577–596.
- Tan, C. P., Jing, Y., and An, S. M. (2019). Literature review and prospects of Total rewards: factor evolution, theoretical basis and research perspectives. *Foreign Econ. Manag.* 41, 101–113. doi: 10.16538/j.cnki.fem.2019.05.008
- Wang, X. Y., Zhang, R. Y., Wang, X. J., Xu, D. M., and Tian, F. Q. (2022). How do Mobile social apps matter for college students' satisfaction in group-based learning? The mediation of collaborative learning. *Front. Psychol.* 25:795660. doi: 10.3389/fpsyg.2022.795660
- Wen, Z. (2006). Job analysis & salary design employees. *J. Enterp. Manag.* 196–285.
- Wen, X. W., Gu, L. T., and Wen, S. M. (2019). Job satisfaction and job engagement: empirical evidence from food safety regulators in Guangdong. *China. J Clean Prod.* 20, 999–1008. doi: 10.1016/j.jclepro.2018.10.089
- Xing, S. P., Zhao, C. H., Zhang, Y., and Liu, D. (2017). How does comprehensive compensation incentive drive enhancement of human capital value? —a case study based on state grid Hubei electric power company. *Hum Resour Dev China*. 11, 119–130. doi: 10.16471/j.cnki.11-2822/c.2017.11.012
- Yang, L. (2010). The application of two-factor theory in compensation management. *China Bus Trade*. 19, 85–86.
- Yang, Y. M., Li, M. W., Xiong, T., and Song, H. F. (2017). Effect of Total rewards of public institution staff on job satisfaction: to study mediating effect of or intermediary role in perception of pay fairness illustrated by the case of Beijing. *J Beijing Adm Coll*. 1, 76–83. doi: 10.16365/j.cnki.11-4054/d.2017.01.011
- Youssef, M., Saheem, W., Youssef, E. M., Carayannis, E., and Bedford, D. (2017). A structural equation model of knowledge sharing behavior in an emerging economy. *J. Knowl. Manag.* 925–945.
- Zhang, F. B. (2015). Performance evaluation of public expenditure on competitive sports based on structural equation model—An empirical analysis of 25 provinces and cities. *China Sport Sci*. 35, 31–53. doi: 10.16469/j.css.2015.02.004
- Zito, M., Colombo, L., Borgogni, L., Callea, A., Cenciotti, R., Ingusci, E., et al. (2019). The nature of job crafting: positive and negative relations with job satisfaction and work-family conflict. *Int. J. Environ. Res. Public Health* 16:1176. doi: 10.3390/ijerph16071176
- Zou, Y. H., and Cui, G. W. (2014). Changes in athletes' income distribution system and its perfection. *J Nanjing Sport Institute Social Sci*. 28, 105–109. doi: 10.15877/j.cnki.nsic.2014.03.021



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# "Doing good and feeling good" Relationship between authentic leadership with followers' work engagement: The mediating role of hedonic and eudaimonic wellbeing

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The positive behavioral style of authentic leadership has attracted academicians' and practitioners' attention to focus more on a healthy workplace environment and its influence on followers' valued workplace relationship outcomes, such as employees' work engagement. From the lens of social exchange perspective, we tested a unified model of authentic leadership and its influence on the followers' wellbeing (hedonic and eudaimonic wellbeing) and work engagement. We also examined the mediating role of hedonic and eudaimonic wellbeing on followers' work engagement. Using a time-lagged design, we collected data from 250 telecom sector workers employed in the capital city of Islamabad, Pakistan. The results indicate the positive influence of authentic leadership on followers' work engagement and employees' hedonic and eudaimonic wellbeing. Hedonic and eudaimonic wellbeing also positively mediated the relationship between authentic leadership and followers' work engagement. The theoretical and practical implications of the study are also discussed.

## KEYWORDS

authentic leadership, work engagement, hedonic wellbeing, eudaimonic wellbeing, telecom

## Introduction

In recent decades, employee work engagement has flourished as an essential Research Topic in management and applied psychology (1, 2). It is because to accomplish organizational goals, quality of work is more important so that it can stimulate employee engagement for each worker (3). A person can be called a professional when they are truly engaged in their work. The enriched quality of work can be attained only through



higher employee engagement (4). The high engagement of employees is beneficial for an organization as it directly influences individual, team, and organizational level outcomes (2). Engaged employees show more helpful behaviors (5), better job performance (6), lower turnover intentions (7), enriched financial results (8), and increased customer loyalty (9). Thus, due to the significant importance of work engagement and its relevance for modern organizations (2), it is essential to identify different contributing factors to work engagement, and leadership is one such factor.

Studies on positive forms of leadership, especially authentic leadership, proliferated over the past few years as they enhance both individual and organizational productivity (10–12). Authentic leaders show their true selves to employees and play a positive role that helps bring about positive employee changes (13, 14). Authentic leadership can be defined as “a pattern of leader behavior that draws upon and promotes both positive psychological capacities and a positive ethical climate to foster greater self-awareness, an internalized moral perspective, balanced processing of information, and relational transparency on the part of leaders working with followers, fostering positive self-development” (15).

Some theories relate authentic leadership with work engagement, but research supporting such a relationship is minimal (15). Therefore, Alilyyani and Wong (16) stressed the need for more research to identify the role of authentic leaders in affecting employees’ work-related attitudes and behaviors, particularly employee work engagement. Employee work engagement is crucial to a positive organizational outcome. However, the scholarship on the role of authentic leadership and its impact on the employee’s work engagement is inadequate (16). Few researchers attempted to examine the relationship between authentic leadership and work engagement (17, 18), but the relevant literature’s gap is still wide and needs further exploration.

Previous studies suggest that leaders with authenticity traits may influence employees’ wellbeing (19). However, a very limited stream of studies explored the effect of authentic leadership on employee wellbeing (20). In addition, researchers categorized wellbeing into hedonic and eudaimonic wellbeing (21). Hedonic wellbeing aims to boost happiness by attaining pleasure and avoiding pain. Conversely, eudaimonic wellbeing emphasizes self-realization and deep happiness beyond pleasure (22–24). Evidence reveals that there is a significant need for conducting research on hedonic and eudaimonic wellbeing in organizational settings (25, 26).

Cast against that background, the current study makes a vital addition to the existing literature on positive psychology by investigating a new mediation model (hedonic and eudaimonic wellbeing) that explains how and why authentic leaders impact their followers’ engagement in the workplace. Drawing on social exchange theory (27), we investigated the mediating role of hedonic and eudaimonic wellbeing in communicating the

influence of authentic leadership to deepen employees’ work engagement. From a social exchange perspective, when leaders treat their employees well, they are expected to reciprocate by showing more interest in the work assigned to them (28). Grounded on this idea, we posit that employees working in the telecom sector of Pakistan are likely to exhibit more interest in their work in the presence of authentic leadership.

The study contributes to the limited existing literature on authentic leadership, hedonic and eudaimonic wellbeing, and employee work engagement by investigating the influence of authentic leadership, hedonic and eudaimonic wellbeing, and employee work engagement in the South Asian context. It employs a new mediating research model to examine the aforementioned relationship. Finally, conducting this study in a South Asian context, especially in a developing country like Pakistan, provides a unique impetus to the implications of this study, as many of the previous studies on authentic leadership wellbeing (hedonic and eudaimonic wellbeing) were conducted in developed Western countries.

## Theory and hypothesis development

### Authentic leadership and work engagement

Leader authenticity has gained scholars’ and practitioners’ attention for the last 20 years. The concept of “authentic leadership” emerged from positive organizational behavior (29) and transformational leadership (30). Walumbwa and Wang (31) define authentic leadership as leader behaviors focusing on the positive psychological capacity and moral values to stimulate follower self-development. Authentic leadership behaviors comprise four basic components: self-awareness, balanced processing, an internalized moral perspective, and relational transparency (15). First, self-awareness refers to an individual’s awareness of their own strengths and weaknesses, thoughts, and desires (32). Authentic leaders are aware of their strengths and weaknesses and how others perceive them (33). Second, the balance in the processing of information is related to objectively gaining precise information before reaching any mutual decision (15). Third, internalized moral perspectives are related to acting in accordance with one’s moral values and beliefs (32). Authentic leaders display sincere behaviors and act according to their moral values with followers (33). Finally, relational transparency discusses openly sharing one’s feelings and admitting mistakes (15). Authentic leaders freely share their feelings and opinions with followers (34, 35) and demonstrate their true selves to them, irrespective of whether they are positive or negative (36).

Employee work engagement plays a central role in achieving organizational goals. Schaufeli and Salanova (37) define work engagement as a “positive, fulfilling, work-related state of mind

characterized by vigor, dedication, and absorption” (p. 74). Vigor indicates workers’ determination and mental resilience in responding to challenges in the workplace (2). Dedication refers to an employee’s strong involvement with and identification with their job (37). Absorption indicates employees’ completely focused attention and happy engagement with their job within the work environment (37, 38). Work engagement has three different dimensions: physical, cognitive, and emotional. People express and interact with their work in all three ways (cognitively, emotionally, and physically); however, Kahn et al. (39) mentioned that these behaviors may be best used in a single dimension because of their psychological presence at work.

Moreover, a leader’s positive role in the organization enables employees to trust their leader, work collectively as a team, and experience positive emotions in the workplace (33). Empirical evidence reveals that only a few researchers explored the positive role of authentic leadership in influencing employees’ work engagement (17, 18). For instance, Towsen and Stander (18) examined the relationship between authentic leadership and work engagement and found that employees displayed more work engagement and dedication under the influence of authentic leadership. However, it clearly lacks the impact of mediating the role of hedonic and eudaimonic wellbeing on the relationship between authentic leadership and employee work engagement in the organizational environment.

## Social exchange theory

Social exchange theory has been widely used as an underlying mechanism in leadership literature linking leadership with employees’ work engagement (27). Blau (27) defines social exchange as “the voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do bring from others” (p. 91). According to this theory, every individual’s behavior depends on another person’s behavior. Therefore, working under the supervision of authentic leadership, the worker may act in accordance with the norm of reciprocity (40) and show more engagement at the workplace in response to the leader’s positive behaviors, thus keeping the balance in the exchange relationship (41). Past studies confirmed that subordinates respond to authentic leader behaviors by performing better in the workplace (11, 42). Relying on the social exchange perspective, we argued that employees inspired by their leader’s authentic behaviors, such as honesty, showing their authentic selves to followers and possessing moral standards and values, are more engaged in their work and show better performance. Hence, we formulate the following hypothesis:

*Hypothesis 1:* Authentic leadership is positively related to employees’ work engagement.

## Authentic leadership and hedonic and eudaimonic wellbeing

In the current arena, wellbeing appears as an essential topic for research in the field of empirical psychology. According to Ryan and Deci (23), “wellbeing” is a mental representation, optimal role, and understanding of an individual concerning the nature and experience of wellbeing. Researchers conducted studies on wellbeing and further categorized it into hedonic and eudaimonic wellbeing (21), the former as subjective wellbeing and the latter as psychological wellbeing (43). Hedonic wellbeing focuses on the pleasure principle and pain avoidance (44). This perspective, also known as subjective wellbeing, is composed of positive effects and mental assessments of life satisfaction (45). However, eudaimonic wellbeing seeks deep pleasure and self-realization beyond present pleasure and happiness (23). Eudaimonic wellbeing, also called psychological wellbeing, focuses on authenticity, purposefulness, resources, strengths, and a meaningful life (24).

Authentic leaders act as positive role models by generating a productive and pleasant environment, enhancing employees’ hedonic wellbeing, and boosting organizational success (46). Past studies indicated the influence of authentic leadership on employees’ hedonic wellbeing (46–48). Eudaimonic wellbeing is also important for positive psychological functioning (49). However, very few researchers explored the role of authentic leadership on the eudaimonic wellbeing of employees (20, 46).

Authentic leaders’ positive role influences followers to respond by engaging in activities that align with their leader’s moral values and behaviors (46). From the social exchange (27) perspective, when employees experience their leader as trustworthy and supportive, they are more satisfied at the workplace and show more engagement in their work, which can boost organizational effectiveness. Moreover, when an authentic leader shows their true self and creates a supportive environment in the workplace, such initiatives help build trust in leaders and encourage employees to find purpose and meaning in the workplace by utilizing their full potential for the organization’s goals and achievements. Hence, we posit the following hypothesis:

*Hypothesis 2:* Authentic leadership is positively related to employees’ hedonic wellbeing.

*Hypothesis 3:* Authentic leadership is positively related to employees’ eudaimonic wellbeing.

## Hedonic wellbeing, eudaimonic wellbeing, and employees work engagement

Past studies suggested a positive link between psychological wellbeing and work engagement (50, 51). A study conducted by

Shimazu and Schaufeli (52) indicates the positive association of psychological wellbeing with work engagement. Similarly, the study conducted by Brunetto and Teo (53) revealed a positive relationship between psychological wellbeing and work engagement. The above discussion shows a positive relationship between psychological wellbeing and works engagement; however, none of the studies focused on hedonic and eudaimonic wellbeing and its relationship with work engagement. Moreover, Ibrahim Said (54) recently suggested a positive association between hedonic and eudaimonic wellbeing and work engagement. So, the current study filled this gap by concentrating on examining the aforesaid relationship. We argue that both hedonic and eudaimonic wellbeing is crucial for leaders; thus, they must provide a pleasant environment for workers to become positive and more engaged. So, we posit the hypothesis as follows:

*Hypothesis 4:* Hedonic wellbeing is positively related to employees' work engagement.

*Hypothesis 5:* Eudaimonic wellbeing is positively related to employees' work engagement.

## The mediating role of hedonic and eudaimonic wellbeing

Based on the above discussed literature, we hypothesize that hedonic and eudaimonic wellbeing may mediate the link between authentic leadership and work engagement in accordance with the stimuli-organism-response model (55). Authentic leadership acts as a stimulus that promotes hedonic and eudaimonic wellbeing among employees (organism), which improves their willingness to enhance their engagement in work (response). The leader's positive role and supportive behavior give more energy and enhance employees' hedonic and eudaimonic wellbeing, enhancing employees' motivation to engage in positive work and increase their personal growth (46). When leaders provide a good workplace setting for their employees and focus on their wellbeing, they are optimistic about their personal growth. They are satisfied with their working lives, enhancing their engagement in work (56). Authentic leadership may enhance employees' hedonic and eudaimonic wellbeing (H2 and H3). Such types of wellbeing also enhance employees' work engagement (H4 and H5) (see Figure 1).

Past research studies revealed the positive mediating role of employee wellbeing on the relationship between authentic leadership and work engagement (56). In addition, past studies also revealed the positive mediating effect of eudaimonic wellbeing on the association between CSR and knowledge-sharing behavior (57). However, this is the first study examining the mediating role of hedonic and eudaimonic wellbeing on the relationship between authentic leadership and employee

work engagement. Therefore, based on the above discussion, we hypothesize as follows:

*Hypothesis 6:* Hedonic wellbeing positively mediates the relationship between authentic leadership and employees' work engagement.

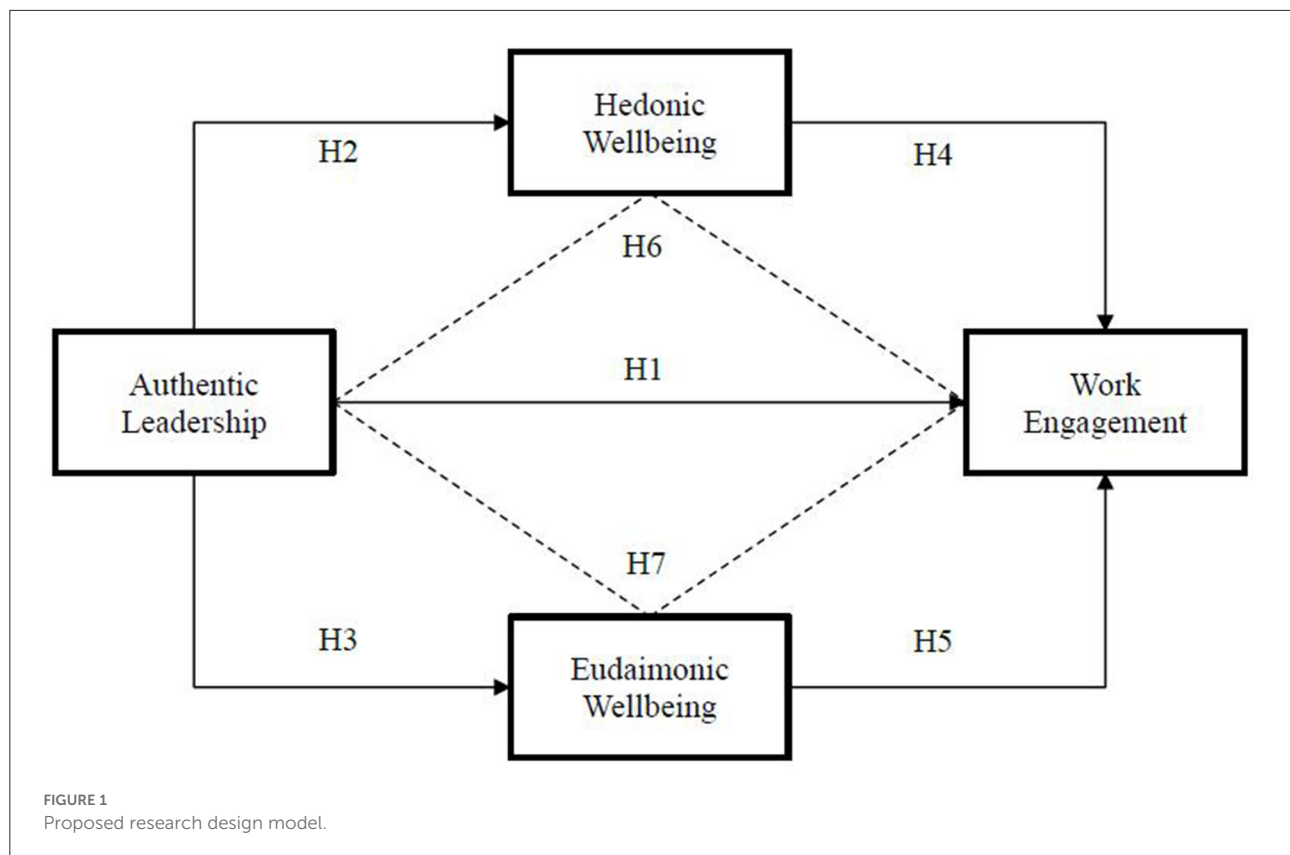
*Hypothesis 7:* Eudaimonic wellbeing positively mediates the relationship between authentic leadership and employees' work engagement.

## Methodology

### Sampling and method

The data were collected under a research project that aimed to examine the influence of authentic leadership on employees' work engagement and the mediating role of hedonic and eudaimonic wellbeing among employees in telecom sector companies (Zong, Ufone, and Telenor) in Islamabad, Pakistan. The data were collected in two waves using a time-lagged design by distributing questionnaires along with a cover letter explaining the purpose of the study. Time-lag studies are commonly used for data collection processes to reduce common method bias and temporal effect, and this approach is preferred in similar nature studies (42, 58). The researcher visited the aforementioned telecom sectors and discussed the study's importance. Together with the managers and after formal approval from the organizational leaders, the researchers approached the employees at their workplace and encouraged them to participate in the study. In addition, the researchers distributed the questionnaires among employees in two waves within a gap of 1 month. In the first wave, the respondents rated their authentic leadership behaviors and provided demographic information. In the second wave, employees rated their work engagement and hedonic and eudaimonic wellbeing. The confidentiality of their responses was ensured.

We used convenient sampling techniques to easily approach the respondents and get efficient responses. We distributed 350 questionnaires among employees in telecom sector companies (Zong, Ufone, and Telenor) and received a total of 250 completed questionnaires—a response rate of 71%. Out of the total 250 responses, the majority of respondents ( $N = 184$ , 74%) were men, whereas 66 respondents (26%) were women. The majority of the respondents ( $N = 145$ , 58%) were aged between 21 and 30 years, 90 (36%) respondents were aged between 31 and 40 years, and the remaining 15 (6%) were of the age between 41 and 50 years. In addition, the majority of 145 (58%) respondents were married, 105 (42%) were unmarried, 72 (29%) held bachelor's degrees, 149 (60%) held master's degrees, and the remaining 29 (11%) held MPhil or higher degrees. Further, the majority of 132 (53%) respondents had 1–5 years of job experience, 74 (30%) had 6–10 years of experience, 31 (12%) had 11–15 years of job experience, and the remaining



13(5%) had 16–20 years of job experience. Lastly, out of the total respondents, only 56 (22%) were found working as a manager, and the majority, 194(78%), were found working as staff members in the telecom sectors.

16 items, and sample items include “My manager says exactly what he or she means,” “My manager encourages everyone to speak their mind,” and “My manager asks us to take positions that support our core values.” The scale reliability was 0.965.

## Common method variance

We also used the common method bias (CMB) test. We performed Harman’s single-factor analysis to assess this study’s common method variance (59), as it relied on self-report measures. The results indicate no high bivariate correlations between constructs ( $r > 0.90$ ). Hence, this study found no CMB evidence (60).

## Measures

We used a 5-point Likert scale ranging from “strongly disagree” to “strongly agree” to measure the variables used in the study.

### Authentic leadership

The authentic leadership scale developed by Walumbwa and Avolio (15) was used in this study. The scale is composed of

### Work engagement

We used a single-dimensional scale for work engagement, as suggested by May and Gilson (61). They argue that, due to psychological presence at the workplace, employee work engagement can be adequately measured through a single dimension (Kahn) (39). Therefore, we used a short version (9 items) of the Utrecht Work Engagement Scale developed by Schaufeli and Salanova (37) in the study. Examples include: “At my work, I feel bursting with energy,” “I am enthusiastic about my job,” and “I am immersed in my work.” The reliability of the scale was 0.878.

### Hedonic and eudaimonic wellbeing

The hedonic and eudaimonic wellbeing scales developed by Waterman and Schwartz (62) were used in this study. The hedonic wellbeing scale comprises six items, and the eudaimonic wellbeing scale also comprises six items. The sample items of

hedonic wellbeing include “This work gives me my strongest sense of enjoyment,” “When I engage in this work, I feel happier than I do when engaged in most other activities,” and “This work gives me my greatest pleasure.” The reliability of the hedonic wellbeing scale was 0.887. The sample items of eudaimonic wellbeing include the following: “This work gives me my greatest feeling of really being alive,” “This work gives me my strongest feeling that this is who I really am,” “When I engage in this work, I feel that this is what I was meant to do.” The reliability of the eudaimonic wellbeing scale was 0.876.

## Results

### Descriptive statistics

A correlation analysis was performed to examine the basic relationship between the variables. Table 1 indicates the means, standard deviations, and variable correlations of the sample. The results indicate that the correlation between authentic leadership and work engagement was found to be positive and significant ( $r = 0.419$  and  $p < 0.001$ ). Similarly, the correlation between authentic leadership and hedonic wellbeing was found to be positive ( $r = 0.428$ ,  $p < 0.001$ ). The correlation between authentic leadership and eudaimonic wellbeing was also found to be significant and positive ( $r = 0.597$  and  $p < 0.001$ ). Moreover, the correlation between work engagement and hedonic wellbeing was found to be significant ( $r = 0.710$  and  $p < 0.001$ ). Likewise, the correlations between work engagement and eudaimonic wellbeing were also found to be positive and significant ( $r = 0.540$  and  $p < 0.001$ ). Finally, the correlation between hedonic and eudaimonic wellbeing was found to be positive and significant ( $r = 0.711$ ,  $p < 0.001$ ).

### Confirmatory factor analysis

Confirmatory factor analyses (CFAs) were performed in SPSS Amos to examine the scales' convergence and discriminant validity. To calculate model fit indices and compare them with other models, we first analyzed the baseline model (4 factors) composed of all the main variables, i.e., authentic leadership, work engagement, hedonic wellbeing, and eudaimonic wellbeing (shown in Table 2). The findings showed a good model fit for the baseline model compared to the other proposed models in our study; chi-square/degree of freedom ( $\chi^2/df$ ) = 1.558, comparative fit index (CFI) = 0.929, incremental fit index (IFI) = 0.930, Tucker–Lewis index (TLI) = 0.924, root mean square error of approximation (RMSEA) = 0.047. Second, we authenticated leadership and work engagement items and combined them into a new single factor in the three-factor model (Model 2); chi-square/degree of freedom ( $\chi^2/df$ ) = 3.403, comparative fit index (CFI) = 0.693, incremental fit

index (IFI) = 0.694, Tucker–Lewis index (TLI) = 0.674, root mean square error of approximation (RMSEA) = 0.098. Third, work engagement, eudaimonic wellbeing, and hedonic wellbeing items were merged into a new single factor in the two-factor model (Model 3); chi-square/degree of freedom ( $\chi^2/df$ ) = 2.590, comparative fit index (CFI) = 0.796, incremental fit index (IFI) = 0.798, Tucker–Lewis index (TLI) = 0.784, root mean square error of approximation (RMSEA) = 0.080. Finally, we combined all the items of the studied variables (authentic leadership, work engagement, hedonic wellbeing, and eudaimonic wellbeing into a new single factor in the one-factor model) (Model 1); chi-square/degree of freedom ( $\chi^2/df$ ) = 4.725, comparative fit index (CFI) = 0.522, incremental fit index (IFI) = 0.526, Tucker–Lewis index (TLI) = 0.494, root mean square error of approximation (RMSEA) = 0.122. Confirmatory factor analysis with maximum likelihood estimation was conducted for the above model. The factor loading for every factor was found positive and indicated good convergent validity. The average variance extracted (AVE) for all the variables proposed was checked, and the square root of every AVE was found to be greater than all the coefficients of the variables (63).

### Regression analysis

We conducted a regression analysis to reconfirm the results that were verified in the correlation analysis. A simple linear regression analysis was performed to test the main hypothesis shown in Table 3.

Table 3 indicates the positive relationship of authentic leadership with work engagement ( $\beta = 0.358$ ,  $p < 0.0001$ ), supporting Hypothesis 1. Hypothesis 2 predicted a positive link between authentic leadership with employees' hedonic wellbeing. The result indicates the positive association of authentic leadership with employees' hedonic wellbeing ( $\beta = 0.411$  and  $p < 0.0001$ ), supporting Hypothesis 2. Hypothesis 3 predicted a positive relationship between authentic leadership and employees' eudaimonic wellbeing. The results revealed that authentic leadership is positively linked with eudaimonic wellbeing ( $\beta = 0.484$  and  $p < 0.0001$ ), fully supporting Hypothesis 3. Further, Hypothesis 4 predicted a positive relationship between hedonic wellbeing and work engagement. The results revealed that hedonic wellbeing positively correlated with work engagement ( $\beta = 0.633$  and  $p < 0.0001$ ), supporting our Hypothesis 4. Hypothesis 5 reveals a positive association between eudaimonic wellbeing and work engagement ( $\beta = 0.570$  and  $p < 0.0001$ ), supporting Hypothesis 5.

### Mediation analysis

The process program for SPSS developed by Hayes (64) was used to analyze mediating hypotheses. To find the mediating



TABLE 1 Descriptive statistics, mean, standard deviation (SD), and correlation of the variables.

	Mean	SD	1	2	3	4
Authentic leadership	3.8990	0.89058	1			
Work engagement	3.8760	0.76228	0.419**	1		
Hedonic wellbeing	3.8327	0.85461	0.428**	0.710**	1	
Eudaimonic wellbeing	4.0727	0.72190	0.597**	0.540**	0.711**	1

N = 250, \*p < 0.05, \*\*p < 0.001.

TABLE 2 Confirmatory factor analysis and alternative measurement models.

Measurement Model	$\chi^2$	Df	$\chi^2/\text{df}$	CFI	IFI	TLI	RMSEA
M1: 4 Factors Model (Hypothesized 4 factor model)	970.6	623	1.558	0.929	0.930	0.924	0.047
M2: 3 Factor Model: "AL+WE, HD, EUD" (authentic leadership and work engagement were merged)	2,130	626	3.403	0.693	0.694	0.674	0.098
M3: 2 Factor Model: "AL, WE+EUD+HD" (work engagement, eudemonic wellbeing and hedonic wellbeing were merged)	1,626	628	2.590	0.796	0.798	0.784	0.080
M4: 1 Factor Model: "AL+ HD+ EUD+WE" (authentic leadership, work engagement, eudemonic wellbeing and hedonic wellbeing were merged)	2,972	629	4.725	0.522	0.526	0.494	0.122

AL, Authentic Leadership; WE, Work Engagement; HD, Hedonic Wellbeing; EUD, Eudemonic Wellbeing;  $\chi^2/\text{df}$ , Chi-square/degree of freedom; IFI, Incremental Fit Index; CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root mean square error of approximation.

TABLE 3 Regression analysis of authentic leadership, hedonic wellbeing, eudaimonic wellbeing, and work engagement.

Variable	HDW	EUDW	Work engagement
Constant			
Gender	0.172	0.217	0.082
Age	0.102	0.057	0.178*
AL	0.411***	0.484***	0.358***
HDW	–	–	0.633***
EUDW	–	–	0.570***
R <sup>2</sup>	0.183	0.356	0.175
$\Delta R^2$	0.180	0.354	0.172
F	55.664	137.172	52.736

N = 250, \*p < 0.05, \*\*\*p < 0.0001. AL, Authentic Leadership; HDW, hedonic wellbeing; EUDW, eudaimonic wellbeing.

effects of hedonic and eudaimonic wellbeing on the association between authentic leadership and followers' work engagement, Model 4 from Hayes process templates was used. Additionally, 95% correct bias CI with 5000 bootstrapping procedures sample estimates was selected.

TABLE 4 Coefficient and bootstrapping for the mediation analysis.

Testing Paths	Unstandardized coefficient		T	Sig	Bootstrapping	
	Coefficient	Std. error			LCI	ULCI
IV → M (a)	0.411	0.055	7.461	0.0001	0.302	0.519
M → DV (b)	0.579	0.044	13.303	0.0001	0.493	0.665
IV → M → DV(c')	0.121	0.042	2.885	0.004	0.038	0.203
IV → DV (c)	0.358	0.049	7.262	0.0001	0.261	0.456
Indirect effects	0.238	0.045	–	–	0.159	0.335

IV, Authentic leadership; MV, hedonic wellbeing; DV, work engagement.

In Hypothesis 6, we hypothesized the positive mediating effects of hedonic wellbeing on the relationship between authentic leadership and work engagement. The results shown in Table 4 indicate that hedonic wellbeing positively and partially mediated the influence of authentic leadership and work engagement ( $\beta = 0.121$  and  $p < 0.004$ ); hence, our Hypothesis 6 is partially supported.



TABLE 5 Coefficient and bootstrapping for the mediation analysis.

Testing paths	Unstandardized coefficient		T	Sig	Bootstrapping	
	Coefficient	Std error			LLCI	ULCI
IV → M (a)	0.484	0.041	11.712	0.0001	0.402	0.565
M → DV (b)	0.476	0.070	6.821	0.0001	0.338	0.613
IV → M → DV(c')	0.128	0.057	2.269	0.024	0.017	0.240
IV → DV (c)	0.358	0.049	7.262	0.0001	0.261	0.456
Indirect effects	0.230	0.045	–	–	0.153	0.327

IV, Authentic leadership; MV, eudaimonic wellbeing; DV, work engagement.

Likewise, in Hypothesis 7, we hypothesized the positive mediating effect of eudaimonic wellbeing on the relationship between authentic leadership and work engagement. The results shown in Table 5 indicate that eudaimonic wellbeing positively and partially mediated the influence of authentic leadership and work engagement ( $\beta = 0.128$  and  $p < 0.024$ ); hence, our Hypothesis 7 is partially supported.

## Discussion

This study examines the influence of authentic leadership on followers' work engagement and the mediating effects of hedonic and eudaimonic wellbeing on the relationship between authentic leadership and work engagement.

We found a positive link between authentic leadership and followers' work engagement. As discussed in the literature section, authentic leadership has gained scholars' attention owing to its positive influence on employees (15, 65), and it should be verified in various organizational situations (16, 66). In addition, work engagement is considered one of the most important organizational factors for workers' effectiveness (2) and is widely used as a driver of positive outcomes (18, 67, 68). The present study makes an important addition to the existing literature by exploring the relationship between authentic leadership and employees' work engagement in the context of the different telecom sectors in Pakistan. In addition, in accordance with previous research findings (17, 18) and with our expectations, this study's findings reveal a positive relationship between authentic leadership and followers' work engagement, supporting Hypothesis 1. The results indicate that a leader should be aware of his strengths and weaknesses, maintain a transparent relationship with followers, and encourage them to freely create confidence among employees and make a difference in their work. One can expect that an authentic leader is an important resource in flourishing loyal, hardworking, and dedicated employees that are fully absorbed in their work.

Second, as expected, authentic leadership is positively associated with hedonic and eudaimonic wellbeing, supporting our Hypotheses 2 and 3. These particular findings are in agreement with previous research studies (20, 46, 48). Moreover, this study is among the first to empirically test the influence of authentic leadership on both dimensions of wellbeing (hedonic and eudaimonic) in the telecom sectors. Third, this study has also confirmed that hedonic and eudaimonic wellbeing are positively associated with followers' work engagement, supporting our Hypotheses 4 and 5. As discussed in the literature section, none of the studies focused on hedonic and eudaimonic wellbeing and its relationship with work engagement. Moreover, Ibrahim Said (54) recently suggested a positive association between hedonic and eudaimonic wellbeing and work engagement. So, the current study filled this gap and is essential to the literature on wellbeing (hedonic and eudaimonic) and work engagement. Furthermore, our study results also support the social exchange base mechanism between leaders and followers by showing the positive effect of authentic leadership on followers' work engagement.

The current study findings also indicate that hedonic and eudaimonic wellbeing mediated the link between authentic leadership and followers' work engagement, supporting Hypotheses 6 and 7. From a social exchange perspective, our study findings also indicate how hedonic and eudaimonic wellbeing is vital in boosting employees' work engagement. Past studies also tested the mediating mechanism of wellbeing in the effect of authentic leadership on follower attitudes and behaviors at the workplace (20, 46–48). However, most of these studies used either hedonic wellbeing or eudaimonic wellbeing in their studies. Given the distinctions between the model of hedonic and eudaimonic wellbeing (21), we assume that these two dimensions of wellbeing mediate the relationship between authentic leadership and employees' work engagement (21). This is among the first empirical research to investigate hedonic and eudaimonic wellbeing as a mediating variable in finding the relationship between

authentic leadership and followers' work engagement and to make a new contribution to the authentic leadership and wellbeing literature.

## Practical implications, limitations, and future research suggestions

The current study has confirmed the important role of authentic leadership in influencing employees' work engagement through the development of hedonic and eudaimonic wellbeing. Due to the development of the multinational telecom sectors in Pakistan, the competition among the telecom sector companies has increased. Therefore, the top management of telecom sector companies should pay attention to the importance of the authentic leadership role of their managerial staff and arrange leadership development seminars to boost positive organizational outcomes.

Based on the findings, we propose that organizational management pay attention to leadership development and training. Considering the significance of leader authenticity, management should consider authentic leadership components such as self-awareness, relational transparency, internalized moral perspectives, and balanced information processing in developing organizational policies and strategies. A leader's authenticity not only enhances employees' understanding of wellbeing but also serves as an important factor in influencing followers to exhibit high work engagement.

In addition, the findings suggest that followers' work engagement can be boosted by improving the quality of the leader–follower relationship and creating an environment where team members are united and work as a team, ultimately boosting organizational performance. The study findings also suggest that managers should pay attention to how their authentic leadership behaviors may contribute to the development of hedonic and eudaimonic wellbeing, aiming to increase their employees' workplace relationships. Further, organizational management should also focus on leaders and happiness because happy workers and happy leaders cause their followers to experience a high level of productivity, higher organizational performance, and lower burnout.

The study's results are significant, and all the proposed hypotheses were accepted. However, some suggestions were given to address the following limitations. First, the study only focused on the telecom sectors in Pakistan. The study should be extended to other work settings to better understand the relationships among the studied variables. Second, common method bias is another limitation of the study. Future studies should be expanded to other departments and groups to overcome this issue. Third, to increase the findings' generalizability, the current study should be replicated in other countries. Fourth, the researchers followed a convenience

sampling technique for data collection. In the future, the researchers should focus on other sampling techniques such as purposeful sampling. Fifth, we collected the data from a single source; therefore, the studies should use a multisource data design in future. Sixth, future researchers are encouraged to consider other organizational variables, such as career success, employee's intention to stay, and organizational identification, while focusing on authentic leadership. In addition, we examined hedonic and eudaimonic wellbeing as mediating variables in examining the relationship between authentic leadership and followers' work engagement. In the future, researchers are encouraged to consider other variables like core values and self-efficacy to examine the above-studied relationship.

## Conclusion

We proposed and empirically tested a unified model explaining the association between authentic leadership and followers' work engagement. Our study results confirm that the telecom sector's managers' authentic leadership, as perceived by their followers, is related to the work engagement of their followers. Moreover, this pioneering study examines hedonic and eudaimonic wellbeing as mediating variables underlying the relationship between authentic leadership and followers' work engagement. It makes a significant addition to the wellbeing and authentic leadership literature by examining the crucial role of hedonic and eudaimonic wellbeing and its influence on the relationship between authentic leadership and followers' work engagement. Most importantly, this study reconfirms the applicability of social exchange theory (27) in explaining the relationship of authentic leadership with wellbeing (hedonic and eudaimonic wellbeing) and work engagement in the Pakistani context. Our study findings can be used to inform the manager about the organizational consequences of their authentic leadership style.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethical Committee of Department of Psychology and Behavioral Science Zhejiang University China. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

TF and SI equally contributed to the original draft, the conceptualization, data collection, formal analysis, and methodology. ASB provided resources and administered the project. AK, MKK, and MAS reviewed and edited the paper. All authors contributed to the article and approved the submitted version.

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## References

1. Park J, Han SJ, Kim J, Kim W. Structural relationships among transformational leadership, affective organizational commitment, and job performance: the mediating role of employee engagement. *Eur J Train Dev.* (2021). doi: 10.1108/EJTD-10-2020-0149
2. Bakker AB, Albrecht S. Work engagement: current trends. *Career Dev Int.* (2018) 23:4–11. doi: 10.1108/CDI-11-2017-0207
3. Alqarni SAY. Quality of work life as a predictor of work engagement among the teaching faculty at King Abdulaziz University. *Int J Human Soc Sci.* (2016) 6:118–35. Available online at: [http://www.ijhssnet.com/journals/Vol\\_6\\_No\\_8\\_August\\_2016/14.pdf](http://www.ijhssnet.com/journals/Vol_6_No_8_August_2016/14.pdf)
4. Satata DBM. Employee engagement as an effort to improve work performance: literature review. *Ilomata Int J Soc Sci.* (2021) 2:41–9. doi: 10.52728/ijss.v2i1.152
5. Bakker AB, Demerouti E, Sanz-Vergel AI. Burnout and work engagement: the JD-R approach. *Annu Rev Organiz Psychol Organiz Behav.* (2014) 1:389–411. doi: 10.1146/annurev-orgpsych-031413-091235
6. Christian MS, Garza AS, Slaughter JE. Work engagement: a quantitative review and test of its relations with task and contextual performance. *Personnel Psychol.* (2011) 64:89–136. doi: 10.1111/j.1744-6570.2010.01203.x
7. Memon MA, Salleh R, Baharom MNR. The link between training satisfaction, work engagement and turnover intention. *Eur J Train Dev.* (2016) 40:407–29. doi: 10.1108/EJTD-10-2015-0077
8. Xanthopoulou D, Bakker AB, Demerouti E, Schaufeli WB. Reciprocal relationships between job resources, personal resources, work engagement. *J Vocat Behav.* (2009) 74:235–44. doi: 10.1016/j.jvb.2008.11.003
9. Rasool A, Shah FA, Tanveer M. Relational dynamics between customer engagement, brand experience, and customer loyalty: an empirical investigation. *Journal of Internet Commerce.* (2021) 20:273–92. doi: 10.1080/15332861.2021.1889818
10. Bailey C, Madden A, Alfes K, Fletcher L. The meaning, antecedents and outcomes of employee engagement: a narrative synthesis. *Int J Manag Rev.* (2017) 19:31–53. doi: 10.1111/ijmr.12077
11. Duarte AP, Ribeiro N, Semedo AS, Gomes DR. Authentic leadership and improved individual performance: affective commitment and individual creativity's sequential mediation. *Front Psychol.* (2021) 12:675749. doi: 10.3389/fpsyg.2021.675749
12. Semedo AS, Coelho A, Ribeiro N. The relationship between authentic leaders and employees' creativity: what are the roles of affective commitment and job resourcefulness? *Int J Workplace Health Manag.* (2018) 11:58–73. doi: 10.1108/IJWHM-06-2017-0048
13. Avolio BJ, Walumbwa FO, Weber TJ. Leadership: current theories, research, future directions. *Annu Rev Psychol.* (2009) 60:421–49. doi: 10.1146/annurev.psych.60.110707.163621

## Conflict of interest

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14. Leroy H, Anseel F, Sels L. Authentic leadership, authentic followership, basic need satisfaction, and work role performance: a cross-level study. *J Manag.* (2015) 41:1677–97. doi: 10.1177/0149206312457822
15. Walumbwa FO, Avolio BJ, Peterson SJ. Authentic leadership: development and validation of a theory-based measure. *J Manag.* (2008) 34:89–126. doi: 10.1177/0149206307308913
16. Alilyani B, Wong CA, Cummings G. Antecedents, mediators, and outcomes of authentic leadership in healthcare: a systematic review. *Int J Nurs Stud.* (2018) 83:34–64. doi: 10.1016/j.ijnurstu.2018.04.001
17. Oh J, Cho D, Lim DH. Authentic leadership and work engagement: the mediating effect of practicing core values. *Leadership Organiz Dev J.* (2018) 39:276–90. doi: 10.1108/LODJ-02-2016-0030
18. Towsen T, Stander MW, van der Vaart L. The relationship between authentic leadership, psychological empowerment, role clarity, and work engagement: evidence from South Africa. *Front Psychol.* (2020) 11:1973. doi: 10.3389/fpsyg.2020.01973
19. Wright TA, Quick JC. The role of character in ethical leadership research. *Leadership Quart.* (2011) 22:975–8. doi: 10.1016/j.leaqua.2011.07.015
20. Kim J-I. The effects of emotional intelligence, self-leadership, psychological wellbeing to academic achievement of nursing college student. *J Korea Acad Indust Cooper Soc.* (2018) 19:574–83. Available online at: <http://koreascience.or.kr/article/JAKO201811459664363.page>
21. Huta V, Waterman AS, Eudaimonia and its distinction from hedonia: developing a classification and terminology for understanding conceptual and operational definitions. *J Happiness Stud.* (2014) 15:1425–56. doi: 10.1007/s10902-013-9485-0
22. Seligman ME. Can happiness be taught? *Daedalus.* (2004) 133:80–7. doi: 10.1162/001152604323049424
23. Ryan RM, Deci EL. On happiness and human potentials: A review of research on hedonic and eudaimonic wellbeing. *Annu Rev Psychol.* (2001) 52:141. doi: 10.1146/annurev.psych.52.1.141
24. Waterman AS, Schwartz SJ, Zamboanga BL, Williams MK, Agocha VB, Kim SY, et al. The Questionnaire for Eudaimonic Well-Being: Psychometric properties, demographic comparisons, and evidence of validity. *J Positive Psychol.* (2010) 5:41–61. doi: 10.1080/17439760903435208
25. der Kinderen S, Valk A, Khapova SN, Tims M. Facilitating eudaimonic wellbeing in mental health care organizations: the role of servant leadership and workplace civility climate. *International J Environ Res Public Health.* (2020) 17:1173. doi: 10.3390/ijerph17041173
26. Straume LV, Vittersø J. Happiness, inspiration and the fully functioning person: separating hedonic and eudaimonic wellbeing in the workplace. *J Positive Psychol.* (2012) 7:387–98. doi: 10.1080/17439760.2012.711348

27. Balu PM. *Exchange and Power in Social Life* (2nd Ed.) New York, NY: Routledge (2017). doi: 10.4324/9780203792643
28. Liborius P. Who is worthy of being followed? The impact of leaders' character and the moderating role of followers' personality. *J Psychol.* (2014) 148:347–85. doi: 10.1080/00223980.2013.801335
29. Luthans F. The need for and meaning of positive organizational behavior. *J Organiz Behav.* (2002) 23:695–706. doi: 10.1002/job.165
30. Avolio. *Full Leadership Development: Building the Vital Forces in Organizations*. London, UK: Sage (1999).
31. Walumbwa FO, Wang P, Wang H, Schaubroeck JA, Bruce J. Psychological processes linking authentic leadership to follower behaviors. *Leadership Quart.* (2010) 21:901–14. doi: 10.1016/j.leaqua.2010.07.015
32. Zamahani M, Ghorbani V, Rezaei F. Impact of authentic leadership and psychological capital on followers' trust and performance. *Austral J Basic Appl Sci.* (2011) 5:658–67. Available online at: <http://www.ajbasweb.com/old/ajbas/2011/December-2011/658-667.pdf>
33. Avolio BJ, Gardner WL, Walumbwa FO, Luthans F, May DR. Unlocking the mask: A look at the process by which authentic leaders impact follower attitudes and behaviors. *Leadership Quart.* (2004) 15:801–23. doi: 10.1016/j.leaqua.2004.09.003
34. Eagly AH. Achieving relational authenticity in leadership: does gender matter? *Leadership Quart.* (2005) 16:459–74. doi: 10.1016/j.leaqua.2005.03.007
35. Gardner WL, Avolio BJ, Luthans F, May DR, Walumbwa F. "Can you see the real me?" A self-based model of authentic leader and follower development. *The Leadership Quarterly*, (2005) 16:343–72. doi: 10.1016/j.leaqua.2005.03.003
36. Qian J, Lin X, Chen GZ-X. Authentic leadership and feedback-seeking behaviour: an examination of the cultural context of mediating processes in China. *J Manag Organiz.* (2012) 18:286–99. doi: 10.5172/jmo.2012.18.3.286
37. Schaufeli WB, Salanova M, González-romá V, Bakker AB. The measurement of engagement and burnout: a two sample confirmatory factor analytic approach. *J Happiness Stud.* (2002) 3:71–92. doi: 10.1023/A:1015630930326
38. Costa PL, Passos AM, Bakker AB. Team work engagement: a model of emergence. *J Occup Organiz Psychol.* (2014) 87:414–36. doi: 10.1111/joop.12057
39. Kahn WA. To be fully there: psychological presence at work. *Hum Relat.* (1992) 45:321–49. doi: 10.1177/001872679204500402
40. Gouldner AW. The norm of reciprocity: a preliminary statement. *Am Sociol Rev.* (1960) 25:161–78. doi: 10.2307/2092623
41. Cropanzano R, Mitchell MS. Social exchange theory: an interdisciplinary review. *J Manag.* (2005) 31:874–900. doi: 10.1177/0149206305279602
42. Farid T, Khan A, MA J, Khattak A, Naseer Ud Din M. The impact of authentic leadership on organizational citizenship behaviors: the mediating role of affective and cognitive-based trust. *Front Psychol.* (2020) 11:1975. doi: 10.3389/fpsyg.2020.01975
43. Keyes CL, Shmotkin D, Ryff CD. Optimizing wellbeing: the empirical encounter of two traditions. *J Pers Soc Psychol.* (2002) 82:1007. doi: 10.1037/0022-3514.82.6.1007
44. Kahneman D, Diener E, Schwarz N. *Well-being: Foundations of Hedonic Psychology*. New York, NY: Russell Sage Foundation (1999).
45. Diener E, Oishi S, Lucas RE. Personality, culture, and subjective wellbeing: emotional and cognitive evaluations of life. *Annu Rev Psychol.* (2003) 54:403–25. doi: 10.1146/annurev.psych.54.101601.145056
46. Ilies R, Morgeson FP, Nahrgang JD. Authentic leadership and eudaemonic wellbeing: understanding leader–follower outcomes. *Leadership Quart.* (2005) 16:373–94. doi: 10.1016/j.leaqua.2005.03.002
47. Goldman BM, Kerns MH. The role of authenticity in healthy psychological functioning and subjective wellbeing. *Ann Am Psychother Assoc.* (2002) 5:18–20. Available online at: <https://psycnet.apa.org/record/2002-11420-003>
48. Penger S, Cerne M. Authentic leadership, employees' job satisfaction, and work engagement: a hierarchical linear modelling approach. *Econ Res Ekonomska Istraživanja.* (2014) 27:508–26. doi: 10.1080/1331677X.2014.974340
49. McMahan EA, Estes D. Hedonic versus eudaemonic conceptions of wellbeing: evidence of differential associations with self-reported wellbeing. *Soc Indic Res.* (2011) 103:93–108. doi: 10.1007/s11205-010-9698-0
50. Robertson IT, Cooper CL. Full engagement: the integration of employee engagement and psychological wellbeing. *Leadership Organiz Dev J.* (2010). doi: 10.1108/01437731011043348
51. Shimazu A, Schaufeli WB. Is workaholism good or bad for employee wellbeing? The distinctiveness of workaholism and work engagement among Japanese employees. *Industrial Health.* (2009) 47:495–502. doi: 10.2486/indhealth.47.495
52. Shimazu A, Schaufeli WB, Kubota K, Kawakami N. Do workaholism and work engagement predict employee wellbeing and performance in opposite directions? *Industrial Health.* (2012) 50:316–21. doi: 10.2486/indhealth.MS1355
53. Brunetto Y, Teo STT, Shacklock K, Farr-Wharton R. Emotional intelligence, job satisfaction, wellbeing and engagement: explaining organisational commitment and turnover intentions in policing. *Hum Resource Manag J.* (2012) 22:428–41. doi: 10.1111/j.1748-8583.2012.00198.x
54. Ibrahim NF, Al-Mansor A, Abas N, Said. Relationship between wellbeing perspectives, employee engagement and intrinsic outcomes: a literature review. *J Crit Rev.* (2020) 7:69–74. doi: 10.31838/jcr.07.12.11
55. Mehrabian A, Russell JA. *An Approach to Environmental Psychology*. Cambridge, MA: The MIT Press (1974).
56. Koon V-Y, Ho T-S. Authentic leadership and employee engagement: the role of employee wellbeing. *Hum Syst Manag.* (2021) 40:81–92. doi: 10.3233/HSM-200943
57. Chtioui R, Berraies S, Dhaou A. Perceived corporate social responsibility and knowledge sharing: mediating roles of employees' eudaemonic and hedonic wellbeing. *Soc Responsib J.* (2022). doi: 10.1108/SRJ-11-2021-0498
58. Usman M, Ghani U, Cheng J, Farid T, Iqbal S. Does participative leadership matters in employees' outcomes during COVID-19? Role of leader behavioral integrity. *Front Psychol.* (2021) 12:646442. doi: 10.3389/fpsyg.2021.646442
59. Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol.* (2003) 88:879. doi: 10.1037/0021-9010.88.5.879
60. Lowry PB, Gaskin J. Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: when to choose it and how to use it. *IEEE Transact Profess Commun.* (2014) 57:123–46. doi: 10.1109/TPC.2014.2312452
61. May DR, Gilson RL, Harter LM. The psychological conditions of meaningfulness, safety and availability and the engagement of the human spirit at work. *J Occup Organiz Psychol.* (2004) 77:11–37. doi: 10.1348/096317904322915892
62. Waterman AS, Schwartz SJ, Conti R. The implications of two conceptions of happiness (hedonic enjoyment and eudaemonia) for the understanding of intrinsic motivation. *J Happiness Stud.* (2008) 9:41–79. doi: 10.1007/s10902-006-9020-7
63. Fornell C, Lacker D. Evaluating structural equation modeling for travel behavior research. *Transport Res Part B.* (1981) 37:1–25.
64. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Publications (2013).
65. Walumbwa FO, Luthans F, Avey JB, Oke A. Retracted: authentically leading groups: the mediating role of collective psychological capital and trust. *J Organiz Behav.* (2011) 32:4–24. doi: 10.1002/job.653
66. Gardner WL, Coglisier CC, Davis KM, Dickens MP. Authentic leadership: a review of the literature and research agenda. *Leadership Quart.* (2011) 22:1120–45. doi: 10.1016/j.leaqua.2011.09.007
67. Halbesleben JR. A meta-analysis of work engagement: relationships with burnout, demands, resources, and consequences. *Work Engagement Handb Essent Theory Res.* (2010) 8:102–17.
68. Olugbade OA, Karatepe OM. Stressors, work engagement and their effects on hotel employee outcomes. *Service Industries J.* (2019) 39:279–98. doi: 10.1080/02642069.2018.1520842



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# Limited social support is associated with depression, anxiety, and insomnia in a Japanese working population

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**Background:** Lack of social support is associated with depression, anxiety, and insomnia. This study aimed to determine the source of support related to depression, anxiety, and insomnia among Japanese workers.

**Methods:** As part of a cohort study, we conducted a questionnaire survey among city government employees in Koka City, Shiga Prefecture, Japan, from September 2021 to March 2022. We used the Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), and Insomnia Severity Index (ISI) to assess depressive symptoms, anxiety symptoms, and insomnia, respectively. We used the Brief Job Stress Questionnaire (BJSQ) to assess job stressors and social support (from supervisors, colleagues, and family).

**Results:** A total of 1,852 Japanese employees (38.4% male, 45.9 ± 12.9 years) participated in the survey, with 15.5, 10.8, and 8.2% of the participants having depressive symptoms (PHQ-9 ≥ 10), anxiety symptoms (GAD-7 ≥ 10), and insomnia (ISI ≥ 15), respectively. The logistic regression analysis suggested that job stressors were associated with depressive symptoms ( $p < 0.001$ ), anxiety symptoms ( $p < 0.001$ ), and insomnia ( $p = 0.009$ ). In contrast, support from co-workers ( $p = 0.016$ ) and family members ( $p = 0.001$ ) was associated with decreased depressive symptoms. Support from family members was associated with decreased insomnia ( $p = 0.005$ ).

**Conclusion:** Social support from co-workers and family may be associated with reduced depressive symptoms, and family support may be associated with reduced insomnia in the Japanese working population.

**Clinical trial registration:** <https://clinicaltrials.gov/ct2/show/NCT03276585>.

## KEYWORDS

social support, job stress, depression, anxiety, insomnia, occupational health



## Introduction

Stress in individual workers and the work environment has been reported to be associated with chronic absenteeism, turnover, suicide, and family disruption (1–3). A previous study reported that 40% of U.S. workers rated their jobs as very or extremely stressful and that 26% were often or very often burned out or stressed by their work (4). The National Institute for Occupational Safety and Health (NIOSH) defines occupational stress as “the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker (4).” In the NIOSH model of job stress, stressful job conditions may lead to the risk of injury and illness, and individual and situational factors can modify and protect workers from risk (4).

Job stressors (exposure to stressful working conditions) may cause negative outcomes such as depression, anxiety, and insomnia (5). Depression is a major global public health problem and is projected to greatly contribute to disease burden worldwide in the coming decades (6, 7). Insomnia commonly occurs as a principal component of depression (8) and causes presenteeism (low work productivity due to being present at work, but ill or experiencing medical conditions) (9). Depression and anxiety are the two most prevalent mental disorders in the Japanese population (10, 11).

Social support is defined as a perception leading a person to believe that they are cared for and loved, esteemed, and a member of a network of mutual obligations (12). A systemic review indicated that low co-worker support and low supervisor support predicted the incidence of stress-related diseases, together with high job demands, low job control, low procedural justice, low relational justice, and a high effort-reward imbalance (13). A meta-analysis indicated that a high level of job stress, effort-reward imbalance, high demand, heavy workload, and low social support are associated with insomnia (14). Social support includes received and perceived social support. Received social support refers to the amount of support received, while perceived social support refers to its adequacy and availability (15). Research has shown that perceived social support is more closely related to mental health than received social support (16). Bidirectional associations were found between depressive and anxiety symptoms and loneliness (17). Loneliness was a stronger predictor of depressive and anxiety symptoms relative to the reverse causal direction. High loneliness may be a key risk factor for the development of future anxiety or depressive symptoms (17), thus, perceived social support not only from the workplace but also from family/friends may be important to decrease depression and anxiety levels in workplaces. According to a systemic review on depression and work-related risk factors, previous studies mainly reported support from supervisors and co-workers, but studies reporting support from family/friends were very limited (18). In another review of job stress, anxiety,

and depression, family support was not mentioned (19). In a systemic review on insomnia and job stress, three studies reported social support, one reported support from supervisors or co-workers, and two did not report the origin of support (14).

Some studies analyzed the association between depression, anxiety, and insomnia among Japanese workers (20–24). Honda et al. reported that having little conversation with co-workers and/or supervisors was a risk factor for psychological distress among Japanese workers (20). Nishitani and Sakakibara reported that insomnia was related to the psychological response of depression in Japanese male workers of a manufacturing plant (21). Toyoshima et al. reported that insomnia directly affected state anxiety among Tokyo Medical University employees (22). Deguchi et al. reported that anxious temperament and role conflict were associated with insomnia among Japanese local government employees (23). Saojyo et al. found a synergistic association of job control and social support at work with depression and insomnia among Japanese government employees (24). However, these are cross-sectional studies, and depression, anxiety, insomnia, and social support (both at work and at home) were not simultaneously analyzed.

We hypothesized that lack of social support is associated with depressive symptoms, anxiety symptoms, and insomnia in the Japanese working population. The purpose of this study was to test this hypothesis and determine the source of support related to depression, anxiety, and insomnia among cohort study (NinJaSleep Study) participants.

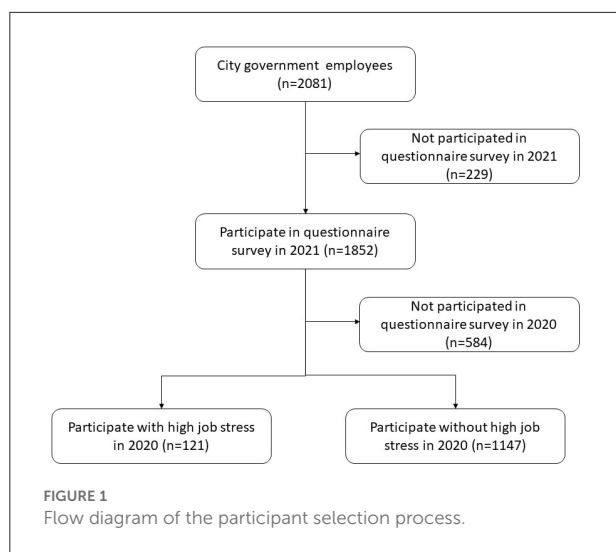
## Materials and methods

### Participants

We have performed a cohort study on sleep and mental health in a Japanese working population, named the Night in Japan Home Sleep Monitoring Study (NinJaSleep Study) (8, 25, 26). We conducted questionnaire surveys on sleep, mental health, and job stress among local government employees of Koka City, a rural city in Shiga Prefecture, Japan, which is known as the home of the ninja. Employees ( $n = 2081$ ) were recruited for the questionnaire survey, and 1,852 employees participated in the survey from September 2021 to March 2022 (Figure 1).

The Ethics Committee of the Shiga University of Medical Science approved the study protocol (R2017–111). The study was registered at UMIN-CTR (UMIN000028675, registered on 2017/8/15) and [ClinicalTrials.gov](https://www.clinicaltrials.gov) (NCT03276585, registered on 2017/9/3). Informed consent was obtained from all the participants. The datasets analyzed in this study are available from the corresponding author upon reasonable request.





## Questionnaire

Job stress was assessed using the Brief Job Stress Questionnaire (BJSQ) (16), a 57-item multidimensional job stress questionnaire evaluated on a Likert scale of 1 to 4. The BJSQ contains 17, 29, 9, and 2 items that assess job stressors, stress reactions, social support, and work/life satisfaction, respectively. Job stressors have nine subscales (job demands, job control, meaningfulness of work, work environment, suitability for work, physical burden, skill utilization, required job quality, and interpersonal relationships), with scores ranging from 17 to 68 and higher scores suggesting higher job stress levels.

“Social Support” included three subscales (supervisors, co-workers, and family), with scores ranging from 3 to 12 for each subscale and lower scores suggesting better support. “How freely can you talk with the following people?,” “How reliable are the following people when you are troubled?,” and “How well will the following people listen to you when you ask for advice on personal matters?” were asked about superiors, co-workers, and family (spouse, family, friends, etc.) on a four-point scale (1 = extremely, 2 = very much, 3 = somewhat, and 4 = not at all). The sum of the scores for superiors, co-workers, and family were separately calculated to indicate social support, with a range of 3–12 for each category. Cronbach’s alpha coefficients for job demand, job control, and social support from supervisors, coworkers, and family/friends were reported to be 0.77–0.83, 0.68–0.69, 0.79–0.89, 0.76–0.85, and 0.83–0.86, respectively (27, 28). All BJSQ scales have been proven to have acceptable or high levels of internal consistency reliability and factor-based validity (27, 29). Workers with high job stress levels were identified using the BJSQ scoring program ver. 3.5 (Ministry of Health, Labor, and Welfare, Tokyo, Japan).

The Patient Health Questionnaire-9 (PHQ-9) is a 9-item questionnaire designed to screen for depression/depressive

symptoms in clinical and research settings (30). The PHQ-9 contains items derived from the DSM-IV classification system pertaining to (1) anhedonia, (2) depressed mood, (3) trouble sleeping, (4) feeling tired, (5) change in appetite, (6) guilt or worthlessness, (7) trouble concentrating, (8) feeling slowed down or restless, and (9) suicidal thoughts; each item is scored from “0” (not at all) to “3” (nearly every day) (30). The standard cutoff score for screening to identify possible major depression/depressive symptoms is  $\geq 10$ . In previous studies, participants with a PHQ-9 score  $\geq 10$  were classified as having depression (30, 31). According to a meta-analysis comparing PHQ-9 with validated diagnostic interviews, PHQ-9 had a sensitivity and specificity of 0.85 (95% confidence interval (CI):0.79–0.89) and 0.85 (95% CI: 0.82–0.87) to detect major depression, respectively (32).

The 7-item Generalized Anxiety Disorder Scale (GAD-7) is a widely used tool for assessing the frequency of anxiety symptoms in the past 2 weeks on a scale of “0” (not at all) to “3” (nearly every day) (33). The sum of the scores ranges from 0 to 21. Participants with GAD-7 scores  $\geq 10$  were classified as having moderate anxiety symptoms, indicating a need for further diagnostic testing (34).

Insomnia severity was measured using the Japanese version of the Insomnia Severity Index (ISI) (35), a validated 7-item self-report questionnaire that assesses insomnia severity over the past 3 weeks. The total score ranges from 0 to 28, with lower scores indicating fewer insomnia symptoms. Severity levels were categorized as no insomnia (0–7 points), sub-threshold (mild) insomnia (8–14 points), moderate insomnia (15–21 points), or severe insomnia ( $\geq 22$  points) (36).

All these questionnaires were self-administered. Participants with symptoms of insomnia, anxiety, and depression were defined as having ISI  $\geq 15$ , GAD-7  $\geq 10$ , and PHQ-9  $\geq 10$ , respectively.

Demographic data, including birth year and month, height (cm), body weight (kg), sex, and history of chronic conditions such as hypertension, diabetes, and lipidemia were also collected. Age in September 2021 was calculated from birth year and month; BMI was calculated from height and body weight; and history of diagnosis (yes/no) of hypertension, diabetes, and lipidemia were asked.

## Statistical analysis

We compared proportions between groups using the  $\chi^2$  test and analyzed continuous data using the *t*-test.

We performed a logistic regression analysis with depressive symptoms (PHQ-9  $\geq 10$ ), anxiety symptoms (GAD-7  $\geq 10$ ), and insomnia (ISI  $\geq 15$ ) as dependent variables after adjusting for age, sex, BMI, job stressors, support from supervisors, support from co-workers, support from family, and high job stress. The results of high job stress analysis were assessed using the BJSQ

TABLE 1 Characteristics of participants.

Number		1852
Age	Years	45.9 ± 12.9
Sex	Male n(%)	712 (38.4)
BMI	kg/m <sup>2</sup>	22.6 ± 3.65
PHQ-9		4.85 ± 4.78
	PHQ-9 ≥ 10, %	15.5
GAD-7		3.83 ± 4.22
	GAD-7 ≥ 10, %	10.8
ISI		7.32 ± 4.77
	ISI ≥ 15, %	8.2
Hypertension	n (%)	251 (13.6)
Diabetes	n (%)	64 (3.46)
Lipidemia	n (%)	164 (8.85)
With high job stress	%	9.5

High job stress assessed with BJSQ in 2021. Mean ± standard deviation.

PHQ-9, Patient Health questionnaire-9; GAD-7, 7-item Generalized Anxiety Disorder Scale; ISI, insomnia severity index.

in the previous year for two reasons. First, since the BJSQ determines high stress based on job stressor and social support, it may be not appropriate to analyze correlations using high stress determinations from the same year. Second, after high job stress was detected, workers who experienced this were expected to be cared for by their supervisors, co-workers, and family. Thus, the high job stress in the previous year may have affected their support.

We performed a linear regression analysis as a sensitivity analysis using the PHQ-9, GAD-7, or ISI scores as dependent values. All models included job stressors, and support from supervisors, co-workers, and family.

All data were analyzed using SPSS 25.0, statistical software (SPSS Inc., Chicago, IL), and MedCalc ver. 20.106 (MedCalc Software Ltd., Ostend, Belgium). Differences were considered statistically significant at  $p < 0.05$ .

## Results

The participation rate was 89.0% (1852/2081). Among the eligible participants, 38.4 and 61.6% were males and females, respectively (Table 1). Furthermore, 15.5, 10.8, and 8.2 of the participants had depression (PHQ-9 ≥ 10), anxiety (GAD-7 ≥ 10), and insomnia (ISI ≥ 15), respectively (Table 1). Of the participants, 41.8, 52.4, 5.7, and 0.1% classified their occupation as administrative/clerical, educational/teaching, medical/health support, or temporary/contracted, respectively. Of these jobs, 2.8% were night shifts.

Job stressors and support from supervisors, co-workers, and family members were significantly associated with depressive symptoms, anxiety symptoms, and insomnia (Table 2). We further analyzed the association between depressive symptoms, anxiety symptoms, insomnia, job stressors, and social support using logistic regression analysis (Table 3). Job stressors as well as lack of support from supervisors, co-workers, and family were associated with depressive symptoms, anxiety symptoms, and insomnia in the unadjusted model. In the adjusted model, job stressors were significantly associated with depressive and anxiety symptoms and insomnia. Support from co-workers and family members was associated with depressive symptoms, and family support was associated with insomnia. For sensitivity analysis, we performed a linear regression analysis. The results of the linear regression analysis were like those of the adjusted logistic regression analysis (Table 4).

When workers had high job stress levels, job stressors decreased and support from supervisors and co-workers improved in the following year (Table 5). However, support from the family did not change. When the distribution of participants with and without high job stress levels in 2020 was analyzed separately, apparent differences were observed in job stressors, support from supervisors, and support from co-workers (Figure 2).

## Discussion

A questionnaire survey was conducted to analyze the association between social support and mental health outcomes in the Japanese working population. Higher scores on social support in the BJSQ (suggesting poorer support) were associated with higher PHQ-9, GAD-7, and ISI scores (suggesting severe symptoms of depression, anxiety, and insomnia, respectively) (Tables 2, 3). High job demand (increased workload/time pressure), low job control (minimal decision-making), and low social support have been reported to be associated with poorer employee mental health (37) and insomnia (38). Thus, social support may be important for preventing mental health problems in the working population.

The development of the BJSQ was based on the NIOSH job stress model (39). In the BJSQ, job stressors may include stressful job conditions, and social support may suggest individual and situational factors in the model (40). Job stressors were significantly associated with depression, anxiety, and insomnia in all analyses. Higher social support scores, which suggest poorer support, were associated with worse outcomes (higher PHQ-9, GAD-7, and ISI scores). These results may fit well with the NIOSH job stress model (4).

TABLE 2 Comparison between participants with and without depressive symptoms, anxiety symptoms, and insomnia.

	PHQ-9 < 10	PHQ-9 ≥ 10	<i>p</i> -value	GAD-7 < 10	GAD-7 ≥ 10	<i>p</i> -value	ISI < 15	ISI ≥ 15	<i>p</i> -value
<i>N</i> (%)	1565 (84.5)	287 (15.5)		1652 (89.2)	200 (10.8)		1701 (91.8)	151 (8.15)	
Age, years	46.6 ± 13.1	42.2 ± 11.3	<b>&lt; 0.001</b>	46.4 ± 13.1	41.7 ± 10.9	<b>&lt; 0.001</b>	46.1 ± 13.1	44.3 ± 11.2	0.062
Sex, male%	38.8	36.6	0.509	39.0	34.0	0.191	38.2	41.7	0.384
BMI, kg/m <sup>2</sup>	22.6 ± 3.59	22.6 ± 3.95	0.952	22.6 ± 3.63	22.5 ± 3.81	0.717	22.6 ± 3.61	22.7 ± 4.09	0.612
Job stressors	41.4 ± 6.83	46.7 ± 8.98	<b>&lt; 0.001</b>	41.5 ± 6.89	47.6 ± 6.70	<b>&lt; 0.001</b>	41.84 ± 6.99	46.1 ± 7.46	<b>&lt; 0.001</b>
Support from supervisors	6.89 ± 2.08	7.99 ± 2.26	<b>&lt; 0.001</b>	6.95 ± 2.08	7.94 ± 2.40	<b>&lt; 0.001</b>	6.99 ± 2.11	7.83 ± 2.37	<b>&lt; 0.001</b>
Support from co-workers	6.54 ± 1.99	7.65 ± 2.12	<b>&lt; 0.001</b>	6.61 ± 2.01	7.52 ± 2.22	<b>&lt; 0.001</b>	6.63 ± 2.01	7.57 ± 2.24	<b>&lt; 0.001</b>
Support from family	5.04 ± 1.94	6.00 ± 2.32	<b>&lt; 0.001</b>	5.14 ± 1.99	5.61 ± 2.31	<b>&lt; 0.001</b>	5.12 ± 1.99	6.03 ± 2.32	<b>&lt; 0.001</b>
Hypertension	227 (14.6)	24 (8.4)	<b>0.005</b>	234 (14.3)	17 (8.5)	<b>0.026</b>	231 (13.7)	20 (13.2)	0.876
Diabetes	62 (4.0)	2 (0.7)	<b>0.005</b>	62 (3.8)	2 (1.0)	<b>0.043</b>	62 (3.7)	2 (1.3)	0.131
Lipidemia	141 (9.1)	23 (8.1)	0.579	146 (8.9)	18 (9.0)	0.953	149 (8.8)	15 (9.9)	0.652

Job stressors and support were assessed using the brief job stress questionnaire. Mean ± standard deviation (SD).

PHQ-9, Patient Health questionnaire-9; GAD-7, 7-item Generalized Anxiety Disorder Scale; ISI, insomnia severity index. *P*-values < 0.05 were indicated in bold. Percentages for hypertension, diabetes and lipidemia represent percentages in the respective columns.

TABLE 3 Logistic regression analysis of depressive symptoms, anxiety symptoms, and insomnia.

	Unadjusted			Adjusted		
	OR	(95% CI)	<i>p</i> -value	OR	(95% CI)	<i>p</i> -value
<b>Depressive symptoms (PHQ-9 ≥ 10)</b>						
Job stressors	1.124	(1.101–1.147)	<b>&lt; 0.001</b>	0.080	(1.048–1.114)	<b>&lt; 0.001</b>
Support from supervisors	1.289	(1.210–1.374)	<b>&lt; 0.001</b>	0.997	(0.886–1.121)	0.957
Support from co-workers	1.324	(1.239–1.416)	<b>&lt; 0.001</b>	1.163	(1.029–1.315)	<b>0.016</b>
Support from family	1.246	(1.173–1.323)	<b>&lt; 0.001</b>	1.164	(1.067–1.271)	<b>0.001</b>
<b>Anxiety Symptoms (GAD-7 ≥ 10)</b>						
	OR	95% CI	<i>p</i> -value	OR	95% CI	<i>p</i> -value
Job stressors	1.141	(1.114–1.168)	<b>&lt; 0.001</b>	1.098	(1.061–1.137)	<b>&lt; 0.001</b>
Support from supervisors	1.252	(1.164–1.347)	<b>&lt; 0.001</b>	1.028	(0.904–1.170)	0.674
Support from co-workers	1.251	(1.160–1.349)	<b>&lt; 0.001</b>	1.082	(0.946–1.238)	0.249
Support from family	1.116	(1.040–1.196)	<b>0.002</b>	0.999	(0.903–1.104)	0.982
<b>Insomnia (ISI ≥ 15)</b>						
	OR	95% CI	<i>p</i> -value	OR	95% CI	<i>p</i> -value
Job stressors	1.092	(1.065–1.119)	<b>&lt; 0.001</b>	1.050	(1.012–1.088)	<b>0.009</b>
Support from supervisors	1.207	(1.113–1.310)	<b>&lt; 0.001</b>	1.031	(0.894–1.189)	0.677
Support from co-workers	1.260	(1.157–1.373)	<b>&lt; 0.001</b>	1.077	(0.927–1.251)	0.330
Support from family	1.225	(1.134–1.324)	<b>&lt; 0.001</b>	1.164	(1.047–1.293)	<b>0.005</b>

Adjusted for age, sex, BMI, job stressors, support from supervisors, support from co-workers, support from family, hypertension, diabetes, lipidemia, and high job stress in the previous year. Job stressors and support were assessed using the Brief Job Stress Questionnaire during the same year.

PHQ-9, Patient Health questionnaire-9; GAD-7, 7-item Generalized Anxiety Disorder Scale; ISI, insomnia severity index. *P*-values < 0.05 were indicated in bold.

We found that lack of support from co-workers and family was associated with depressive symptoms and that lack of support from family

was associated with insomnia. Support from closer groups seems to work protectively against depression and insomnia.

TABLE 4 Linear regression analysis of PHQ-9, GAD-7, and ISI.

PHQ-9	Total	
	$\beta$	<i>p</i> -value
Job stressors	0.346	<b>&lt;0.001</b>
Support from supervisors	0.052	0.089
Support from co-workers	0.066	<b>0.033</b>
Support from family	0.149	<b>&lt;0.001</b>
GAD-7		
	$\beta$	<i>p</i> -value
Job stressors	0.379	<b>&lt;0.001</b>
Support from supervisors	0.025	0.405
Support from co-workers	0.072	<b>0.020</b>
Support from family	0.088	<b>&lt;0.001</b>
ISI		
	$\beta$	<i>p</i> -value
Job stressors	0.253	<b>&lt;0.001</b>
Support from supervisors	0.061	0.056
Support from co-workers	0.026	0.419
Support from family	0.145	<b>&lt;0.001</b>

Job stressors and support from supervisors, co-workers, and family members were assessed using the brief job stress questionnaire.

PHQ-9, patient health questionnaire-9; GAD-7, 7-item Generalized Anxiety Disorder scale; ISI, insomnia severity index. *P*-values < 0.05 were indicated in bold.

Comparing the presence of high stress levels in the previous year with changes in workplace stressors and social support in that year and the following year, the high stress level group showed a decrease in workplace stressors and improved support from supervisors and coworkers. This suggests that the high stress level-related decisions led to an improvement in the work environment in the following year.

In the previous year's high stress level group, the degree of family support did not change between that year and the following year. On the other hand, a logistic regression analysis of the relationship between family support and outcomes such as depression and insomnia in the same year showed a significant correlation. It is possible that family support may have already been provided sufficiently when the patient was determined to be highly stressed in the previous year.

Stressors and social support were compared in histograms stratified by the presence or absence of high stress levels in the previous year. The distribution of family support showed no clear relationship with the presence or absence of high stress levels in the previous year. On the other hand, the distribution of stressors and support from supervisors

and co-workers apparently differed depending on the presence or absence of high stress levels in the previous year. These results suggest that family members may have already provided sufficient support to those in the high stress level group in the previous year and that although support from supervisors and co-workers improved after the high stress level rating, there may be still room for further improvement.

A systematic review of human resource management training programs aimed at teaching supervisors how to reduce employees' psychosocial stress reported only poor quality and inconsistent results (39). Some studies have suggested that supervisor training may be beneficial, but others have shown no improvement when compared with the absence of intervention (39). Both in-person (face-to-face) (41) and computer-based (web- and mobile-based) stress-management interventions (42) have reportedly been effective in reducing job stress levels. In this study, support from supervisors improved between the first and second years of the study but was not significantly associated with employee outcomes. However, a reduction in job stress levels was associated with decreased depression, anxiety, and insomnia. Stress-management interventions and reduction in job stressors may be more effective strategies than supervisor education to reduce workplace stress. We found that family support protects against depression and insomnia.

This study had some limitations. Our target population was government employees in a rural city in Japan. Our results cannot be generalized to other parts of Japan or other countries without further investigations. We plan to use the results of this study in our activities as occupational physicians to provide interventions aimed at reducing long-term absence and turnover through improved social support in multiple workplaces. This was a questionnaire survey, and structured interviews were not performed to diagnose depression, anxiety, insomnia, or other mental disorders. Social support was also assessed using a questionnaire asking how the participants recognized support but did not ask how much support was provided. However, perceived social support has been reported to have significantly higher effects than actual social support on promoting mental health (43).

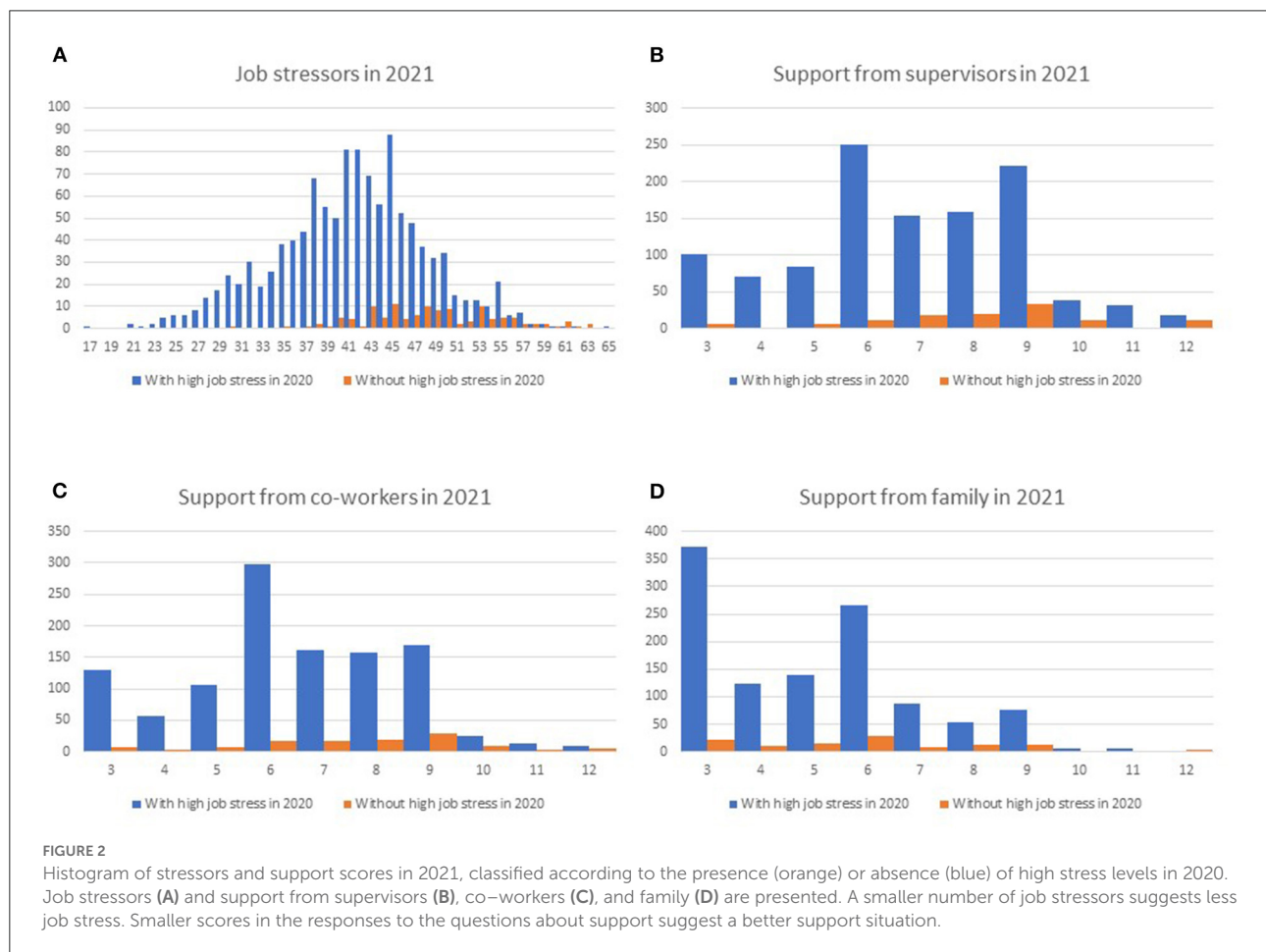
The results of this cohort study have been displayed as posters in the cafeteria of the City Hall and lectures have been held to publicize the results to the participants (25). We plan to publicize the results of the present study in the same manner. We believe that incorporating into workplace training programs the usefulness of social support from supervisors and coworkers in improving depression, anxiety disorders, and insomnia will be useful in preventing these problems in the workplace.

In conclusion, social support from co-workers and family may be associated with decreased depressive symptoms, and family support may be associated with decreased insomnia in the Japanese working population. Anxiety symptoms were mainly associated with job stressors.

TABLE 5 Changes in job stressors and social supports according to high job stress.

	With high job stress	Without high job stress	<i>p</i> -value
Delta job stressors	$-1.61 \pm 5.98$	$1.13 \pm 5.54$	<b>&lt;0.001</b>
Delta support from supervisors	$-0.47 \pm 2.23$	$0.08 \pm 2.03$	<b>0.011</b>
Delta support from co-workers	$-0.52 \pm 2.19$	$0.10 \pm 1.88$	<b>0.003</b>
Delta support from family	$0.01 \pm 1.72$	$0.18 \pm 1.70$	0.297

Mean  $\pm$  standard deviation (SD). The changes in scores from 2020 to 2021 were compared with those of high job stress in 2020. A smaller number of job stressors suggests less job stress. A smaller number of supports suggests better support. Job stressors and support from supervisors, co-workers, and family members were assessed using the brief job stress questionnaire. *P*-values < 0.05 were indicated in bold.



## Data availability statement

The datasets analyzed in this study are available from the corresponding author upon reasonable request.

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Shiga University of Medical Science. The patients/participants

provided their written informed consent to participate in this study.

## Author contributions

Conceptualization: YK and HK. Methodology, software, formal analysis, writing original draft preparation, visualization, supervision, and funding acquisition: HK. Validation: YS. Investigation: CO and HK. Resources: KN and HK. Data acquisition: the NinJaSleep Study Group. Data curation: CO.



Writing review and editing: YK, CO, YS, AU, KN, AM, and YO. Project administration: YO. All authors have read and agreed to the published version of the manuscript.

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## References

- Inoue A, Tsutsumi A, Kachi Y, Eguchi H, Shimazu A, Kawakami N. Psychosocial work environment explains the association of job Dissatisfaction with long-term sickness absence: a one-year prospect study of Japanese employees. *J Epidemiol.* (2020) 30:390–5. doi: 10.2188/jea.JE20190050
- Kachi Y, Inoue A, Eguchi H, Kawakami N, Shimazu A, Tsutsumi A. Occupational stress and the risk of turnover: a large prospective cohort study of employees in Japan. *BMC Public Health.* (2020) 20:174. doi: 10.1186/s12889-020-8289-5
- Bhui KS, Dinos S, Stansfeld SA, White PD, A. synthesis of the evidence for managing stress at work: a review of the reviews reporting on anxiety, depression, and absenteeism. *J Environ Public Health.* (2012) 2012:515874. doi: 10.1155/2012/515874
- Sauter S, Murphy L, Colligan M, Swanson N, Hurrell J Jr., Scharf F Jr., et al. *Stress at work: U.S. Department of Health and Human Services. Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.* (1999) DHHS (NIOSH) Publication No. 99-101:1-26. Available online at: <https://www.cdc.gov/niosh/docs/99-101/> (accessed May 30, 2022).
- Kato M. Final development of the brief job stress questionnaire mainly used for assessment of the individuals. In: *The Ministry of Labour Sponsored Grant for The Prevention Of Work-Related Illness.* Tokyo: Tokyo Medical University (2000). p. 126–64.
- Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* (2012) 380:2197–223. doi: 10.1016/S0140-6736(12)61690-0
- Baglioni C, Spiegelhalter K, Nissen C, Riemann D. Clinical implications of the causal relationship between insomnia and depression: how individually tailored treatment of sleeping difficulties could prevent the onset of depression. *EPMA J.* (2011) 2:287–93. doi: 10.1007/s13167-011-0079-9
- Takami M, Kadotani H, Nishikawa K, Sumi Y, Nakabayashi T, Fujii Y, et al. Quality of life, depression, and productivity of city government employees in Japan: a comparison study using the Athens insomnia scale and insomnia severity index. *Sleep Sci Pract.* (2018) 2:1–8. doi: 10.1186/s41606-018-0024-0
- Itani O, Kaneita Y, Otsuka Y, Tokiya M, Jike M, Matsumoto Y, et al. A cross-sectional epidemiological study of the relationship between sleep duration, quality, and rhythm and presenteeism in workers. *Sleep Biol Rhythms.* (2022) 20:53–63. doi: 10.1007/s41105-021-00339-4
- Kadotani T, Kadotani H, Arai H, Takami M, Ito H, Matsuo M, et al. Comparison of self-reported scales and structured interviews for the assessment of depression in an urban male working population in Japan: a cross-sectional survey. *Sleep Sci Pract.* (2017) 1:1–7. doi: 10.1186/s41606-017-0010-y
- Kawakami N, Takeshima T, Ono Y, Uda H, Hata Y, Nakane Y, et al. Twelve-month prevalence, severity, and treatment of common mental

## Conflict of interest

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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disorders in communities in Japan: preliminary finding from the world mental health Japan survey 2002–2003. *Psychiatry Clin Neurosci.* (2005) 59:441–52. doi: 10.1111/j.1440-1819.2005.01397.x

12. Cobb S. Social support as a moderator of life stress. *Psychosom Med.* (1976) 38:300–14. doi: 10.1097/00006842-197609000-00003

13. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med (Lond).* (2010) 60:277–86. doi: 10.1093/occmed/kqq081

14. Yang B, Wang Y, Cui F, Huang T, Sheng P, Shi T, et al. Association between insomnia and job stress: a meta-analysis. *Sleep Breath.* (2018) 22:1221–31. doi: 10.1007/s11325-018-1682-y

15. Haber MG, Cohen JL, Lucas T, Baltes BB. The relationship between self-reported received and perceived social support: a meta-analytic review. *Am J Community Psychol.* (2007) 39:133–44. doi: 10.1007/s10464-007-9100-9

16. Eagle DE, Hybels CF, Proeschold-Bell RJ. Perceived social support, received social support, and depression among clergy. *J Soc Pers Relatsh.* (2019) 36:2055–73. doi: 10.1177/0265407518776134

17. McDowell CP, Meyer JD, Russell DW, Sue Brower C, Lansing J, Herring MP. Bidirectional associations between depressive and anxiety symptoms and loneliness during the COVID-19 pandemic: dynamic panel models with fixed effects. *Front Psychiatry.* (2021) 12:738892. doi: 10.3389/fpsy.2021.738892

18. Saade S, Parent-Lamarche A, Bazarbachi Z, Ezzeddine R, Ariss R. Depressive symptoms in helping professions: a systematic review of prevalence rates and work-related risk factors. *Int Arch Occup Environ Health.* (2022) 95:67–116. doi: 10.1007/s00420-021-01783-y

19. Bhui KS, Dinis S, Stansfeld SA, White PD. A synthesis of the evidence for managing stress at work: a review of the reviews reporting on anxiety, depression, and absenteeism. *J Environ Public Health.* (2012) 2012:515874.

20. Honda A, Date Y, Abe Y, Aoyagi K, Honda S. Work-related stress, caregiver role, and depressive symptoms among Japanese workers. *Saf Health Work.* (2014) 5:7–12. doi: 10.1016/j.shaw.2013.11.002

21. Nishitani N, Sakakibara H. Job stress factors, stress response, and social support in association with insomnia of Japanese male workers. *Ind Health.* (2010) 48:178–84. doi: 10.2486/indhealth.48.178

22. Toyoshima K, Inoue T, Shimura A, Uchida Y, Masuya J, Fujimura Y, et al. Mediating roles of cognitive complaints on relationships between insomnia, state anxiety, and presenteeism in Japanese adult workers. *Int J Environ Res Public Health.* (2021) 18:4516. doi: 10.3390/ijerph18094516

23. Deguchi Y, Iwasaki S, Ishimoto H, Ogawa K, Fukuda Y, Nitta T, et al. Relationships between temperaments, occupational stress, and insomnia among Japanese workers. *PLoS ONE.* (2017) 12:e0175346. doi: 10.1371/journal.pone.0175346

24. Saijo Y, Chiba S, Yoshioka E, Nakagi Y, Ito T, Kitaoka-Higashiguchi K, et al. Synergistic interaction between job control and social support at work on depression, burnout, and insomnia among Japanese civil servants. *Int Arch Occup Environ Health.* (2015) 88:143–52. doi: 10.1007/s00420-014-0945-6

25. Omichi C, Kadotani H, Sumi Y, Ubara A, Nishikawa K, Matsuda A, et al. Prolonged sleep latency and reduced REM latency are associated with depressive symptoms in a Japanese working population. *Int J Environ Res Public Health.* (2022) 19:2112. doi: 10.3390/ijerph19042112

26. Fujiwara K, Goto Y, Sumi Y, Kano M, Kadotani H. Sleep-EEG-based parameters for discriminating fatigue and sleepiness. *Front Sleep.* (2022) 1:975415. doi: 10.3389/frsle.2022.975415

27. Shimomitsu T, Haratani T, Nakamura K, Kawakami N, Hayashi T, Hiro H, et al. The final development of the brief job stress questionnaire mainly used for assessment of the individuals. In: Kato M, editor. *The Ministry of Labour Sponsored Grant for the Prevention of Work-Related Illness: the 1999 report.* Tokyo: Tokyo Medical College (2000). p. 126–64.

28. Otsuka T, Kawada T, Ibuki C, Kusama Y. Relationship between job strain and radial arterial wave reflection in middle-aged male workers. *Prev Med.* (2009) 49:260–4. doi: 10.1016/j.ypmed.2009.07.005

29. Ito S, Fujita S, Matumoto K, Kitazawa T, Seto K, Hasegawa Y. Factorial structure for the Brief Job Stress Questionnaire in Japanese health care workers. *J Med Soc Toho Univ* (2013) 60(1):15–23. doi:10.14994/tohoigaku.60.15

30. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* (2001) 16:606–13. doi: 10.1046/j.1525-1497.2001.016009606.x

31. Gilbody S, Richards D, Brealey S, Hewitt C. Screening for depression in medical settings with the patient health questionnaire (PHQ): a diagnostic meta-analysis. *J Gen Intern Med.* (2007) 22:1596–602. doi: 10.1007/s11606-007-0333-y

32. Levis B, Benedetti A, Thombs BD. DEPRESSION Screening Data (DEPRESSD) Collaboration. Accuracy of patient health Questionnaire-9 (PHQ-9) for screening to detect major depression: individual participant data meta-analysis. *BMJ.* (2019) 365:11476. doi: 10.1136/bmj.11476

33. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* (2006) 166:1092–7. doi: 10.1001/archinte.166.10.1092

34. Plummer F, Manea L, Trepel D, McMillan D. Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic metaanalysis. *Gen Hosp Psychiatry.* (2016) 39:24–31. doi: 10.1016/j.genhosppsych.2015.11.005

35. Munezawa T, Inoue Y, Morin CM, Nedate K. Development of the Japanese version of the Insomnia Severity Index (ISI-J). *Jpn J Psychiatr Treat.* (2009) 24:219–25.

36. Bastien CH, Vallières A, Morin CM. Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Med.* (2001) 2:297–307. doi: 10.1016/S1389-9457(00)00065-4

37. Harvey SB, Modini M, Joyce S, Milligan-Saville JS, Tan L, Mykletun A, et al. Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occup Environ Med.* (2017) 74:301–10. doi: 10.1136/oemed-2016-104015

38. Portela LF, Kröning Luna CK, Rotenberg L, Silva-Costa A, Toivanen S, Araújo T, et al. Job strain and self-reported insomnia symptoms among nurses: what about the influence of emotional demands and social support? *BioMed Res Int.* (2015) 2015:820610. doi: 10.1155/2015/820610

39. Kuehnl A, Seubert C, Rehfuess E, von Elm E, Nowak D, Glaser J. Human resource management training of supervisors for improving health and well-being of employees. *Cochrane Database Syst Rev.* (2019) 9:CD010905. doi: 10.1002/14651858.CD010905.pub2

40. Ministry of Health, Labour and Welfare, Labour Standards Bureau, Health and Safety Department. *Stress Check System Implementation Manual Based on the Occupational Health and Safety Law.* (2015). Available online at: <https://www.mhlw.go.jp/content/000533925.pdf> (accessed May 30, 2022).

41. Ruotsalainen JH, Verbeek JH, Mariné A, Serra C. Preventing occupational stress in healthcare workers. *Cochrane Database Syst Rev.* (2015) 13:CD002892. doi: 10.1002/14651858.CD002892.pub5

42. Phillips EA, Gordeev VS, Schreyögg J. Effectiveness of occupational e-mental health interventions: a systematic review and meta-analysis of randomized controlled trials. *Scand J Work Environ Health.* (2019) 45:560–76. doi: 10.5271/sjweh.3839

43. Prati G, Pietrantonio L. The relation of perceived and received social support to mental health among first responders: a meta-analytic review. *J Community Psychol.* (2010) 38:403–17. doi: 10.1002/jcop.20371



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# Association between nocturnal sleep duration and the risk of hyperuricemia among Chinese government employees: A cross-sectional study

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**Objectives:** Evidence has shown that nocturnal sleep duration is associated with the risk of hyperuricemia, yet the findings are inconsistent. Thus, we aimed at exploring the association between nocturnal sleep duration and the risk of hyperuricemia in Chinese government employees.

**Methods:** A total of 10,321 government employees aged 20–60 years were collected from the Cohort Study on Chronic Diseases among Government Employees in Hunan Province, China. Sleep duration was self-reported. And serum uric acid levels  $>420 \mu\text{mol/L}$  in men and  $>360 \mu\text{mol/L}$  in women were considered hyperuricemia. The association between nocturnal sleep duration and hyperuricemia risk was examined utilizing multivariate logistic regression models. To further examine the connection between nocturnal sleep duration and serum uric acid levels, multiple linear regression analyses were utilized.

**Results:** The prevalence of hyperuricemia was 17.2%. The results of logistic regression demonstrated that, in contrast to participants whose sleep duration was 7–8 h, those who slept for  $<7$  h had an elevated risk of hyperuricemia ( $\text{OR} = 1.343$ , 95%CI: 1.126, 1.601). Further stratified analysis revealed that this association was still observed in those without obesity ( $\text{OR} = 1.365$ ; 95%CI: 1.127, 1.655), hypertension ( $\text{OR} = 1.290$ , 95%CI: 1.054, 1.578), or diabetes mellitus ( $\text{OR} = 1.361$ , 95%CI: 1.136, 1.631). Multiple linear regression showed that shorter sleep duration ( $< 7$  h) was positively correlated with serum uric acid levels. In comparison to individuals who slept for 7–8 h, those with sleep duration of fewer than 7 h had serum uric acid levels that were  $7.231 \mu\text{mol/L}$  (95% CI: 2.875, 11.588) higher.

**Conclusion:** Short nocturnal sleep duration ( $< 7$  h) was associated with a higher risk of hyperuricemia, especially in participants without obesity, hypertension, or diabetes mellitus. Besides, short nocturnal sleep duration was related to greater uric acid levels.

## KEYWORDS

nocturnal sleep duration, hyperuricemia, serum uric acid levels, association, government employees

## Introduction

Serum uric acid is the final metabolic product of purine (1). Hyperuricemia is a disease marked by unusually high serum uric acid levels (2), which can cause several diseases linked to crystal deposits, including uric acid nephropathy, gout, and urolithiasis (3). Many epidemiological studies have pointed out that hyperuricemia is intimately linked to the development of cardiovascular diseases (4), diabetes mellitus (DM) (5), hypertension (6), and dyslipidemia (7). It is one of the most common metabolic disorders in modern times with a heavy health and economic burden. The prevalence of hyperuricemia was 14.6% in the United States in 2015–2016 (8) and 16.6% in South Australia in 2008–2010 (9). In China, the prevalence of hyperuricemia was 11.1% in 2015–2016 and 14.0% in 2018–2019 (10), with an increasing trend. Therefore, preventing and managing hyperuricemia is an important public health issue.

The Health Ecology model (HEM) emphasizes that individual and population health is the outcome of the interaction among individual elements, material, and social environment. From the inside to the outside, this model has five levels: personal features, behavioral characteristics, interpersonal networks, living and working situations, and policy environment (11). Sleep, which is located in the second layer of the model, may have an impact on health. When we sleep, our body undergoes important metabolic regulation and hormone secretion, which play a vital role in maintaining a healthy balanced state (12). Both too little and too much sleep has been linked to obesity (13), hypertension (14), cardiovascular disease (13), DM (15), non-alcoholic liver disease (16), and dyslipidemia (17). Sleep deprivation activates proteolytic pathways, leading to an increase in byproducts of protein breakdown, such as purines, affecting the balance between uric acid synthesis, and degradation (18). Furthermore, sleep affects serum uric acid levels by regulating catecholamines, and cortisol levels (19). Therefore, we postulated that there might be a relationship between nocturnal sleep duration and hyperuricemia.

The relationship between sleep duration and hyperuricemia has been explored in various earlier research, but the findings remain contradictory. A study using the China Health and Nutrition Survey (CHNS) database found that individuals who slept for shorter periods of time had a higher risk of hyperuricemia (20). Results of the Kailuan cohort study revealed that the incidence of hyperuricemia was lower in long sleepers (21). In contrast, the correlation between sleep duration and hyperuricemia risk was insignificant in the Chinese Multi-Ethnic Cohort (CMEC) in the Yunnan region (22) and the National Health and Nutrition Examination Survey (NHANES) (23). A recent study reported that sleep duration was negatively correlated with serum uric acid levels

(24), and another study with Korean women demonstrated a U-shaped association between sleep duration and serum uric acid levels (25). These associations may vary by race, gender, age, etc.

Government employees have the characteristics of long working h and lack of physical activity, so they are more likely to suffer from diseases than ordinary people (26, 27). Moreover, occupational staff have poorer sleep quality and shorter sleep duration (28). So far, there is no evidence on the association of nocturnal sleep duration with the risk of hyperuricemia and serum uric acid levels among Chinese government employees. In attempt to close this knowledge gap, we analyzed the baseline data of the Cohort Study on Chronic Diseases among Government Employees in Hunan Province, China, designed to look into any connections between nocturnal sleep duration, the risk of hyperuricemia, and serum uric acid levels among Chinese government employees.

## Materials and methods

### Study participants

The current study is based on data from the baseline survey of the Cohort Study on Chronic Diseases among Government Employees in Hunan Province, China, between 2018 and 2019. In China, government employees mainly refer to those who perform their public duties in a government department, state-owned company, or public institution in accordance with the law (such as civil servants, employees of public schools, or public hospitals) (29). Five cities in the Hunan Province of China (Changsha, Huaihua, Zhuzhou, Xiangtan, and Changde) were selected as the study sites. These cities were chosen based on the degree of participant collaboration, local infrastructures, and local economic development. Government employees from these cities were continuously invited to take part in our study from January 2018 to December 2019. We adopted the following inclusion criteria: (1) age 20–60 on the investigation day; (2) employees of the investigation institution; (3) without any cognitive impairment, being able to read and communicate normally; (4) those who completed the questionnaire and underwent physical examination; (5) those who voluntarily participated and signed the informed consent form. In five cities, a total of 30 departments were enlisted for the study. These departments included government agencies (860 employees), state-owned enterprises (1,818 employees), public institution (7,643 employees). 10,321 employees in total were recruited after filling out questionnaires. The work presented in this paper was approved by the Ethics Committee of the Xiangya School of Public Health, Central South University.

## Assessment of nocturnal sleep duration

Sleep duration was measured by using the following question “During the past month, when did you usually go to bed and wake up?” It was calculated as the time difference between waking up and going to bed normally. According to previous studies (30), sleep duration was divided into five groups: < 7, 7–8, 8–9, 9–10, and  $\geq 10$  h in our study. And sleep duration of 7–8 h was set as a reference. The use of hypnotics was divided into use and non-use over the past month. Moreover, this study used subjective sleep quality (including very good, fair, poor, and very bad) to evaluate participants’ sleep quality.

## Definition of hyperuricemia

Following a minimum 12-hour overnight fast, blood samples were obtained from the antecubital vein of individuals for basic biochemical assays, which were drawn from 07:30 to 10:00 in the morning, and stored in a  $-20^{\circ}\text{C}$  refrigerator until testing. Serum uric acid levels were measured by Hitachi 7,600–110 chemical autoanalyzer (Tokyo, Japan) with the use of enzyme colorimetry. Serum uric acid levels  $> 420\ \mu\text{mol/L}$  for men and  $> 360\ \mu\text{mol/L}$  for women were considered to have hyperuricemia (31).

## Covariates

The potential covariates in this study included participants’ sociodemographic factors, occupational factors, lifestyle habits, mood symptoms, dietary habits, disease histories, and family histories, which were collected using the self-reported digital questionnaire.

Sociodemographic factors included gender, age, education level, marital status, and annual household income. The education level was divided into high school or below, university, and postgraduate or above. Marital status was categorized as unmarried, married/cohabitating, and divorced/widowed. Annual household income was classified into  $\leq 100,000$  RMB, 100,000–200,000 RMB, and  $> 200,000$  RMB.

Occupational factors included work intensity, daily sedentary time, and position levels. Work intensity was divided into brain work and physical work. The daily sedentary time was classified into four groups:  $< 2$  h, 2–4 h, 4–6 h, and  $> 6$  h. Position levels were categorized into three levels: junior, middle, and senior or higher.

Several lifestyle habits were examined, including smoking, drinking, physical exercise participation, and napping. The participants’ smoking habits were classified into current smokers and non-smokers; the latter included those who had smoked in the past and those who had never smoked. Participants

who had smoked one or more cigarettes per day for the past year were considered current smokers. Drinking habits were categorized into two categories: current drinkers and non-drinkers (including those who had previously drunk and those who had never drunk). Those who consumed alcohol at least once per week in the past year were considered current drinkers, including beer, liquor, or other alcoholic beverages. Physical exercise was divided into two groups: participation and non-participation; those who exercised on average once a week or more over the previous year were considered physically active. The following questions were posed to participants to assess daytime napping: “Have you taken naps in the past six months?” If the answer is “Yes”, ask to report the average specific nap time, otherwise, mark it as 0.

Mood symptoms were represented by depression and anxiety conditions. The Patient Health Questionnaire-2 (PHQ-2) was utilized to determine whether participants had developed depressive symptoms within the previous 2 weeks. And the Generalized Anxiety Disorder-2 (GAD-2) was used to measure whether participants had experienced anxiety symptoms in the past 2 weeks. Participants were regarded as having mood symptoms if their PHQ-2 and/or GAD-2 scores met or exceeded 3, or they self-reported having depression or anxiety (32, 33).

The dietary habits included irregular meal, midnight snacks, and diet frequency. Regular meals were defined as three meals on time almost daily in the last 6 months. Eating late-night snacks more than once a week in the last 6 months was defined as eating midnight snacks. Diet frequency included weekly frequency of eating staple food, meat, poultry, seafood, eggs, dairy products, vegetables, beans, fruits, and desserts, which was divided into five categories: eating every day, 4–6 days a week, 1–3 days a week, less than once a week/rarely/never.

Additionally, hypertension (Yes or No), obesity (Yes or No), dyslipidemia status (Yes or No), and DM (Yes or No) were objectively detected and evaluated in accordance with previous studies (34). Height and weight were measured using a high-definition liquid crystal intelligent body scale. Participants were asked to wear light clothes, and remove shoes and hats before measurement. This was measured twice to obtain an average value. Weight (kg) divided by height squared ( $\text{m}^2$ ) was used to establish the body mass index (BMI), and a BMI  $\geq 28.0\ \text{kg/m}^2$  was considered obesity (35). Hypertension was defined as either systolic blood pressure (SBP)  $\geq 140\ \text{mmHg}$  or diastolic blood pressure (DBP)  $\geq 90\ \text{mmHg}$ , or both self-reporting a diagnosis of hypertension, or taking medication for blood pressure (36). Fasting blood glucose (FPG)  $\geq 7.0\ \text{mmol/L}$ , self-reporting a diabetes diagnosis, or taking antidiabetic drugs were all considered to be indicators of DM (37). Total cholesterol (TC) levels  $\geq 6.2\ \text{mmol/L}$ , or triglyceride (TG) levels  $\geq 2.3\ \text{mmol/L}$ , or low-density lipoprotein cholesterol (LDL-C) levels  $\geq 4.1\ \text{mmol/L}$ , or high-density lipoprotein cholesterol (HDL-C) levels  $< 1.0\ \text{mmol/L}$ , or a history of dyslipidemia, or taking anti-dyslipidemia medications were all considered to be



dyslipidemia (38). Furthermore, family history was considered if either grandparents, parents, or siblings had hypertension, DM, obesity, hyperlipidemia (dyslipidemia), or gout.

## Statistical analyses

All analyses were conducted using IBM SPSS 25.0 and R 3.5.0. Covariate characteristics were expressed as mean  $\pm$  standard deviation ( $M \pm SD$ ) (the quantitative data) or proportion (%) (the qualitative data). To analyze the distinctions in characteristics across groups, student *t*-tests were employed for numerical variables and chi-square was utilized for categorical data. Multivariate logistic regression analyses were applied to assess the association between nocturnal sleep duration and the risk of hyperuricemia. Additionally, multiple linear regression analyses were utilized to look into the relationship between nocturnal sleep duration and serum uric acid levels. We constructed three models: model 1 was only adjusted for gender and age; model 2 was additionally adjusted by marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, eating midnight snacks, using hypnotics, nap duration on the basis of model 1; model 3 was additionally adjusted for obesity, DM, hypertension, and dyslipidemia on the basis of model 2. Furthermore, to visually explore the dose-response relationship between nocturnal sleep duration and hyperuricemia risk, a restricted cubic spline (RCS) function was utilized, with five knots positioned at the 5%, 27.5%, 50%, 72.5%, and 95% percentiles of sleep duration (39). In order to assess the association in various individuals, studies were conducted across subgroups stratified by gender, age, obesity, dyslipidemia, hypertension, and DM, based on the findings of logistic regression analysis.

Two approaches were carried out in sensitivity analyses to assess the reliability of the findings. First, family history (including a family history of DM, hypertension, obesity, hyperlipidemia /dyslipidemia, and gout) and diet frequency, were further controlled in addition to the adjusted factors in the logistic regression models. Additionally, we corrected for potential confounders using the propensity score regression adjustment. In this method, propensity scores were computed using a logistic regression model with whether the nocturnal sleep duration was  $>7$  h as the dichotomous dependent variable and the other covariates (gender, age, marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, eating midnight snacks, using hypnotics, nap duration, obesity, hypertension, DM, and dyslipidemia) as the independent variable. A *P*-value  $<0.05$  was regarded to be statistically significant.

## Results

### Characteristics of participants

A total of 10,321 people were included in the present study, of which 60.7% were women, the mean age ( $\pm$  SD) was 36.8 ( $\pm$  9.6) years, the mean nocturnal sleep duration ( $\pm$  SD) was 7.70 ( $\pm$  0.92) h and 17.2% had hyperuricemia (1,775/10,321). Table 1 indicates the study population's characteristics based on whether or not they had hyperuricemia. Compared with participants without hyperuricemia, those with hyperuricemia tended to be older and comprised a greater proportion of men, married, and brain work. Besides, participants with hyperuricemia were more likely to be sedentary, tended to smoke, and drink, had higher position levels, engaged in less physical exercise, had irregular eating habits, and used fewer hypnotics. They also had longer daytime naps, shorter nighttime sleep durations, and a greater prevalence of dyslipidemia, hypertension, obesity, and DM compared to participants without hyperuricemia ( $P < 0.05$ ). The baseline characteristics of participants categorized by nocturnal sleep duration are shown in Supplementary Table 1.

### Association between nocturnal sleep duration and hyperuricemia risk

Figure 1 presents the association between nocturnal sleep duration and the risk of hyperuricemia. After adjusting for sociodemographic factors, occupational factors, lifestyle habits, and chronic diseases, participants who slept for  $<7$  h had a 1.343 (95% CI: 1.126, 1.601) higher risk of hyperuricemia as compared to those whose sleep duration was 7–8 h. A higher risk of hyperuricemia was also seen in people with a sleep duration of  $\geq 10$  h (OR = 1.144, 95% CI: 0.762, 1.716), albeit this difference was not statistically significant. When fewer covariates were used, the findings remained similar (Supplementary Figure 1). Besides, the sensitivity analysis revealed that shorter sleep duration ( $< 7$  h) was linked with hyperuricemia before (OR = 1.343, 95% CI: 1.126, 1.601) and after (OR = 1.317, 95% CI: 1.103, 1.573) additional adjustment for family history and dietary frequency. After adjusting confounding factors using the propensity score, the OR of hyperuricemia in the sleep duration of  $<7$  h group was 1.318 (95% CI: 1.131, 1.537), compared to  $\geq 7$  h group (Supplementary Table 2).

Figure 2 displays the dose-response relationship between nocturnal sleep duration and hyperuricemia risk after accounting for various factors. The restricted cubic spline indicated that the non-linearity was insignificant ( $P = 0.1207 > 0.05$ ). But the curve has a tendency: with an increase of sleep duration, the OR value of hyperuricemia initially decreased and reached the lowest value when the sleep

TABLE 1 Characteristics of participants based on hyperuricemia.

Characteristics	Non-hyperuricemia ( <i>n</i> = 8,546)	Hyperuricemia ( <i>n</i> = 1,775)	<i>P</i> -value
Age (year, mean $\pm$ SD)	36.60 $\pm$ 9.48	38.18 $\pm$ 10.01	<0.001
<b>Gender (<i>n</i>, %)</b>			<0.001
Men	2,811 (32.9)	1,240 (69.9)	
Women	5,735 (67.1)	535 (30.1)	
<b>Education level (<i>n</i>, %)</b>			0.193
High school or below	440 (5.1)	109 (6.1)	
University	5,467 (64.0)	1,110 (62.5)	
Postgraduate or above	2,639 (30.9)	556 (31.3)	
<b>Marital status (<i>n</i>, %)</b>			0.020
Unmarried	1,833 (21.4)	328 (18.5)	
Married/cohabitating	6,512 (76.2)	1,404 (79.1)	
Divorced/widowed	201 (2.4)	43 (2.4)	
<b>Annual household income (yuan, <i>n</i>, %)</b>			0.287
$\leq$ 100,000	3,609 (42.2)	761 (42.9)	
100,000–200,000	3,123 (36.5)	616 (34.7)	
>200,000	1,814 (21.2)	398 (22.4)	
<b>Work intensity (<i>n</i>, %)</b>			<0.001
Brain work	4,752 (55.6)	1,139 (64.2)	
Physical work	3,794 (44.4)	636 (35.8)	
<b>Sedentary time (<i>n</i>, %)</b>			0.012
<2 h	2,274 (26.6)	438 (24.7)	
2–4 h	3,880 (45.4)	773 (43.5)	
4–6 h	1,567 (18.3)	377 (21.2)	
> 6 h	825 (9.7)	187 (10.5)	
<b>Position levels (<i>n</i>, %)</b>			<0.001
Junior	4,110 (48.1)	786 (44.3)	
Middle	2,967 (34.7)	620 (34.9)	
Senior or higher	1,469 (17.2)	369 (20.8)	
<b>Participating in physical exercise (<i>n</i>, %)</b>	4,002 (46.8)	886 (49.9)	0.018
<b>Current smoking (<i>n</i>, %)</b>	902 (10.6)	392 (22.1)	<0.001
<b>Current drinking (<i>n</i>, %)</b>	709 (8.3)	352 (19.8)	<0.001
<b>Having mood symptoms (<i>n</i>, %)</b>	516 (6.0)	99 (5.6)	0.456
<b>Irregular meal habits (<i>n</i>, %)</b>	3,839 (44.9)	739 (41.6)	0.011
<b>Midnight snacks (<i>n</i>, %)</b>	262 (3.1)	70 (3.9)	0.056
<b>Using hypnotics (<i>n</i>, %)</b>	526 (6.2)	84 (4.7)	0.021
<b>Obesity (<i>n</i>, %)</b>	897 (10.5)	324 (18.3)	<0.001
<b>Hypertension (<i>n</i>, %)</b>	1,276 (14.9)	443 (25.0)	<0.001
<b>Diabetes mellitus (<i>n</i>, %)</b>	243 (2.8)	92 (5.2)	<0.001
<b>Dyslipidemia (<i>n</i>, %)</b>	1,518 (17.8)	823 (46.4)	<0.001

(Continued)

TABLE 1 (Continued)

Characteristics	Non-hyperuricemia ( <i>n</i> = 8,546)	Hyperuricemia ( <i>n</i> = 1,775)	<i>P</i> -value
<b>Sleep quality (<i>n</i>, %)</b>			0.033
Very good	3,772 (44.1)	821 (46.3)	
Fair	3,788 (44.3)	773 (43.5)	
Poor	939 (11.0)	179 (10.1)	
Very bad	47 (0.5)	2 (0.1)	
<b>Sleep duration (h/night)</b>			<0.001
<7	913 (10.7)	247 (13.9)	
7–8	3,537 (41.4)	742 (41.8)	
8–9	3,054 (35.7)	608 (34.3)	
9–10	856 (10.0)	146 (8.2)	
$\geq$ 10	186 (2.2)	32 (1.8)	
<b>Daytime napping (min, <i>M</i> <math>\pm</math> SD)</b>	28.58 $\pm$ 27.50	31.46 $\pm$ 28.14	<0.001

There were two types of data presented: mean (standard deviation) or number (percentage). In order to calculate a *P*-value, *t*-tests are used for continuous variables, and chi-square tests for categorical variables. M, mean; SD, standard deviation.

duration was about 8.5 h, and then appeared an upward tendency. The same trend was also observed in women (with a similar trough of around 8.5 h), but not in men (Supplementary Figure 2).

## Nocturnal sleep duration and hyperuricemia risk in subgroups

Figure 3 displays the findings for subgroups stratified by gender, age, and chronic conditions (hypertension, dyslipidemia, DM, and obesity) on the relationships between nocturnal sleep duration and hyperuricemia. Short nocturnal sleep duration (< 7 h) was linked with a higher risk of hyperuricemia in men (OR = 1.265, 95% CI: 1.012, 1.582) and in women (OR = 1.390, 95% CI: 1.041, 1.855). Besides, the association was also observed in participants aged < 45 years (OR = 1.350, 95% CI: 1.093, 1.667), those without obesity (OR = 1.365, 95% CI: 1.127, 1.655), hypertension (OR = 1.290, 95% CI: 1.054, 1.578) and DM (OR = 1.361, 95% CI: 1.136, 1.631). Regardless of whether the individuals had dyslipidemia, it was discovered that short nocturnal sleep duration raised the risk of hyperuricemia, and the association seemed to be more pronounced in those with dyslipidemia (OR = 1.442, 95% CI: 1.085, 1.916). There was no interaction between nocturnal sleep duration and gender, age, hypertension, dyslipidemia, DM, or obesity (*P* > 0.05 for interaction).



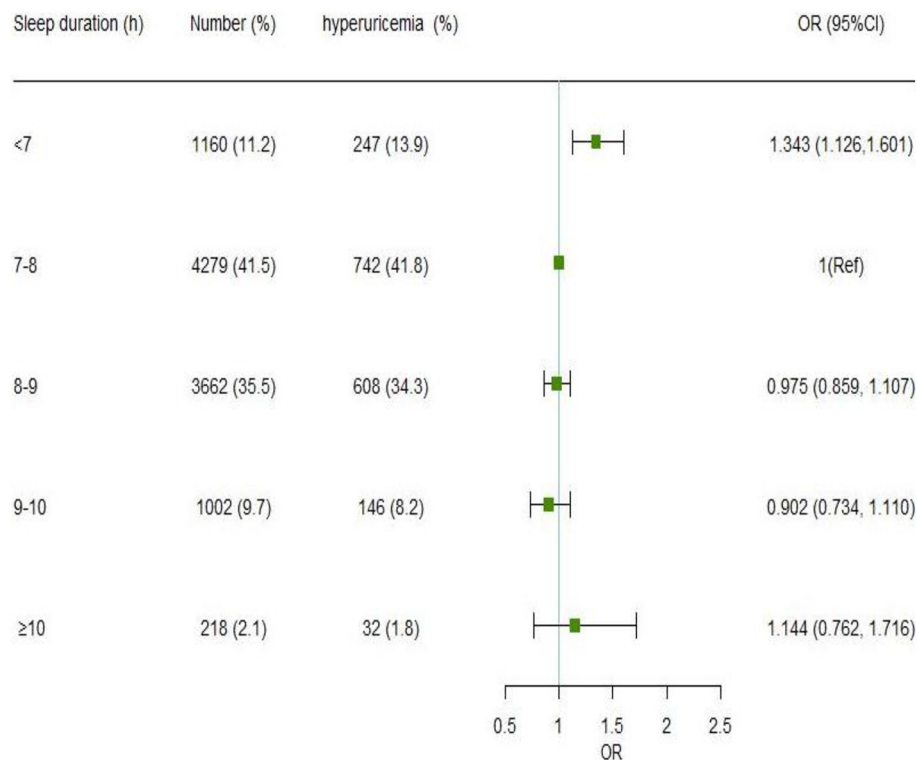


FIGURE 1

Association of nocturnal sleep duration with hyperuricemia by the logistic regression model. Model was adjusted for gender, age, marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, midnight snacks, using hypnotics, nap duration, obesity, DM, hypertension, and dyslipidemia. The odds ratio point estimates are shown as small squares, while the 95% CIs are shown as horizontal lines. CI is for confidence interval; Ref stands for reference.

## Relationship between nocturnal sleep duration and serum uric acid levels

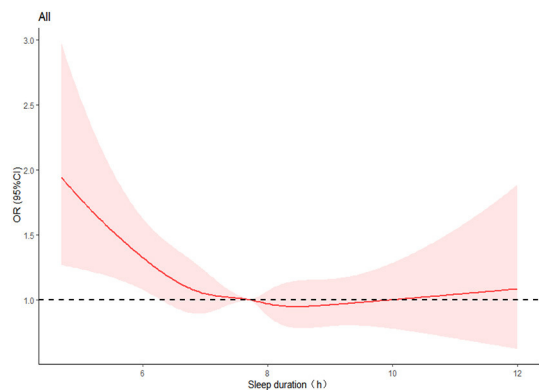
The association between nocturnal sleep duration and serum uric acid levels was investigated using multiple linear regression analysis (Table 2). The results indicated that after adjusting for multiple variables, participants whose sleep duration was <7 h had 7.231  $\mu\text{mol/L}$  higher serum uric acid levels (95% CI: 2.875, 11.588) compared to those with a sleep duration of 7–8 h. The results of the sensitivity analysis indicated after additional adjustment for family history and dietary frequency, higher uric acid levels were linked to short sleep duration (< 7 h) ( $\beta = 6.707$ , 95% CI: 2.347, 11.067). After adjusting for confounding factors using the propensity score, the results did not change substantially ( $\beta = 8.343$ , 95% CI: 2.858, 13.828) (Supplementary Table 3).

## Discussion

The findings of this study demonstrated that insufficient sleep duration (< 7 h) was linked to a higher risk of

hyperuricemia, and raised serum uric acid levels. Additionally, subgroup analysis revealed that a significant association between short nocturnal sleep duration and hyperuricemia still existed among participants without obesity, hypertension, or DM, which offers knowledge about protecting vulnerable people and screening high-risk populations. In all, our research implied that proper sleep extension might be a possible public health measure to lower the risk of hyperuricemia.

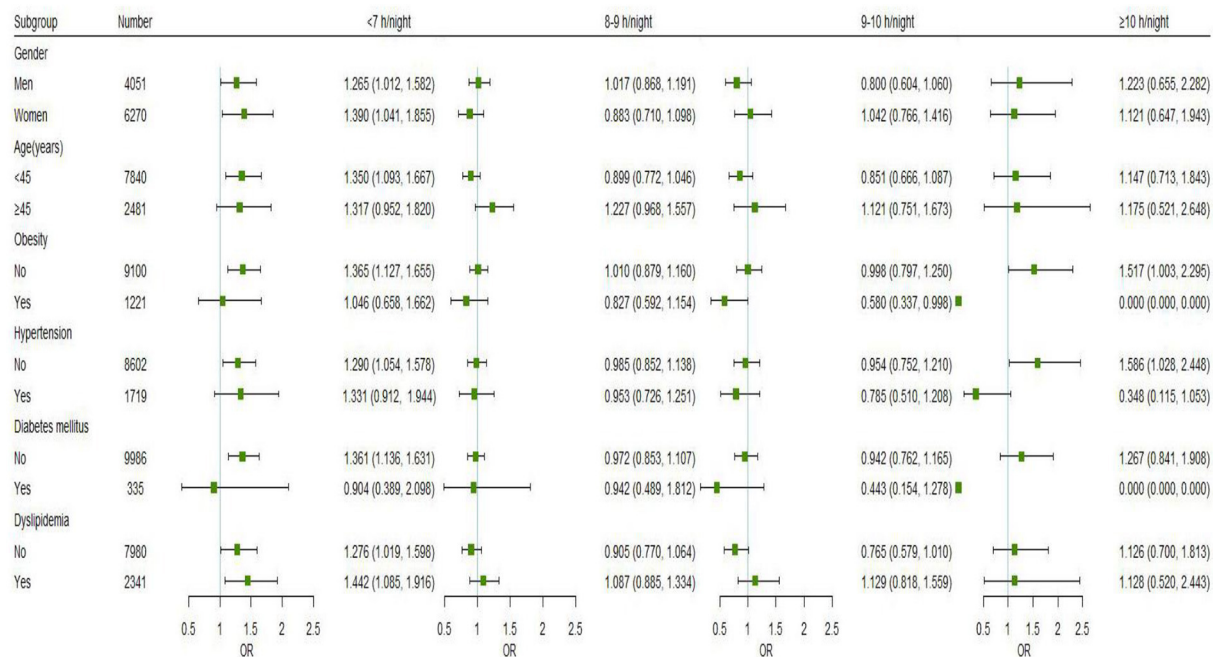
Adequate sleep can eliminate fatigue and improve body immunity, which is beneficial to health. Previous studies have proven that short sleep duration was linked to a variety of chronic conditions (17, 37, 40). Li et al. (36) and Fernandez-Mendoza et al. (41) demonstrated that hypertension risk increased when people slept for shorter periods. Liu et al. (37) and Yadav et al. (42) reported that diabetes risk increased with shorter sleep duration. Besides, inadequate sleep duration is linked to metabolic syndrome (40) and obesity (43). Previous research has demonstrated a correlation between nocturnal sleep duration and hyperuricemia risk. The main outcome of this study was in line with Yu et al.'s study of 8,289 adults aged  $\geq 18$  years, in which shorter sleep duration was linked to a higher risk of hyperuricemia (20). A study of 6,151 Korean



**FIGURE 2**  
Restricted cubic spline plots of the relationship between nocturnal sleep duration and hyperuricemia. The curve was computed using restricted cubic spline (RCS) function that took into account variables including gender, age, marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, midnight snacks, using hypnotics, nap duration, obesity, DM, hypertension, and dyslipidemia. The red area represents the 95% confidence interval for the odds ratio. The dotted line shows the level at which the OR value is equal to 1.

women older than 20 years (25) revealed that long night sleep duration elevated the incidence of hyperuricemia (OR = 1.94, 95%CI: 1.27, 2.96), but our research found the relationship was insignificant. Dong et al. (44) found there was no correlation between nocturnal sleep duration and hyperuricemia risk in a survey involving 29,643 adults aged 18–79 in rural Henan province, which was congruent with the results of a study conducted by Wang et al. in a multi-ethnic population of 22,038 people aged 30–79 years (22). Additionally, the current study discovered that short nocturnal sleep duration was linked to increased serum uric acid levels, which was in agreement with the results on 4,555 Taiwanese people aged  $\geq 18$  years (45). In the study of 1,842 older people with high cardiovascular risk, Papandreou et al. (24) observed an inverse relationship between nocturnal sleep duration and serum uric acid levels. The reason for the inconsistent outcomes of this research may be related to the selection of participants, the grouping of sleep duration, and the confounding variables controlled for. In addition, more investigations with large sample populations are required to identify the association between long sleep duration and hyperuricemia risk.

The mechanisms of short sleep duration and hyperuricemia remain unclear. There are, however, several possible conjectures.



**FIGURE 3**  
Subgroup analyses of the associations between nocturnal sleep duration and the risk of hyperuricemia were performed using logistic regression models based on gender, age, and chronic conditions (hypertension, dyslipidemia, DM, and obesity). All models were adjusted for marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, midnight snacks, using hypnotics, nap duration, and were adjusted for gender, age, obesity, DM, hypertension, and dyslipidemia as appropriate. Point estimates for odds ratios are shown as small squares, while the 95% CIs are shown as horizontal lines. The small green squares represent sleep duration of <7 h/night, the blue represents sleep duration of 8–9 h/night, the red represents sleep duration of 9–10 h/night, and the black represents sleep duration of  $\geq 10$  h/night.

TABLE 2 Association between nocturnal sleep duration and serum uric acid levels.

Sleep duration (hours/night)	Number	$\beta$ (95% CI)		
		Model 1	Model 2	Model 3
<7	1,160 (11.2)	7.292 (2.823, 11.760)	7.541 (3.061, 12.022)	7.231 (2.875, 11.588)
7–8	4,279 (41.5)	0 (Ref)	0 (Ref)	0 (Ref)
8–9	3,662 (35.5)	−2.194 (−5.233, 0.845)	−2.047 (−5.098, 1.005)	−2.387 (−5.354, 0.580)
9–10	1,002 (9.7)	−0.796 (−5.540, 3.949)	−0.195 (−4.958, 4.568)	−1.914 (−6.547, 2.720)
≥10	218 (2.1)	1.417 (−7.967, 10.801)	1.897 (−7.484, 11.278)	1.682 (−7.439, 10.802)

Model 1 was only adjusted for gender and age; Model 2 was additionally adjusted by marital status, education level, annual household income, work intensity, sedentary time, position levels, participating in physical exercise, smoking, drinking, having mood symptoms, irregular meal habits, midnight snacks, using hypnotics, nap duration on the basis of Model 1; Model 3 was additionally adjusted for obesity, DM, hypertension, and dyslipidemia on the basis of Model 2.

Sleep deprivation is associated with elevated catecholamine levels, which help break down nucleotides, thus promoting the generation of endogenous uric acid (19). Catecholamines have also been shown to be crucial developing hyperuricemia in animal models (46). Additionally, lack of sleep can activate proteolytic pathways, synthesizing of uric acid, and purines (18). The relationship between sleep duration and serum uric acid levels could also be mediated by inflammation. Studies have reported that sleep duration can significantly impact on inflammatory mediators, thereby resulting in various chronic inflammatory illnesses (47, 48). Uric acid participates in the body's inflammatory response as an immune system activator (49), increasing uric acid levels in the serum. Furthermore, insufficient sleep duration may decrease levels of melatonin and leptin as well as elevate levels of ghrelin and cortisol, which may further result in obesity, diabetes, hyperinsulinemia, dyslipidemia, and hypertension (50), thereby aggravating the burden on the kidney.

Results of subgroup analyses revealed that short nocturnal sleep duration (< 7 h) had a higher risk of hyperuricemia among participants aged <45 years. The association seemed to be more pronounced in women and people with dyslipidemia. Additionally, such association was also found among individuals without hypertension, obesity, or DM. Similar to our results, Liu et al. (51) revealed that insufficient sleep duration was connected with an increased risk of hyperuricemia in young people (< 45 years old) among community residents. Previous research that explored the relationship between sleep duration and hyperuricemia also produced inconsistent findings between men and women (20, 51). Men and women have varied sex hormone levels and types, and their bodies react differently to them (52). These factors may lead to gender variations in serum urate excretion. We discovered that those with dyslipidemia had a greater risk of hyperuricemia when they slept for short periods of time, which was lined with earlier research (7). Dyslipidemia can lead to lipid accumulation, which reduces urate excretion by the kidneys and raises serum uric acid levels (53). Yu et al. (20) revealed that hyperuricemia risk is increased by insufficient

sleep time among participants without DM, obesity, and hypertension, suggesting that individuals without traditional risk factors are still at higher risk of hyperuricemia when they sleep less. Although the exact mechanisms are indistinct, it is plausible that the presence of risk factors for chronic diseases or lifestyle changes could obscure the impact of sleep duration in high-risk individuals while leaving a discernible impact in relatively healthy individuals. In addition, sleep duration could be an independent risk factor for hyperuricemia irrespective of these chronic disease factors.

This study added to the evidence of the association between nocturnal sleep duration, the risk of hyperuricemia, and serum uric acid levels in government employees. In addition, our study had a relatively large sample, and many covariates were controlled in the analysis. However, there are still some limitations. First of all, because this study was cross-sectional in nature, it cannot adequately depict the causal association of hyperuricemia and serum uric acid levels with sleep duration. Secondly, nocturnal sleep duration was obtained through self-reporting, without using objective medical equipment to measure, such as polysomnography monitor, or sleep tester; thus, there may exist some recall bias. Thirdly, the study was conducted on a special group of government employees, so care should be taken when inferring these findings to other groups.

## Conclusions

In a word, this study demonstrated that short nocturnal sleep duration was associated with an elevated risk of hyperuricemia, and increased serum uric acid levels in Chinese government employees. The association between nocturnal sleep duration and hyperuricemia remained in participants without hypertension, obesity, or DM. Further confirmation of the longitudinal relationship between nocturnal sleep duration and hyperuricemia risk in this population is required.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Xiangya School of Public Health, Central South University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

YA was responsible for data analyses, manuscript writing, and revision. FO and XL were responsible for the manuscript revision. SX was responsible for the study conceptualization and manuscript revision. All authors participated in the data collection. All authors read and approved the final manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.1055778/full#supplementary-material>

## References

1. Furuhashi M. New insights into purine metabolism in metabolic diseases: role of xanthine oxidoreductase activity. *Am J Physiol Endocrinol Metab.* (2020) 319:E827–e34. doi: 10.1152/ajpendo.00378.2020
2. Dehlin M, Jacobsson L, Roddy E. Global epidemiology of gout: prevalence, incidence, treatment patterns and risk factors. *Nat Rev Rheumatol.* (2020) 16:380–90. doi: 10.1038/s41584-020-0441-1
3. Roughley MJ, Belcher J, Mallen CD, Roddy E. Gout and risk of chronic kidney disease and nephrolithiasis: meta-analysis of observational studies. *Arthritis Res Ther.* (2015) 17:90. doi: 10.1186/s13075-015-0610-9
4. Chiang KM, Tsay YC, Vincent Ng TC, Yang HC, Huang YT, Chen CH, et al. Is hyperuricemia, an early-onset metabolic disorder, causally associated with cardiovascular disease events in han Chinese? *J Clin Med.* (2019) 8:1202. doi: 10.3390/jcm8081202
5. Su H, Liu T, Li Y, Fan Y, Wang B, Liu M, et al. Serum uric acid and its change with the risk of type 2 diabetes: a prospective study in China. *Prim Care Diabetes.* (2021) 15:1002–6. doi: 10.1016/j.pcd.2021.06.010
6. Yazdi F, Shakibi MR, Baniasad A, Najafzadeh MJ, Najafipour H, Yazdi F, et al. Hyperuricaemia and its association with other risk factors for cardiovascular diseases: a population-based study. *Endocrinol Diabet Metab.* (2022) e387. doi: 10.1002/edm2.387
7. Son M, Seo J, Yang S. Association between dyslipidemia and serum uric acid levels in Korean adults: Korea national health and nutrition examination survey 2016–2017. *PLoS ONE.* (2020) 15:e0228684. doi: 10.1371/journal.pone.0228684
8. Singh G, Lingala B, Mithal A. Gout and hyperuricaemia in the USA: prevalence and trends. *Rheumatology.* (2019) 58:2177–80. doi: 10.1093/rheumatology/kez196
9. Ting K, Gill TK, Keen H, Tucker GR, Hill CL. Prevalence and associations of gout and hyperuricaemia: results from an Australian population-based study. *Int Med J.* (2016) 46:566–73. doi: 10.1111/imj.13006
10. Zhang M, Zhu X, Wu J, Huang Z, Zhao Z, Zhang X, et al. Prevalence of hyperuricemia among Chinese adults: findings from two nationally representative cross-sectional surveys in 2015–16 and 2018–19. *Front Immunol.* (2021) 12:791983. doi: 10.3389/fimmu.2021.791983
11. Zhang L, Zhang S, Shi S, Quan H, Yang X. Application of health ecology theory model in self-management of maintenance hemodialysis patients. *Health Educ Health Prom.* (2022) 17:489–92. doi: 10.16117/j.cnki.31-1974/r.2022.05489
12. Bayon V, Leger D, Gomez-Merino D, Vecchierini MF, Chennaoui M. Sleep debt and obesity. *Ann Med.* (2014) 46:264–72. doi: 10.3109/07853890.2014.931103
13. Romero Cabrera JL, Sotos-Prieto M, García Ríos A, Moffatt S, Christophi CA, Pérez-Martínez P, et al. Sleep and association with cardiovascular risk among Midwestern US firefighters. *Front Endocrinol.* (2021) 12:772848. doi: 10.3389/fendo.2021.772848
14. Makarem N, Shechter A, Carnethon MR, Mullington JM, Hall MH, Abdalla M. Sleep duration and blood pressure: recent advances and future directions. *Curr Hypertens Rep.* (2019) 21:33. doi: 10.1007/s11906-019-0938-7

15. Antza C, Kostopoulos G, Mostafa S, Nirantharakumar K, Tahrani A. The links between sleep duration, obesity and type 2 diabetes mellitus. *J Endocrinol.* (2021) 252:125–41. doi: 10.1530/joe-21-0155
16. Peng K, Lin L, Wang Z, Ding L, Huang Y, Wang P, et al. Short sleep duration and longer daytime napping are associated with non-alcoholic fatty liver disease in Chinese adults. *J Diabetes.* (2017) 9:827–36. doi: 10.1111/1753-0407.12489
17. Deng HB, Tam T, Zee BC, Chung RY, Su X, Jin L, et al. Short sleep duration increases metabolic impact in healthy adults: a population-based cohort study. *Sleep.* (2017) 40:zsx130. doi: 10.1093/sleep/zsx130
18. Mónico-Neto M, Antunes HK, Dattilo M, Medeiros A, Souza HS, Lee KS, et al. Resistance exercise: a non-pharmacological strategy to minimize or reverse sleep deprivation-induced muscle atrophy. *Med Hypotheses.* (2013) 80:701–5. doi: 10.1016/j.mehy.2013.02.013
19. Glantzounis GK, Tsimoyiannis EC, Kappas AM, Galaris DA. Uric acid and oxidative stress. *Curr Pharm Des.* (2005) 11:4145–51. doi: 10.2174/138161205774913255
20. Yu X, Gong S, Chen J, Zhang H, Shen Z, Gu Y, et al. Short sleep duration increases the risk of hyperuricemia among Chinese adults: findings from the China health and nutrition survey. *Sleep Med.* (2021) 84:40–5. doi: 10.1016/j.sleep.2021.05.014
21. Cui L, Meng L, Wang G, Yuan X, Li Z, Mu R, et al. Prevalence and risk factors of hyperuricemia: results of the Kailuan cohort study. *Mod Rheumatol.* (2017) 27:1066–71. doi: 10.1080/14397595.2017.1300117
22. Wang Y, Zeng Y, Zhang X, Meng Q, Mi F, Wang S, et al. Daytime napping duration is positively associated with risk of hyperuricemia in a Chinese population. *J Clin Endocrinol Metab.* (2021) 106:e2096–e105. doi: 10.1210/clinem/dgab043
23. Wiener RC, Shankar A. Association between serum uric acid levels and sleep variables: results from the national health and nutrition survey 2005–2008. *Int J Inflam.* (2012) 2012:363054. doi: 10.1155/2012/363054
24. Papandreou C, Babio N, Díaz-López A, Martínez-González M, Becerra-Tomas N, Corella D, et al. Sleep duration is inversely associated with serum uric acid concentrations and uric acid to creatinine ratio in an elderly mediterranean population at high cardiovascular risk. *Nutrients.* (2019) 11:761. doi: 10.3390/nu11040761
25. Lee YC, Son DH, Kwon YJ. U-shaped association between sleep duration, c-reactive protein, and uric acid in Korean women. *Int J Environ Res Public Health.* (2020) 17:2657. doi: 10.3390/ijerph17082657
26. Sun L, Jiang X, Zhao X, Zhang Y, Xu Y, Shang L. Physical activity level and associated factors among civil servants in Xi'an, China. *J Sci Med Sport.* (2016) 19:647–53. doi: 10.1016/j.jsams.2015.08.003
27. Hu Y, Niu Z, Dai L, Maguire R, Zong Z, Hu Y, et al. The relationship between sleep pattern and depression in Chinese shift workers: a mediating role of emotional exhaustion. *Aust J Psychol.* (2020) 72:68–81. doi: 10.1111/ajpy.12253
28. Sun W, Yu Y, Yuan J, Li C, Liu T, Lin D, et al. Sleep duration and quality among different occupations—China national study. *PLoS ONE.* (2015) 10:e0117700. doi: 10.1371/journal.pone.0117700
29. Central Commission for Discipline Inspection of the Communist Party of China. Supervision law of the People's Republic of China. Available online at: [http://www.ccdi.gov.cn/yaowen/201803/t20180326\\_167260.html](http://www.ccdi.gov.cn/yaowen/201803/t20180326_167260.html) (accessed September 25, 2022).
30. Huang X, Xu W, Chen R, Jiang Y, Li J, Xu S. Association between sleep duration and weight gain and incident overweight/obesity: longitudinal analyses from the China Health and Nutrition Survey. *Sleep Breath.* (2021) 25:1187–94. doi: 10.1007/s11325-020-02194-y
31. Bardin T, Magnat E, Clerson P, Richette P, Rouchon B. Epidemiology of gout and hyperuricemia in New Caledonia. *Joint Bone Spine.* (2022) 89:105286. doi: 10.1016/j.jbspin.2021.105286
32. Kroenke K, Spitzer RL, Williams JB. The patient health questionnaire-2: validity of a two-item depression screener. *Med Care.* (2003) 41:1284–92. doi: 10.1097/01.Mlr.0000093487.78664.3c
33. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Int Med.* (2007) 146:317–25. doi: 10.7326/0003-4819-146-5-200703060-00004
34. He J, Ouyang F, Qiu D, Duan Y, Luo D, Xiao S. Association of nap duration after lunch with prevalence of metabolic syndrome in a Chinese government employee population. *Int J Environ Res Public Health.* (2020) 17:4268. doi: 10.3390/ijerph17124268
35. Yang Y, Miao Q, Zhu X, Qin L, Gong W, Zhang S, et al. Sleeping time, BMI, and body fat in Chinese freshmen and their interrelation. *Obes Facts.* (2020) 13:179–90. doi: 10.1159/000506078
36. Li C, Shang S. Relationship between sleep and hypertension: findings from the NHANES (2007–2014). *Int J Environ Res Public Health.* (2021) 18:7867. doi: 10.3390/ijerph18157867
37. Liu X, Li Z, Zhang J, Chen S, Tao L, Luo Y, et al. A novel risk score for type 2 diabetes containing sleep duration: a 7-year prospective cohort study among Chinese participants. *J Diabetes Res.* (2020) 2020:2969105. doi: 10.1155/2020/2969105
38. Chen Y, Chen Y, Tao R. Interpretation of "Guideline for prevention and treatment of dyslipidemia in Chinese adults in 2016". *Chin J Pract Int Med.* (2017) 37:38–42. doi: 10.19538/j.nk2017SI0113
39. Desquilbet L, Mariotti F. Dose-response analyses using restricted cubic spline functions in public health research. *Stat Med.* (2010) 29:1037–57. doi: 10.1002/sim.3841
40. Iftikhar IH, Donley MA, Mindel J, Pleister A, Soriano S, Magalang UJ. Sleep duration and metabolic syndrome. An updated dose-risk metaanalysis. *Ann Am Thor Soc.* (2015) 12:1364–72. doi: 10.1513/AnnalsATS.201504-190OC
41. Fernandez-Mendoza J, He F, Vgontzas AN, Liao D, Bixler EO. Objective short sleep duration modifies the relationship between hypertension and all-cause mortality. *J Hypertens.* (2017) 35:830–6. doi: 10.1097/hjh.0000000000001253
42. Yadav D, Cho KH. Total sleep duration and risk of type 2 diabetes: evidence-based on clinical and epidemiological studies. *Curr Drug Metab.* (2018) 19:979–85. doi: 10.2174/1389200219666180628170431
43. Fan J, Ding C, Gong W, Yuan F, Zhang Y, Feng G, et al. Association of sleep duration and overweight/obesity among children in China. *Int J Environ Res Public Health.* (2020) 17:1962. doi: 10.3390/ijerph17061962
44. Dong X, Liu X, Zhang L, Wang Y, Tu R, Liao W, et al. Snoring and napping independently increased the serum uric acid levels and hyperuricemia risk: the Henan Rural Cohort Study. *Nutr Metab Cardiovasc Dis.* (2022) 32:1427–36. doi: 10.1016/j.numecd.2022.03.006
45. Chou YT Li CH, Shen WC, Yang YC, Lu FH, Wu JS, et al. Association of sleep quality and sleep duration with serum uric acid levels in adults. *PLoS ONE.* (2020) 15:e0239185. doi: 10.1371/journal.pone.0239185
46. Sumi T, Umeda Y. Adrenergic regulation of the plasma levels of purine metabolites in the rat. *Eur J Pharmacol.* (1977) 46:243–7. doi: 10.1016/0014-299990339-9
47. Besedovsky L, Lange T, Haack M. The sleep-immune crosstalk in health and disease. *Physiol Rev.* (2019) 99:1325–80. doi: 10.1152/physrev.00010.2018
48. Tobaldini E, Fiorelli EM, Solbiati M, Costantino G, Nobili L, Montano N. Short sleep duration and cardiometabolic risk: from pathophysiology to clinical evidence. *Nat Rev Cardiol.* (2019) 16:213–24. doi: 10.1038/s41569-018-0109-6
49. Joosten LAB, Crişan TO, Bjornstad P, Johnson RJ. Asymptomatic hyperuricaemia: a silent activator of the innate immune system. *Nat Rev Rheumatol.* (2020) 16:75–86. doi: 10.1038/s41584-019-0334-3
50. Leproult R, Van Cauter E. Role of sleep and sleep loss in hormonal release and metabolism. *Endocr Dev.* (2010) 17:11–21. doi: 10.1159/000262524
51. Liu Z, Wang J, Wei Y, Ying H. Association between sleep duration and hyperuricemia in community residents. *Chin Gener Pract.* (2022) 25:1681–6. doi: 10.12114/j.issn.1007-9572.2022.0026
52. Posadzki-Malaczynska A, Rajpold K, Woznicka-Leskiewicz L, Marcinkowska J. Reversal of an unfavorable effect of hydrochlorothiazide compared to angiotensin converting enzyme inhibitor on serum uric acid and oxypurine levels by estrogen-progestin therapy in hypertensive postmenopausal women. *Curr Med Res Opin.* (2019) 35:1687–97. doi: 10.1080/03007995.2019.1612656
53. Saag KG, Choi H. Epidemiology, risk factors, and lifestyle modifications for gout. *Arthritis Res Ther.* (2006) 8:S2. doi: 10.1186/ar1907





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# Using the ISM-ANP-SD combination model to explore the mechanism and intervention strategies of influencing factors of coal mine safety system

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**Background:** With the intelligent construction of coal mines, the number of coal mine accidents is gradually decreasing, but the complexity of accidents is increasing. Understanding the interaction mechanism among the influencing factors of the coal mine safety system is an essential part of improving and enhancing the safety of the coal mine system.

**Methods:** The descriptive, structural model-network hierarchical analysis (ISM-ANP) was used to explore the interaction between the factors influencing the coal mine safety system and determine each factor's importance. A system dynamics simulation model was constructed to clarify the mechanism of each factor's effect on the safety system.

**Results:** The results show that Individual miners' factors directly influence coal mine system safety, organizational management factors, and group factors indirectly influence system safety and play the role of macro regulation. The intelligent system is the most profound factor influencing system safety. There are apparent differences in the influence of different subsystems on system safety, with organizational management having the most significant influence on system safety, followed by individual miners and group factors, and intelligent system factors and external environmental factors having a more negligible influence on system safety.

**Conclusion:** There is a complex interaction between the factors affecting the safety of the coal mine system, and there are apparent differences in the influence of different subsystems on the safety level of the coal mine system. This study puts forward the intervention strategy to improve the safety of the coal mine system, which provides theoretical support and method guidance for preventing coal mine accidents and improving the safety level of the coal mine system.

## KEYWORDS

coal mine safety system, human-machine safety collaboration, interpretive structural model, network analytic hierarchy process, system dynamics

## Introduction

The rapid development of the mining industry has contributed significantly to China's national economy and social development (1). It is essential to ensure the safety and sustainability of mining operations (2). Carvalho believes sustainable mining depends on better environmental protection, long-term management of natural resources, equitable socio-economic impact, and improved safety of mining activities (3). Among them, ensuring the safety of mining activities is seen as a fundamental determinant of sustainable mining (2, 4). With the continuous improvement of automation and information level in the coal industry, coal enterprises attach great importance to sustainable mining. They have made beneficial attempts and explorations to improve the sustainability of the mining industry and coal mine safety through intelligent construction (5). The achievement of intelligent construction of coal mines at this stage is mainly reflected in the realization of informatization in primary links such as coal mine development and design, geological guarantee, production, and safety. The reduction of personnel, the improvement of efficiency, and the fewer people operating also symbolize the completion of intelligent construction on the coal mining and excavation surfaces, respectively (6). Although coal mine fatalities and accidents are gradually decreasing, the complexity of coal mine accidents is increasing (7). Finding out the reasons for the complex changes in coal mine accidents and systematically analyzing coal mine accidents is an urgent problem to be solved in coal mine safety management under the intelligent construction of coal mines.

The coal mine safety system is a dangerous and dynamic complex system composed of coal mine safety-related elements such as natural conditions, equipment, management systems, and several active subjects (8). System safety is an essential basis for the safe production and operation of coal mines, maintaining daily stability, safety, and economy. With the intelligent construction of coal mining enterprises, the original production equipment or systems have been gradually upgraded and replaced. The application of new technologies allows more factors (such as automation trust and automation dependence) to be introduced into the security system, increasing the complexity inside the system. At this point, if any part of the coal mine safety system fails, it creates a safety hazard and may lead to a coal mine accident. Therefore, it is necessary for coal mining enterprises to shift the focus of safety management to the safety management of coal mine systems and to find out the factors that cause complex changes in coal mine accidents. Researchers need to understand the complexity, evolution law, and operation mechanism of the coal mine safety system by exploring the interaction relationship between the factors of the coal mine safety system and the interaction mechanism between the various subsystems in the coal mine safety system. Coal mine safety accidents can be effectively prevented only with the joint efforts of many parties.

Subsystems and their attributes determine the safety of a coal mine system, and the behavior interaction between subsystems is complex and changeable. The occurrence of an accident is not the result of a single factor but the interaction of many factors (9). Therefore, it is essential for mine safety risk prevention and system safety to deeply understand the causative factors and action mechanisms of accidents (10). Scholars tend to use Decision Making Trial and Evaluation Laboratory and Interpretative Structural Modeling Method (DEMATEL-ISM) (11), data mining (association-rule and decision tree) (12), Structural Equation Model (SEM) (13), Bayesian Networks (BN) (14) and other methods to study the factors influencing coal mine safety and action mechanism. However, previous studies mainly discussed the influence of a single factor and the causal relationship between factors on the accident. The internal interaction between factors and the hierarchy of factors have yet to be deeply studied. There needs to be a more systematic and dynamic analysis of the cause of the accident. ISM can divide a complex system with complex structure and fuzzy logic into several related subsystems, and construct a multi-layer hierarchical structure model, thereby dividing the influence paths and hierarchical structures among factors (15). The ISM has many applications in exploring the hierarchical relationship and correlation between factors (16, 17). It is difficult for the ISM to reflect the relative importance of each element in the entire system. At the same time, Analytical Network Process (ANP) is a multi-criterion weighted decision-making method that can reflect the mutual influence between indicators. ANP can perform a limited ordering of itemsets, more accurately describe the network structure among factors, and complement the computational results of ISM with quantitative analysis (18). ISM-ANP can effectively reflect the influence degree and path of various factors on the coal mine safety system. The current coal mine safety management system has the characteristics of non-linearity and a feedback loop. It is a complex and dynamic man-machine-environment-management system with intertwined effects of multiple factors (9). The dynamic evolution analysis can better reflect its complex and dynamic characteristics. System dynamics (SD) can combine quantitative and qualitative analysis with studying the interaction of various factors in complex systems through model simulation and has a wide range of applications in risk assessment and safety management (19, 20).

Advances in technology have made systems more complex, especially the complexity of the interactions between factors within the system. More understanding of the causal path of complex systems and the dynamic evolution law of system safety may increase the system risk and safety level of the coal mine safety management system. Therefore, based on analyzing the influencing factors of the coal mine safety management system under the background of coal mine intelligent construction, this study proposes a system safety management method combining ISM-ANP-SD. By constructing the ISM-ANP-SD model, we

explored the causal path of coal mine safety accidents and the dynamic evolution law of coal mine system safety. The research results can provide the scientific basis for accident prevention and improvement and provide a reference for the study of coal mine system safety management.

## Analysis of coal mine safety system

### Analysis of influencing factors of the coal mine safety system

Identifying influencing factors of the coal mine safety system is also the process of comprehensively identifying coal mine safety risks. Any factors influencing safety and health related to people, Intelligent systems, and the environment should be considered (21). Scholars have researched the factors influencing the coal mine safety system. Liu et al. (22) analyzed the coal mine safety accidents from the external environment, organizational factors, poor leadership, preconditions for unsafe behavior, and unsafe behavior. Fa et al. (23) divides the factors that restrict the safety production of coal mines into seven aspects: unsafe behavior, unsafe preconditions, unsafe supervision, organizational influence, external influence, mechanical equipment factors, and physical environment factors. Jiskani used fuzzy synthetic evaluation to evaluate 41 risk factors influencing sustainable mining in Pakistan. They classified the risks into 8 categories: Economic and financial, Environmental, Health and safety, Natural and external, Operational and technical, Organizational and managerial, Political and legal, and Socio-cultural (1). Based on the systematic theory of human, machine, environment, and management, Bai and Xu constructed the classification model of coal mine safety evaluation, constructed 14 evaluation index systems from four aspects of human, machine, management, and environment, and used BP neural network to evaluate coal mine safety (24). Ma established 30 evaluation index systems from five aspects: environmental disaster, safety management, facility performance, behavior monitoring, and emergency rescue. AHP, Entropy method, and multi-granularity non-equilibrium semantic treatment method are used to calculate the index's weight, and the suggestion of coal mine safety management is put forward (25). To sum up, scholars' studies on influencing factors of coal mine safety mostly construct index systems from individual factors (26), organizational factors (11, 22), management factors (27, 28), machinery and equipment (29, 30), and environmental factors.

Under the intelligent construction of coal mines, much new intelligent equipment, sensors, and automatic controllers have appeared in the production process, and the stability and reliability of the equipment have been greatly improved (5). The relationship between miners and coal mine machinery and equipment has changed from the traditional "people-oriented, machine-assisted" to the current "human-machine

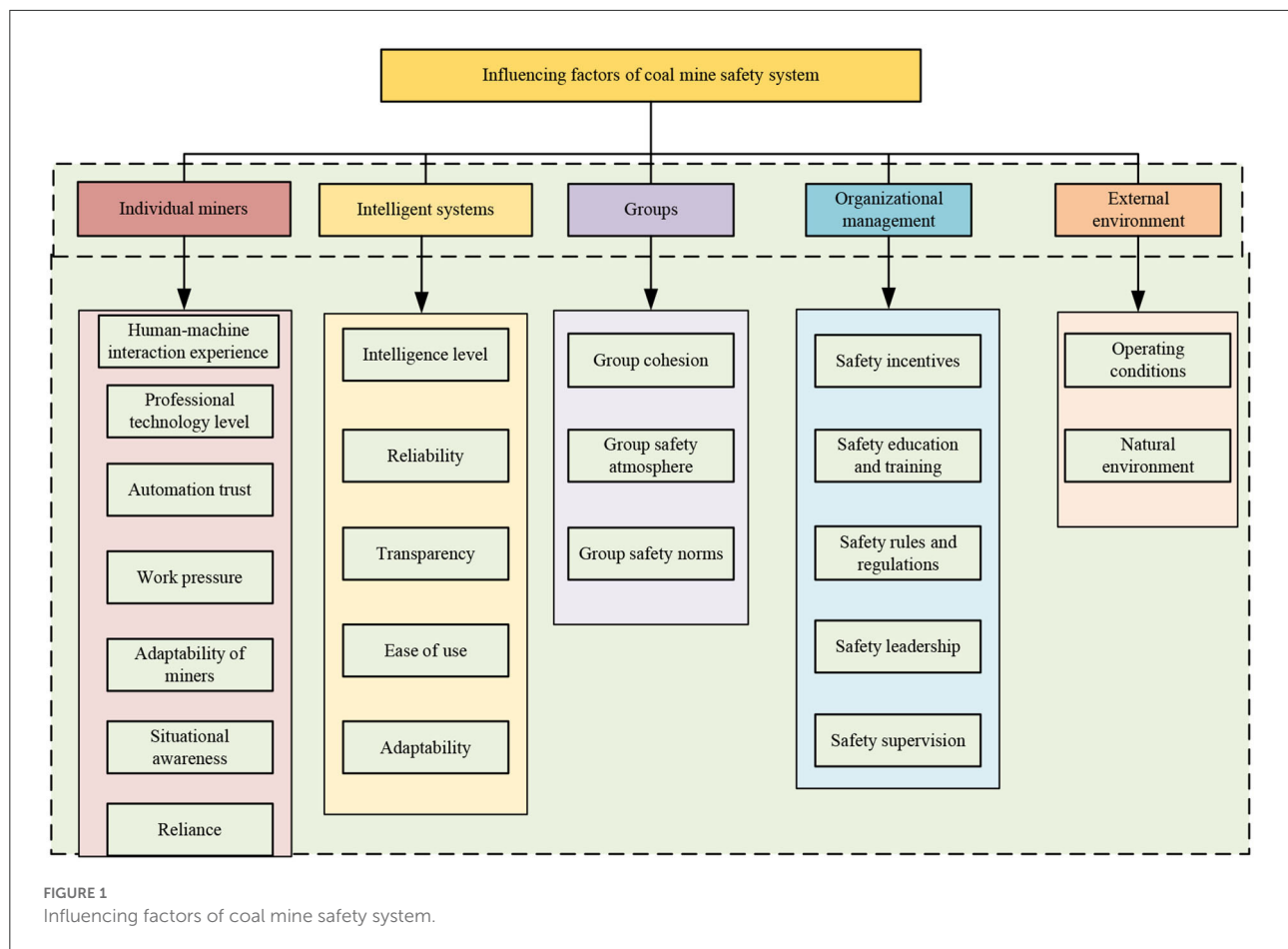
cooperation (31)." Therefore, under the intelligent construction of coal mines, the interaction process of the "human-machine-management-environment" should be considered more in the research on the influencing factors of the coal mine safety system. According to the actual situation of the intelligent construction of coal mines in China and related research results, this study mainly divides the influencing factors of coal mine safety system into five aspects: individual miners, intelligent systems, organizational management, groups, and environment, and determines 22 influencing factors, and constructed a map of the influencing factors of the coal mine safety system, as shown in Figure 1.

### Theoretical model building

Three-dimensional interactive decision-making believes that human behavior, the internal factors of actors, and their environment are independent, continuous, and dynamic interactions. The mode of action between the three is not constant and will show different modes of influence according to specific situations (32). The ternary interactive determinism links people's behavior, the actor's internal factors, and the actor's environment and builds the interaction model of the three. Among them, the internal factors of the actor mainly refer to the individual's psychological functions, such as cognition, emotion, belief, expectation, and attitude. External environmental factors include physical and social factors such as work resources, organizations, and leaders. Behavior mainly refers to the individual's choice of action.

The "stimulus-response" theory originated from behaviorist psychology. Jacoby (33) added individual cognition to the "stimulus-response" theory and proposed the "stimulus-organism-response" theory (S-O-R theory). The S-O-R theory holds no direct interaction between external environmental stimuli and individual responses. An individual is an organism with rich emotions and cognitive activities and has subjective initiative. Therefore, the individual is not simply a passive response to the stimulus but produces a specific psychological activity, which influences the individual to make an active choice.

The coal mine safety system consists of five subsystems: individual miners, intelligent systems, organizational factors, external environment, and management factors. The coal mine safety system is a human-centered man-machine matching system with a feedback process. The user's demand for the system leads to the functional interaction and elastic interaction of each subsystem according to the design requirements; that is, the regular operation of each subsystem depends on the normal operation of the functions of other subsystems associated with it. Combined with ternary interactive determinism, "stimulus-body-response" theory, and according to the actual production situation of the coal mining industry, a conceptual model of the coal mine safety system is constructed, as shown in Figure 2.

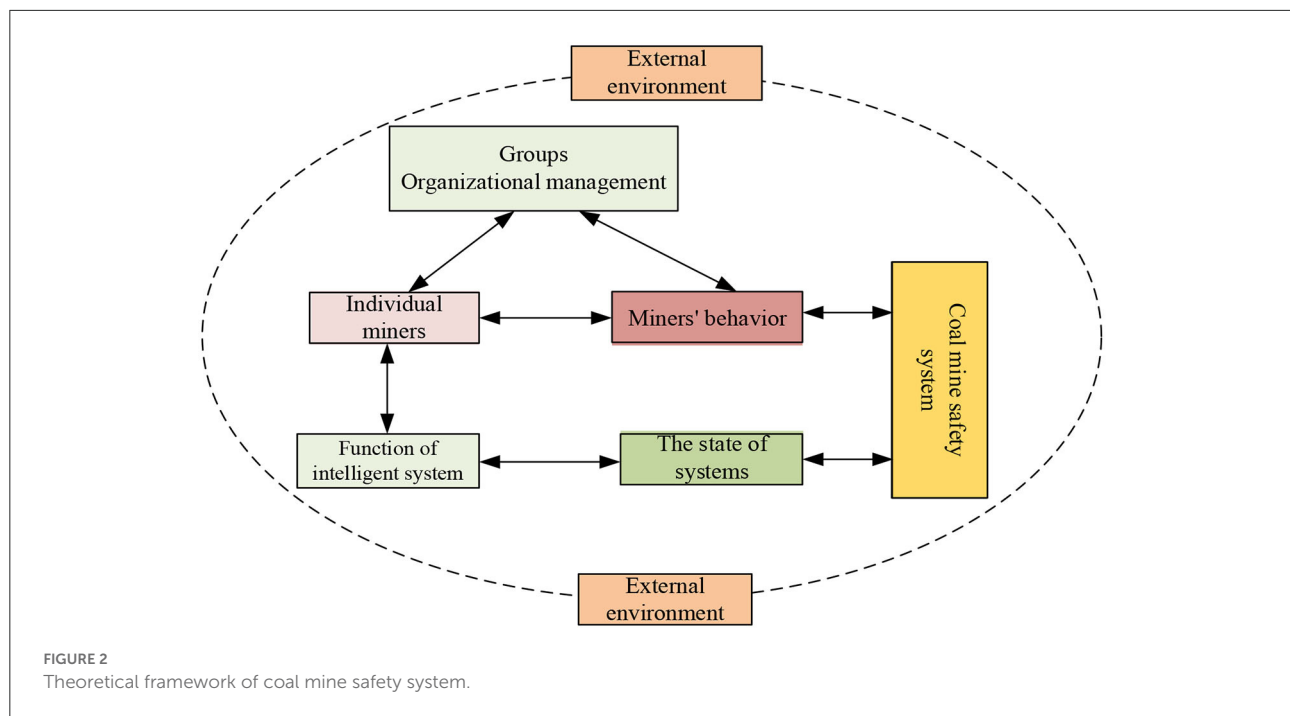


## Research methods

In this paper, the improved ISM based on DEMATEL is used to analyze the hierarchical structure and internal interaction among factors influencing the coal mine safety system from a qualitative point of view. ISM can simplify and regularize the complex and chaotic system by building a multi-level hierarchical structure model to clarify the system's hierarchical structure and internal interaction relationship (15). This method stratifies the influencing factors in the system, which can better solve the problem that there are many influencing factors in the system, and the correlation between the factors is relatively complex and can analyze the core factors in the system and the correlation between the influencing factors. However, the ISM method only considers binary relationships and unidirectional effects between factors when considering the relationships of factors. The direct influence matrix constructed by the DEMATEL method can more accurately describe the strength of the interactions and influence relationships between factors (34). Therefore, when considering the initial relationship between system elements, the improved ISM is based on DEMATEL. The

improved ISM can be used to determine the strength of the influence relationship between factors by constructing the direct influence matrix, which has better applicability and operability than the adjacency matrix built by traditional ISM. In addition, when calculating the reachability matrix, the improved ISM based on DEMATEL can introduce a threshold to screen the action paths and retain the critical path. The ANP method analyzes the relative importance of factors according to the influence relationship of factors in the system, which can quantitatively supplement the research results of ISM. Moreover, ISM and ANP methods are based on the influence relationship between factors to analyze the system and have the same application conditions. Many factors influence the coal mine safety system, and their interaction forms a complex network of influence relations. Based on this characteristic, ISM-ANP is suitable for analyzing the coal mine safety system's action path and key influencing factors.

System dynamics is based on information theory, cybernetics, and system theory and uses computer technology to simulate and analyze the dynamic and complex causal relationships of various elements and to understand complex



systems as a whole. System dynamics is a quantitative research method to study high-order, non-linear, multivariable complex systems. The influence of various factors in the coal mine safety system is complex, dynamic, and implicit. It is necessary to observe the evolution process of safety in the system from a dynamic perspective. The method of system dynamics is suitable for revealing this dynamic evolution law. The specific method steps of the ISM-ANP-SD model of the coal mine safety system constructed in this study are shown in Figure 3.

## Results and discussion

### Model building

#### ISM-ANP model construction

Determine the direct impact matrix. Ten experts were invited to rate the correlation of 22 factors influencing the mine safety system. The invited three intelligent, fully mechanized face technicians have been involved in the intelligent transformation of coal mine enterprises for a long time. They have a complete understanding of the technology adopted in the intelligent construction of coal mines and the situation of the coal mining site and have rich theoretical and practical experience. Four front-line miners have been engaged in coal mining for a long time and fully understand the factors influencing the safety of the coal mine system. Three professors in the field of coal mine safety have been actively involved in the research of coal mine safety management in the past 10 years and have rich experience in coal mine safety management. The 10 experts invited by this

study have strong theoretical and practical experience, which can ensure the reliability and validity of the data. The number 0–4 is used to indicate the degree of influence between factors, where “0” means no influence, “1” slight influence, “2” general influence, “3” strong influence, and “4” strong influence. The scoring value of each expert is averaged to obtain the direct influence matrix of each influencing factor.

MATLAB software calculates the adjacency matrix, and the reachable matrix is obtained. Determine the reachable set  $R_i$  and the antecedent set  $S_i$  of the reachability matrix. The satisfying factors  $R_i = R_i \cap S_i (i = 1, 2, \dots, 22)$  are the factors of the first level of the system, deleting the elements of the first level, calculating according to the formula, analyzing the system layer by layer, and obtaining the hierarchical table of factors. The explanatory structure model of the coal mine safety system constructed according to the reachability matrix and the hierarchical table is shown in Figure 4.

Calculate the judgment matrix. If the direct influence matrix shows an influence relationship between the two factors, the value of the corresponding judgment matrix is 1. If there is no influencing relationship between the two factors, the corresponding judgment matrix value is 0. According to the judgment matrix results, input the Super Decision software to obtain the network structure model of ANP, as shown in Figure 5, and construct 5 cluster judgment matrices and 80 node judgment matrices. Ten experts involved in the ISM were invited to score the judgment matrix using the “1–9 scale method”, and the Super Decision software was used to calculate the weight of each factor. Each calculation result passed the matrix



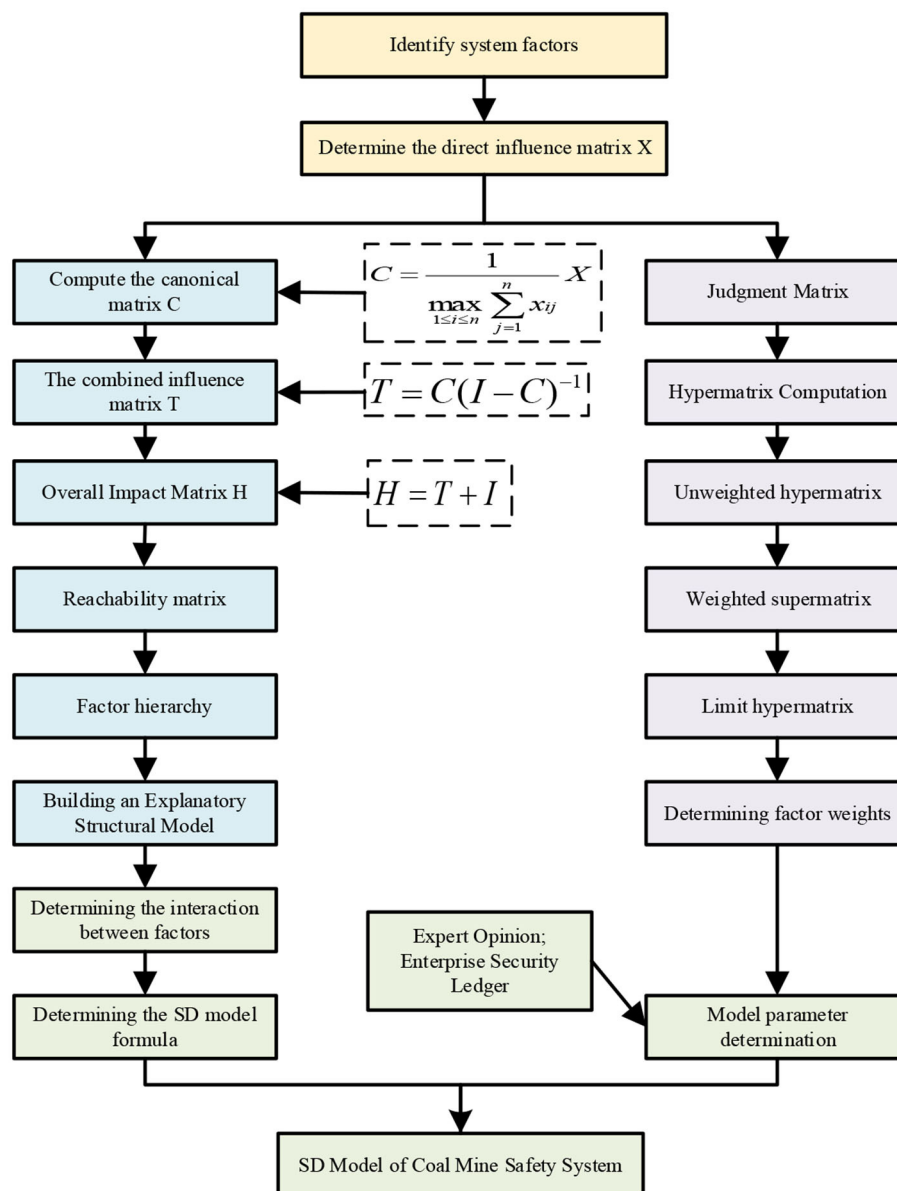


FIGURE 3  
Flow chart of ISM-ANP-SD model of coal mine safety system.

consistency test. The weight calculation results of the ANP model are shown in Table 1.

### Analysis and discussion of the results of the ISM-ANP model

There is a complex relationship between the influencing factors in the coal mine safety system. In the ISM, the first-level factors of automatic trust, miners' adaptability, dependence, organizational cohesion, and natural environment are the most

direct factors that influence the safety of the coal mine system. Interventions on these factors can directly and effectively promote the safety level of the coal mine system. The factors at the second, third and fourth levels are important factors that influence the coal mine safety system. Most of these are related to management and organizational factors. Although the factors at the second, third and fourth levels have no direct impact on the safety of the coal mine system, they can influence the safety of the coal mine system by influencing the state of the miners. The fifth-level influencing factors reliability, transparency, and

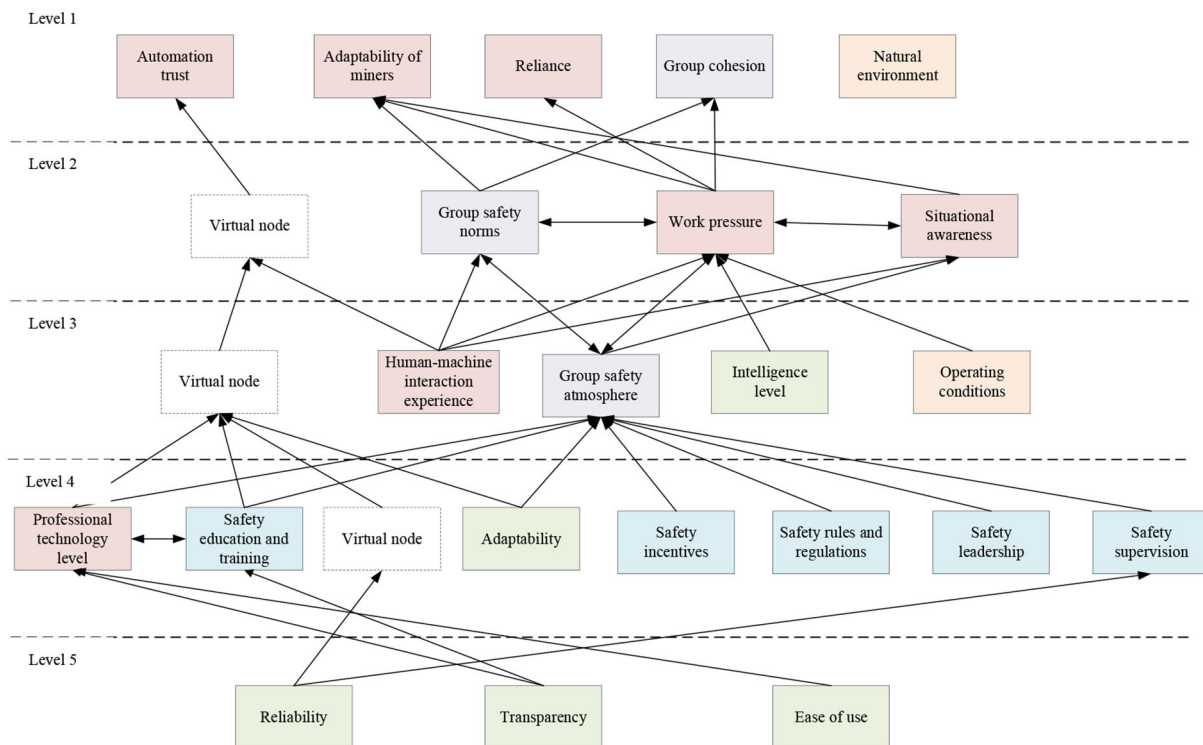


FIGURE 4  
Interpretation structure model of coal mine safety system.

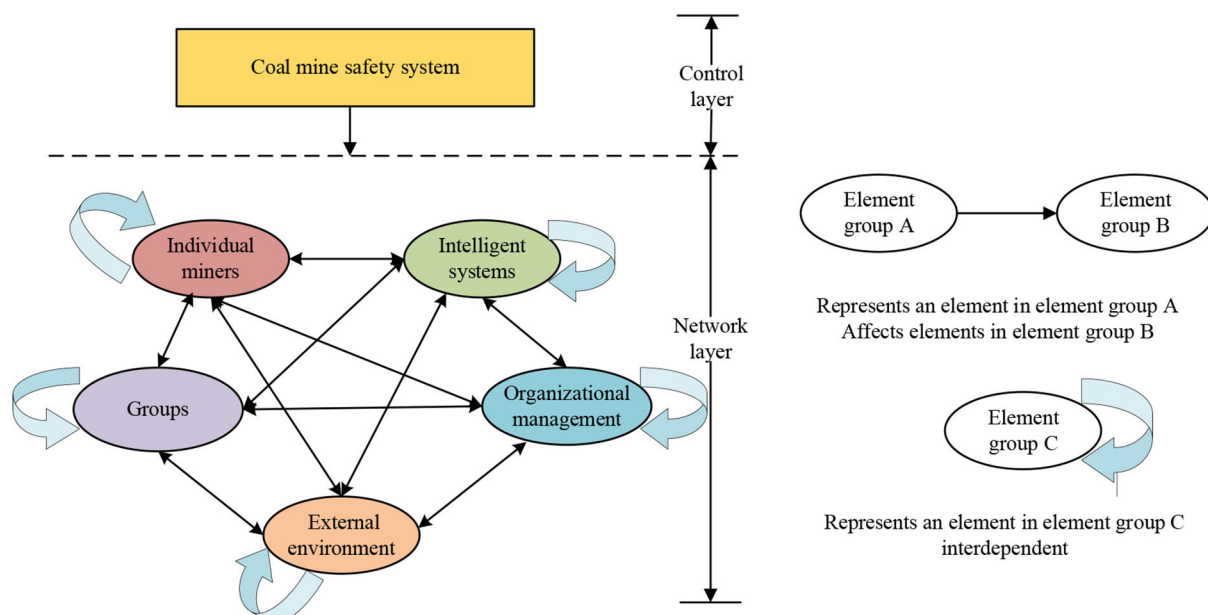


FIGURE 5  
Network structure model of coal mine safety.

TABLE 1 ANP weight calculation results.

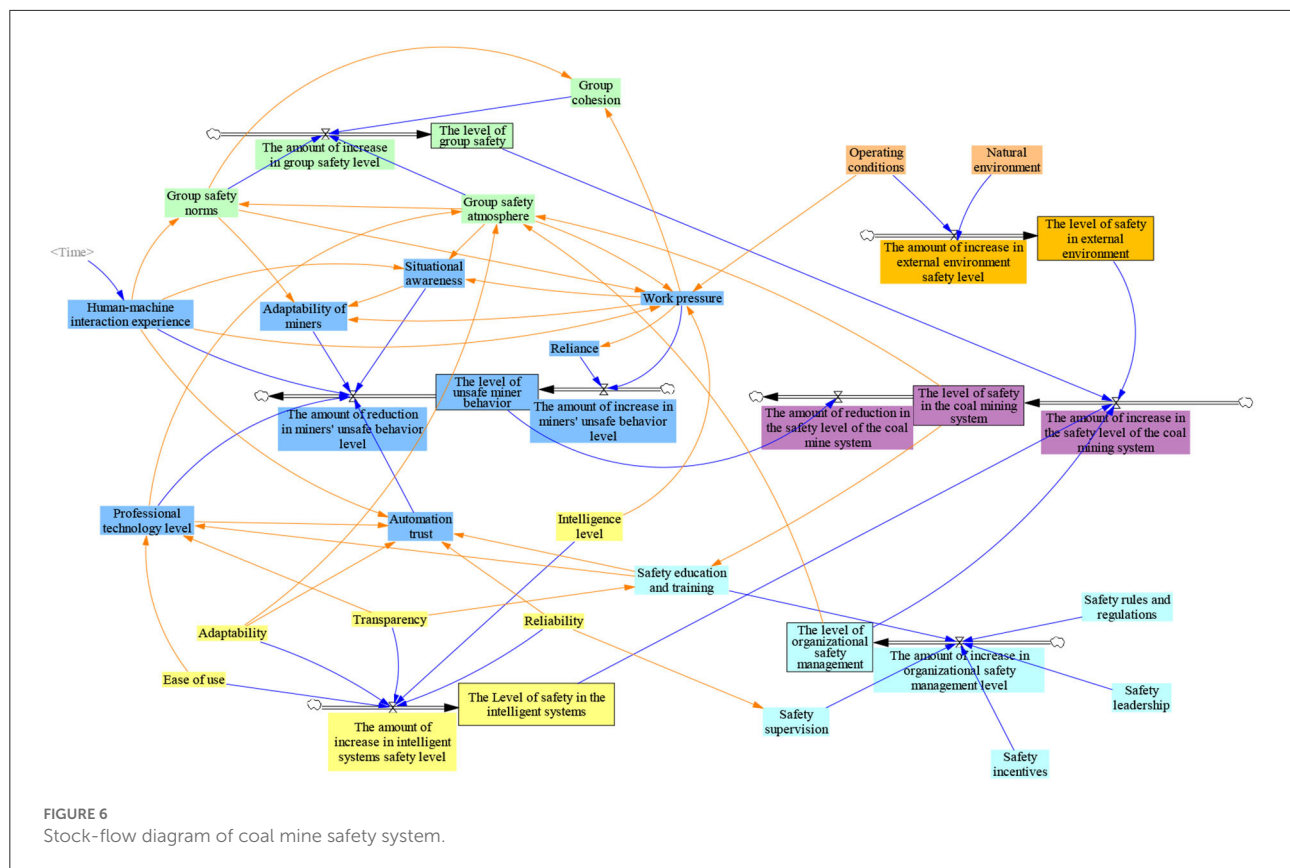
First-level indicator	First-level indicator weight	Secondary indicators	Global weight	Local weights
Individual miners	0.27	Human-machine interaction experience	0.017	0.06
		Professional technology level	0.041	0.16
		Automation trust	0.035	0.13
		Work pressure	0.04	0.15
		Adaptability of miners	0.053	0.2
		Situational awareness	0.051	0.19
		Reliance	0.028	0.11
Intelligent systems	0.11	Intelligence level	0.003	0.02
		Reliability	0.042	0.37
		Transparency	0.022	0.19
		Ease of use	0.028	0.25
		Adaptability	0.019	0.17
Groups	0.21	Group cohesion	0.079	0.39
		Group safety atmosphere	0.077	0.38
		Group safety norms	0.049	0.24
Organizational management	0.37	Safety incentives	0.079	0.22
		Safety education and training	0.083	0.23
		Safety rules and regulations	0.052	0.14
		Safety leadership	0.09	0.25
		Safety supervision	0.062	0.17
External environment	0.05	Operating conditions	0.035	0.7
		Natural environment	0.015	0.3

ease of use are the most profound influencing factors. These three factors are all related to the intelligent system and will not directly lead to coal mine safety accidents. However, it directly impacts miners' behavior and the level of organization and management and is the most fundamental cause of coal mine safety accidents.

Through the ANP calculation results, it can be seen that the ranking of the impact on the coal mine safety system in the first-level indicators is: organizational management, individual miners, groups, intelligent systems, and environment. Combined with the results of ISM, it can be seen that organizational management factors, individual miners, and group factors have a more significant impact on system safety, and individual miners directly influence the coal mine safety system. Organizational and group factors indirectly influence the coal mine safety system and play a role in macro-control. Appropriate intervention on organizational management and group factors can effectively improve the safety behavior of miners. The impact of intelligent systems and environmental factors on system security is tiny. However, the intelligent system's good working performance and good working environment ensure the entire system's security.

## System dynamics model construction

The principles of purpose, applicability, validity, and simplicity must be followed when building a system dynamics model. Each influencing factor finally influences the safety of the coal mine system by influencing miners' unsafe behavior subsystem, intelligent system subsystem, organization management subsystem, group subsystem, and environmental subsystem. According to the interaction relationship between the factors obtained by ISM, Vensim PLE software is used to draw the safety stock-flow map of the coal mine system, as shown in Figure 6. Set the model Initial time = 0, Final time = 24, Units = Month. The simulated data comes from Pingmei No. 4 Mine, owned by China Pingmei Shenma Energy and Chemical Group Co., Ltd. Field research was conducted in Pingmei No. 4 Mine to obtain the operation ledger data from May to August 2021. Interviews were conducted with the intelligent coal face's management personnel, technical personnel, and front-line miners. The initial values of state and auxiliary variables in the SD model were determined by combining the coal mine safety system operation ledger data and interview data. The influence coefficient between variables is mainly determined based on the ANP calculation results and expert interviews.

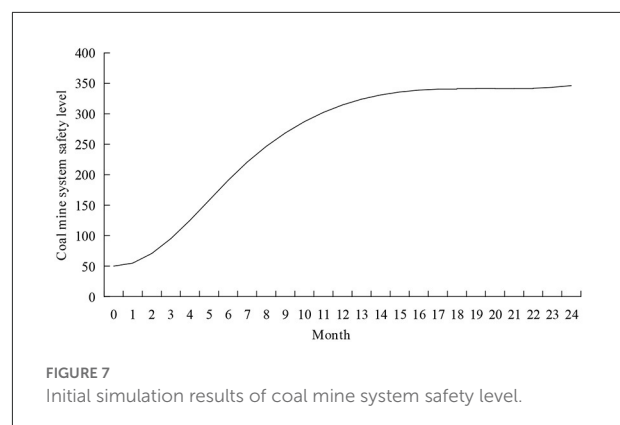


## Model simulation results and analysis

### Analysis of initial simulation results

Models were tested for construct validity, dimensional consistency, and historical values before model simulation and analysis. The model's structural validity test ensures the rationality of the logical relationship of the model. The relationship between the variables in Figure 6 is determined based on the interpretation of the structural model combined with the actual situation of coal mine production, ensuring the model's rationality. The dimensional consistency check ensures whether the dimensions used by the equations and parameters in the model are appropriate. The model is checked for dimensional consistency using the model checking function in the Vensim software and passed. The historical value test of the model verifies the safety value of the coal mine system for 1–6 months. The error rate between the simulated value and the original value is  $3.9\% < 5\%$ , indicating that the model has a reasonable degree of fitting and that the model in this study is valid. The initial simulation results of coal mine system safety are shown in Figure 7.

According to Figure 7, the change in coal mine system safety can be divided into three stages. (1) During the rapid rise period from 0 to June, the safety level of the coal mine system increased from 50 to 190.757: On the one hand, in the interaction process



between miners and intelligent systems, the experience of miners is rapidly accumulated, the adaptability is gradually increased, and the level of automation trust and situational awareness is also improved with human-machine interaction. At this time, miners' work pressure level and dependence on automation are low, and the unsafe behavior of miners is low. On the other hand, due to the high level of safety supervision and safety education and training for miners by managers in the early stage of human-machine interaction, the safety level of the coal mine system has been increased. (2) During the rising period

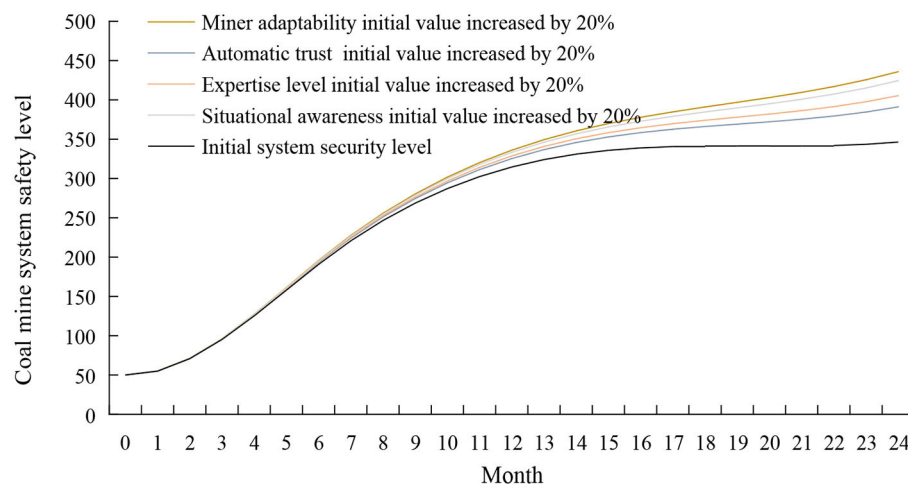


FIGURE 8  
Simulation results of coal mine system safety after the intervention of miners' individual subsystems.

from June to December, the safety level of the coal mine system increased from 190.757 to 314.636: Miners' work pressure and automation dependence increased unsafe behavior in this stage. The gradual familiarization of team members will improve team cohesion and a safe atmosphere. This can effectively alleviate the increase in miners' unsafe behavior caused by work pressure and automation dependence. (3) During the slow-rising period from December to 24, the safety level of the coal mine system increased from 314.636 to 346.374: At this stage, the level of unsafe behavior of miners, the level of environmental safety, and the level of organizational management are gradually stabilized, the group safety norms within the group are gradually formed, and the group cohesion and group safety atmosphere grow slowly. Therefore, the safety level of the coal mine system grows slowly in this stage.

### Analysis and discussion on simulation results of intervention strategy

Individual miners, organization management, intelligent systems, groups, and the environment have operation rules. Each subsystem interacts with the other, and different subsystems have different effects on the behavior of other subsystems and the safety of the coal mine system. The factors of each subsystem are intervened. The influencing mechanism of each factor on the safety of the coal mine system is discussed to provide policy suggestions for improving the safety level of the coal mine system.

#### The intervention in the individual subsystem of miners

In the individual subsystem of miners, human-machine interaction experience is a time-related variable, and human intervention factors have little impact on it. Work pressure

will lead to an increase in the level of miners' unsafe behavior, which negatively influences system security. In order to improve the safety level of the coal mine system, the control variable method is used to increase the initial values of professional technology level, automation trust, situational awareness, and miner adaptability by 20% while keeping other variables unchanged. The simulation results are shown in Figure 8. It can be seen from Figure 8 that after the intervention strategy is adopted, the safety state of the coal mine system is improved compared with the initial state, and the effect is more evident at 7–24 months. The effect on the safety of the coal mine system is from large to small: adaptability of miners, situational awareness, professional technical level, and automation trust.

The tasks and responsibilities performed by miners have undergone significant changes. The complexity of the intelligent system requires miners to have higher adaptability to identify and take corresponding security measures on time in the face of crises (35). The adaptability of miners is the primary ability of employees under the intelligent construction of coal mines. The intelligent construction of coal mines requires miners to have the ability to adapt to pressures, dangers, and emergencies (36). To improve the adaptability of miners, miners must have continuous learning ability and actively understand the principles and methods of equipment. In addition, managers should strengthen risk identification and cognitive training for miners and improve miners' adaptability to dangerous and unexpected situations.

Situational awareness is the perception and understanding of entities in the environment and the prediction of entity states (37). The importance of situational awareness to the security of complex systems has long been demonstrated (38, 39). It can be seen from the model analysis that human-machine interaction experience and group safety atmosphere have a positive impact



on miners' situational awareness. With the increase of human-machine interaction experience and the improvement of group security atmosphere, miners' situational awareness level will increase; work pressure may cause miners to respond slowly and have no apparent sense of system risk. Managers can improve miners' situational awareness by improving the group's safety atmosphere, using miners with experience in human-machine interaction, and timely dredging miners' work pressure.

Relevant knowledge and technical skills are critical to miners' safety awareness (40). Improvements in intelligent coal mine equipment should be accompanied by updating miners' relevant knowledge and technical skills. Professional knowledge and technical skills help miners understand the operating methods and operation level of intelligent systems and reduce the occurrence of unsafe miner behavior. There are two ways to improve miners' expertise: improving the HMI design and enhancing safety education and training for miners. In the design of the HMI, ease of use and transparency should be improved to provide operators with a reliable reference for decision-making (41). Strengthening the education of miners' operating knowledge and operating principles, as well as the training of operating skills, pattern recognition, and pattern matching training, can also effectively improve the professional technical level of miners.

Automated trust influences miners' use of intelligent systems (42). Over-trust or lack of trust will lead to over-supervision or under-supervision of intelligent systems by miners (43), making miners react poorly in critical events and leading to safety accidents (44). Therefore, an appropriate level of trust is essential: operators must understand the capabilities of intelligent systems and adequately monitor them as they approach the limits of their capabilities (45). Maintaining an appropriate level of trust among miners begins with training miners with a clear and detailed introduction to the functions and operation of the intelligent system, explaining the system's limitations, and improving the miners' level of expertise. Second, improve the human-machine interface design of the intelligent system to improve the system's explanation capability so that when the system malfunctions, the system can be explained verbally or visually to the operator promptly to facilitate the operator's understanding of the intent and actions of the intelligent system (46). Finally, miners are encouraged to think positively and try to resolve their distrust of the intelligent system due to personal reasons.

### The intervention in the organizational management subsystem

Under the condition of keeping other variables unchanged, using the control variable method increases the initial values of safety education and training, safety supervision, safety leadership, safety regulations, and safety incentives by 20%. The simulation results are shown in Figure 9. As seen in Figure 9, the safety state of the coal mine system has improved

compared to the initial state after the intervention strategy. The impact of various factors on the safety of the coal mine system is from large to small: safety education and training, safety leadership, safety incentives, safety supervision level, and safety rules and regulations.

Strengthening safety education and training is the most economical and effective way for coal mining enterprises to improve safety performance (47). Increasing the initial value of safety education and training can improve managers' safety management levels and influence miners' subsystems. On the one hand, the increase in safety education and training level can improve miners' professional and technical levels and enhance their ability to deal with emergencies. On the other hand, the knowledge acquired through training is conducive to miners' understanding of the functions and intentions of intelligent systems so that miners can maintain an appropriate level of automation trust (48). Coal mining enterprises should establish a standardized and institutionalized safety education and training mechanism to ensure the strength and sustainability of safety education (49).

The safety leadership behavior of managers is critical to the safety management of coal mining enterprises (50). Leaders can control the age, specialties, and skills of members of the miner group through access management and optimize the group structure to reduce the occurrence of unsafe behaviors. In addition, leaders must correctly use the influence of authority, actively learn and master the legal standards and scientific methods of safety management, and seriously investigate the law of accidents to improve safety management (20).

Security incentives can effectively increase the safe behavior of miners. Managers can mobilize the enthusiasm and consciousness of employees for safety work through material and spiritual rewards, such as rewarding employees who truthfully reflect hidden dangers and risks; rewarding safety production teams, units, and individuals. When workers are encouraged, workers will proactively identify hazards and improve the safety atmosphere in the team (51).

Safety supervision is an essential factor influencing system safety. Managers can refer to BBS and Dupont STOP behavior management methods, formulate scientific and adequate supervision and assessment methods, arrange reasonable safety supervision cycles, and strictly implement safety supervision. Find and solve problems promptly in safe production (20), and create a good group safety atmosphere.

Safety rules and regulations can effectively regulate the behavior of miners. To improve the safety rules and regulations of coal mining enterprises, managers should conduct regular safety inspections, develop a miner's behavior management manual, and clarify guidelines for penalties for violations. In addition, managers need to clarify the criteria for analyzing and assessing miners' unsafe behaviors, establish individual miners' safety integrity files, and implement dynamic management of individual miners' safety behaviors (51).

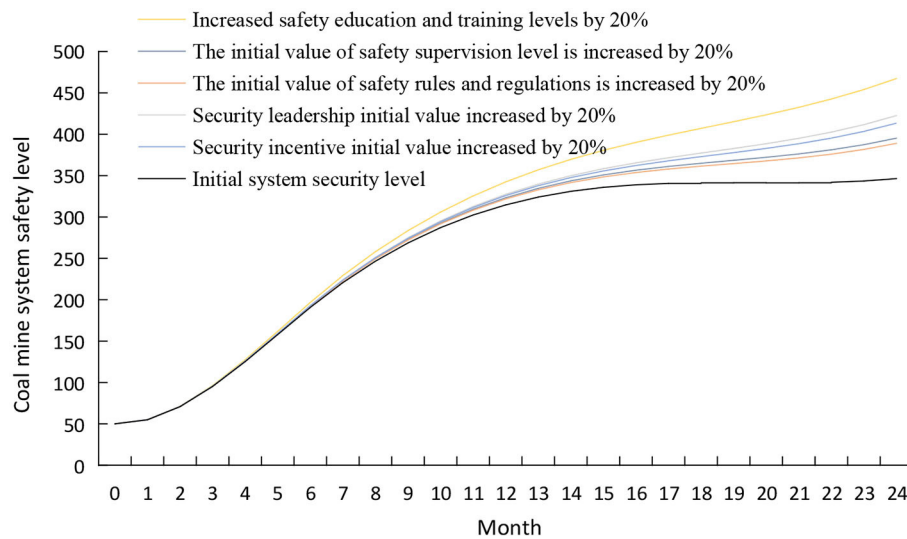


FIGURE 9

Simulation results of coal mine system safety after the intervention of the organizational management subsystem.

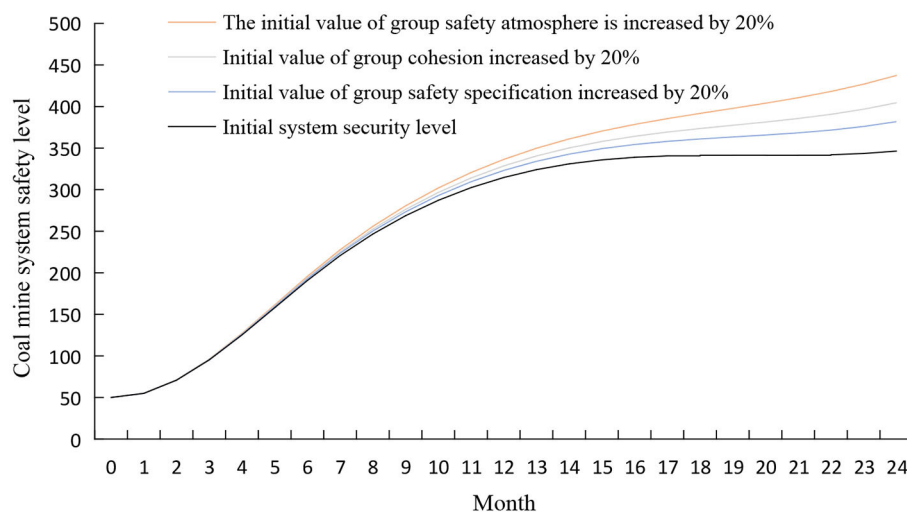


FIGURE 10

Simulation results of coal mine system safety after the intervention of group subsystem.

### The intervention in the group subsystem

The dynamic complexity of coal mine hazards determines that organizational management cannot eliminate all safety risks, and employees must be encouraged to participate actively in safety management. The initial values of group safety climate, group cohesion, and group safety norm were increased by 20% using the control variable method while keeping other variables unchanged. The simulation results are shown in Figure 10. It can be seen that after adopting the intervention strategy, the effect of each factor on the safety level of the coal mine system is from large to small:

group safety atmosphere, group cohesion, and group safety norms (52).

A good group safety atmosphere will reduce the unsafe behavior of miners by reducing the work pressure of miners, thereby leading to an increase in the safety level of the coal mine system (53). A good group safety atmosphere is mainly manifested in showing initiative, proposing changes to improve system security, and helping colleagues have sufficient resources to meet work needs. Team leaders can create a good group safety atmosphere by determining group safety goals and improving group safety standards.

Group cohesion positively influences the active participation of team members in group actions (54). It is necessary to encourage positive emotional interaction among team members and feedback on safety messages to improve team cohesion. The team leader should always pay attention to the members' status, promptly ease the miners' work pressure, and constructively resolve conflicts within the team (55, 56).

Ignoring safety regulations is the root cause of safety incidents (57). The first step to improve group safety norms is introducing standardized business concepts into group safety norms with teams as a unit. Before the team goes down the mine, carry out risk identification activities, regularly analyze unsafe behaviors in the group, improve workers' self-safety awareness, and give full play to the restraint and guiding role of safety norms in the group on miners.

### The intervention in intelligent system subsystem

The factor of an intelligent system is the most profound factor that influences the coal mine safety system, which will influence the decision-making of miners and the way of human-machine interaction. Using the control variable method while keeping other variables unchanged, the initial values of reliability, ease of use, transparency, intelligence level, and adaptability are increased by 20%. The simulation results are shown in Figure 11. It can be seen from Figure 11 that the effect of each factor on the safety level of the coal mine system is from large to small: ease of use, transparency, reliability, adaptability, and intelligence level.

The ease of use and transparency of intelligent systems directly impact miners' level of expertise. The higher the ease of use of the intelligent system, the simpler the operation method, and the fewer operation skills miners need to master, the easier it is to improve the professional technical level in a short period and reduce the unsafe behavior of miners. Higher system transparency can make it easier for miners to understand the system's operating principles through training and mastering the operating methods of the system, which can effectively improve the professional technical level of miners (58).

The reliability of intelligent systems influences miners' trust in the system and safety supervision (59). Intelligent systems with high reliability can increase miners' safety supervision of intelligent systems by setting appropriate human-machine task assignments, effectively reducing people's dependence on intelligent systems, and enabling miners to maintain an appropriate level of trust.

The adaptability of intelligent systems has a significant impact on the safe atmosphere of the group and the automation trust level of miners. High system adaptability can increase miners' safety supervision of machines and reduce people's excessive dependence on intelligent systems, effectively improving miners' trust level in intelligent systems and group safety atmosphere (29).

The intelligence of the intelligent system determines the degree to which miners participate in information acquisition, information analysis, decision-making, and decision-making in the human-computer interaction process. A higher level of intelligence can provide appropriate support for operators and reduce the workload of operators, thereby effectively balancing the work pressure of miners (60).

### The intervention in the external environment subsystem

Using the control variable method while keeping other variables unchanged, the initial value of the natural environment and operating conditions is increased by 20%. The simulation results are shown in Figure 12. It can be seen from Figure 12 that the effect of each factor on the safety level of the coal mine system is from large to minor: operating conditions and natural environment.

Although operating conditions do not directly influence system security, environmental stimuli interact with the human-machine interaction process and influence miners' ability to complete tasks. A good environment is a prerequisite for miners' safe behavior. To improve the working environment of miners, on the one hand, it is necessary to actively introduce advanced tools and mechanical equipment to improve the safety level of coal mining equipment. On the other hand, it is also possible to increase the level of safe operation of miners by adjusting lighting, reducing noise, and generally improving working spaces (61).

## Conclusion

There is a complex interaction between the factors influencing the safety level of coal mine systems. This paper identifies 22 factors influencing coal mine system safety from five aspects: individual miners, organization and management, group, intelligent system, and environment. The ISM method was used to classify the 22 factors into five levels and to show the interaction relationships between the factors. The results of the ISM show that the individual miner factor is the most direct factor influencing system safety. The organizational management factor and group factor indirectly influence the coal mine system safety by influencing the individual miner, and the intelligent system is the most profound factor influencing the coal mine system safety. Through ANP calculation, the weight of each factor influencing the safety of the coal mine system is determined. The leading indicators are sorted by weight: organizational safety management, individual miners, groups, intelligent systems, and environment.

The mechanism of each influencing factor on the coal mine safety system was clarified. Based on the calculation results of ISM-ANP, the interaction relationship between the factors was clarified. We also constructed the system dynamics

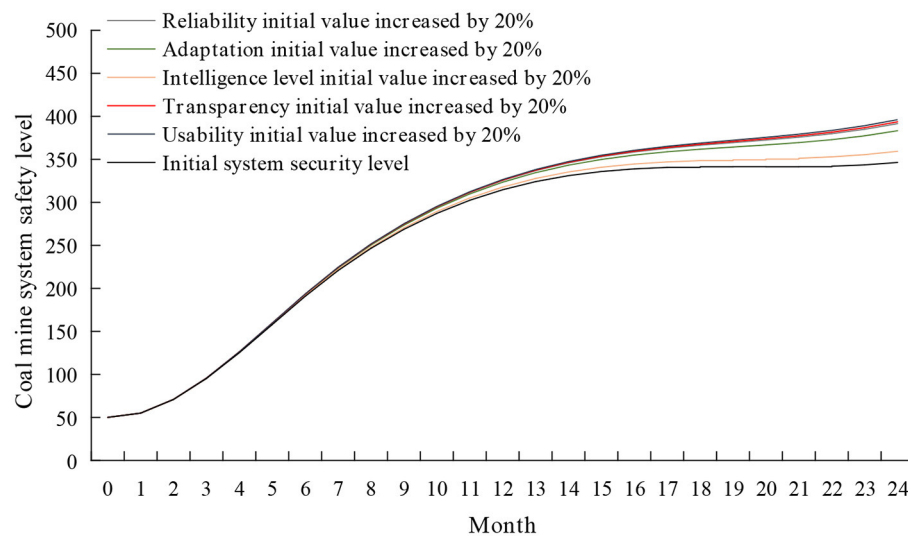


FIGURE 11

Simulation results of coal mine system safety after the intervention of the intelligent system subsystem.

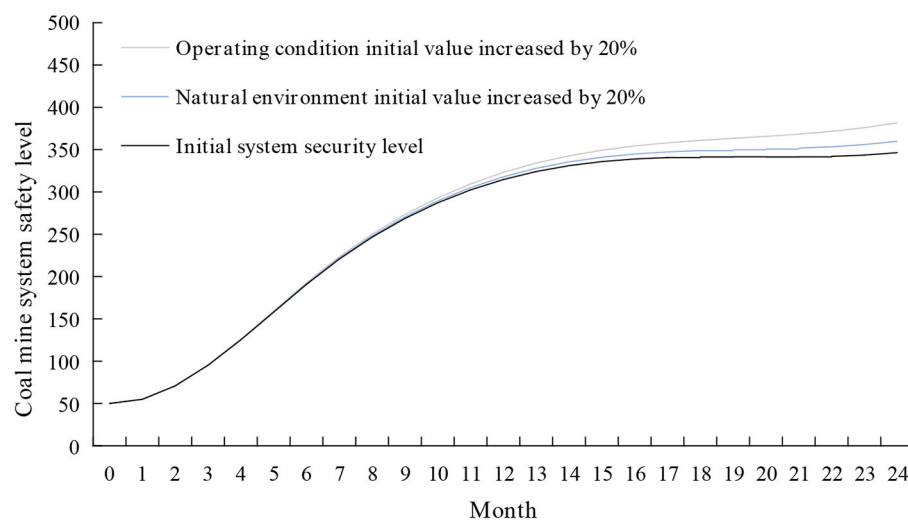


FIGURE 12

Simulation results of coal mine system safety after the intervention of external environment subsystem.

simulation model of the coal mine safety system and clarified the action mechanism of each factor of the safety system. It can be seen from the results that there are apparent differences in the influence of different subsystems on the security level of the system, which is determined by the interaction rules and interaction mechanisms between the systems. The organizational management subsystem has the most significant impact on system security among the five subsystems, followed by the miners' and group subsystems. The intelligent system and environmental subsystem have the most negligible impact on system security. The improvement of

organizational management and group safety level can directly or indirectly influence miners' behavior, increase miners' safety behavior, and effectively promote the improvement of the safety level of the coal mine system. The positive effect of intelligent systems and environmental factors on the safety of coal mine systems is still being determined. However, an excellent operating environment and reliable equipment are the basis for ensuring system safety.

Develop intervention strategies to improve coal mine system safety. According to the simulation results of the model, after adopting different intervention strategies, the safety level of the

coal mine system has increased in different ranges, indicating that the intervention strategy can effectively improve the system's safety level. The factors in each subsystem have different degrees of influence on the safety of the coal mine system, and each subsystem interacts, develops, and changes together. According to the simulation results, this paper proposes targeted intervention strategies from the specific operation level to optimize the coal mine safety management system and improve the system safety level.

## Limitations of the study

According to the ISM-ANP model results, each factor's action mechanism on the coal mine safety system and the importance degree of the factors are clarified. The simulation results of system dynamics have specific reference values for the safety management of the coal mine system. The proposed intervention strategy has guiding significance for the actual coal mine production. However, while getting the above research conclusions, this paper still has some things that could be improved. First, the index system of influencing factors of coal mine safety can be further improved. The indicators of the influencing factors of the coal mine safety system constructed in this paper are determined based on the analysis of the existing influencing factors at home and abroad combined with the actual coal mine safety production at the present stage. However, these studies are not comprehensive, and the follow-up research can be further supplemented and improved by other methods. Secondly, since the ISM-ANP model depends on the decision maker's experience, knowledge, and professional judgment, it is subjective to some extent. Therefore, the actual application of the model may result in different results due to the difference in the personal level of the decision maker. Therefore, more quantitative methods can be considered for subsequent research. Finally, the coal mine safety system is a considerable safety management system. The interaction rules between the model and factors constructed in this paper are simplified compared with the actual situation. There are some differences compared with the complexity of the existing safety system. In future research, the model will continue to be optimized to make the model closer to the actual production situation. The safety strategy explored in this paper will be applied to coal mine safety production.

## Data availability statement

The datasets presented in this article are not publicly available in order to protect the privacy of the respondents. Requests to access the datasets should be directed to KT, [tian6039@126.com](mailto:tian6039@126.com).

## Author contributions

XY and QX contributed to the study's design, data acquisition, data interpretation, model building, manuscript development, and revisions. KT contributed to data acquisition, data interpretation, manuscript development, and revisions. CL and JY contributed to data acquisition and manuscript revisions. All authors approved the final version of the submitted manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Jiskani IM, Cai QX, Zhou W, Lu X. Assessment of risks impeding sustainable mining in Pakistan using fuzzy synthetic evaluation. *Resour Policy*. (2020) 69:13. doi: 10.1016/j.resourpol.2020.101820
- Jiskani IM, Cai QX, Zhou W, Chang ZG, Chalgri SR, Manda E, et al. Distinctive Model of Mine Safety for Sustainable Mining in Pakistan. *Mining Metall Explor*. (2020) 37:1023–37. doi: 10.1007/s42461-020-00207-8
- Carvalho FP. Mining industry and sustainable development: time for change. *Food Energy Security*. (2017) 6:61–77. doi: 10.1002/fes3.109
- Jiskani IM, Silva JMND, Chalgri SR, Behrani P, Lu X, Manda E. Mine health and safety: influence of psychosocial factors on musculoskeletal disorders among miners in Pakistan. *Int J Mining Mineral Eng*. (2020) 11:152–67. doi: 10.1504/IJMMME.2020.108646
- Wang GF, Ren HW, Zhao GR, Zhang DS, Wen ZG, Meng LY, et al. Research and practice of intelligent coal mine technology systems in China. *Int J Coal Sci Technol*. (2022) 9:17. doi: 10.1007/s40789-022-00491-3
- Bai JY, Zheng DZ, Jia C. Safety technology risks and countermeasures in the intelligent construction of coal mines. *Geofluids*. (2022) 2022:8. doi: 10.1155/2022/4491044
- Qiu ZX, Liu QL, Li XC, Zhang JJ, Zhang YQ. Construction and analysis of a coal mine accident causation network based on text mining. *Process Saf Environ Protect*. (2021) 153:320–8. doi: 10.1016/j.psep.2021.07.032
- Chen H, Qi H, Long RY, Zhang ML. Research on 10-year tendency of China coal mine accidents and the characteristics of human factors. *Safety Sci*. (2012) 50:745–50. doi: 10.1016/j.ssci.2011.08.040
- Cheng LH, Guo HM, Lin HF. Evolutionary model of coal mine safety system based on multi-agent modeling. *Process Saf Environ Protect*. (2021) 147:1193–200. doi: 10.1016/j.psep.2021.01.046
- Tubis A, Werbinska-Wojciechowska S, Wroblewski A. Risk assessment methods in mining industry—a systematic review. *Appl Sci Basel*. (2020) 10:34. doi: 10.3390/app10155172
- Wang LL, Cao QG, Zhou LJ. Research on the influencing factors in coal mine production safety based on the combination of DEMATEL and ISM. *Saf Sci*. (2018) 103:51–61. doi: 10.1016/j.ssci.2017.11.007
- Qiao WG, Liu QL, Li XC, Luo XX, Wan YL. Using data mining techniques to analyze the influencing factor of unsafe behaviors in Chinese underground coal mines. *Resour Policy*. (2018) 59:210–6. doi: 10.1016/j.resourpol.2018.07.003
- Zhang YY, Shao W, Zhang MJ, Li HJ, Yin SJ, Xu YJ. Analysis 320 coal mine accidents using structural equation modeling with unsafe conditions of the rules and regulations as exogenous variables. *Accid Anal Prev*. (2016) 92:189–201. doi: 10.1016/j.aap.2016.02.021
- Li M, Wang HT, Wang DM, Shao ZL, He S. Risk assessment of gas explosion in coal mines based on fuzzy AHP and bayesian network. *Process Saf Environ Protect*. (2020) 135:207–18. doi: 10.1016/j.psep.2020.01.003
- Attri R, Dev N, Sharma V. Interpretive structural modeling (ISM) approach: an overview. *Res J Manage Sci*. (2013) 2319:1171. Available online at: <http://www.isca.in/IJMS/Archive/v2/i2/2.ISCA-RJMS-2012-054.php>
- Kaswan MS, Rathi R. Analysis and modeling the enablers of Green Lean Six Sigma implementation using Interpretive Structural Modeling. *J Cleaner Prod*. (2019) 231:1182–91. doi: 10.1016/j.jclepro.2019.05.253
- Etemadinia H, Tavakolan M. Using a hybrid system dynamics and interpretive structural modeling for risk analysis of design phase of the construction projects. *Int J Constr Manag*. (2021) 21:93–112. doi: 10.1080/15623599.2018.1511235
- Kumar S, Raut RD, Nayal K, Kraus S, Yadav VS, Narkhede BE. To identify industry 4.0 and circular economy adoption barriers in the agriculture supply chain by using ISM-ANP. *J Cleaner Prod*. (2021) 293:13. doi: 10.1016/j.jclepro.2021.126023
- Ma H, Wu ZG, Chang P. Social impacts on hazard perception of construction workers: a system dynamics model analysis. *Safety Sci*. (2021) 138:12. doi: 10.1016/j.ssci.2021.105240
- Yu K, Cao QG, Xie CZ, Qu NN, Zhou LJ. Analysis of intervention strategies for coal miners' unsafe behaviors based on analytic network process and system dynamics. *Safety Sci*. (2019) 118:145–57. doi: 10.1016/j.ssci.2019.05.002
- Wang X, Zhang L. A multicriteria decision model based on analytic hierarchy process for managing safety in coal mines. *Geofluids*. (2022) 2022:9. doi: 10.1155/2022/5390249
- Liu RL, Cheng WM, Yu YB, Xu QF. Human factors analysis of major coal mine accidents in China based on the HFACS-CM model and AHP method. *Int J Industrial Ergonomics*. (2018) 68:270–9. doi: 10.1016/j.ergon.2018.08.009
- Fa ZW, Li XC, Qiu ZX, Liu QL, Zhai ZY. From correlation to causality: path analysis of accident-causing factors in coal mines from the perspective of human, machinery, environment and management. *Resour Policy*. (2021) 73:11. doi: 10.1016/j.resourpol.2021.102157
- Bai GX, Xu TL. Coal mine safety evaluation based on machine learning: a BP neural network model. *Comput Intell Neurosci*. (2022) 2022:9. doi: 10.1155/2022/5233845
- Ma JQ, Dai H. A methodology to construct warning index system for coal mine safety based on collaborative management. *Safety Sci*. (2017) 93:86–95. doi: 10.1016/j.ssci.2016.11.012
- Liu JL, Aydin M, Akyuz E, Arslan O, Uflaz E, Kurt RE, et al. Prediction of human-machine interface (HMI) operational errors for maritime autonomous surface ships (MASS). *J Marine Sci Technol*. (2022) 27:293–306. doi: 10.1007/s00773-021-00834-w
- Li S, You MJ, Li DW, Liu J. Identifying coal mine safety production risk factors by employing text mining and Bayesian network techniques. *Process Saf Environ Protect*. (2022) 162:1067–81. doi: 10.1016/j.psep.2022.04.054
- Qiao WG. Analysis and measurement of multifactor risk in underground coal mine accidents based on coupling theory. *Reliabil Eng Syst Safety*. (2021) 208:10. doi: 10.1016/j.res.2021.107433
- Stowers K, Oglesby J, Sonesh S, Leyva K, Iwig C, Salas E. A framework to guide the assessment of human-machine systems. *Human Factors*. (2017) 59:172–88. doi: 10.1177/0018720817695077
- Kari R, Steinert M. Human factor issues in remote ship operations: lesson learned by studying different domains. *J Marine Sci Eng*. (2021) 9:20. doi: 10.3390/jmse9040385
- Zhang Y, Li M, Wang B, Yuan J, Tong R. Developing a taxonomy and a dependency assessment model of performance influence factors for intelligent coal mines. *Process Saf Environ Protect*. (2022) 168:150–65. doi: 10.1016/j.psep.2022.09.061
- Bandura A. Self-efficacy - toward a unifying theory of behavioral change. *Psychol Rev*. (1977) 84:191–215. doi: 10.1037/0033-295X.84.2.191
- Jacoby J. Stimulus-organism-response reconsidered: an evolutionary step in modeling (consumer) behavior. *J Consum Psychol*. (2002) 12:51–7. doi: 10.1207/S15327663JCP1201\_05
- Si SL, You XY, Liu HC, Zhang P. DEMATEL technique: a systematic review of the state-of-the-art literature on methodologies and applications. *Mathematical Problems Eng*. (2018) 2018:33. doi: 10.1155/2018/3696457
- Korner U, Muller-Thur K, Lunau T, Dragano N, Angerer P, Buchner A. Perceived stress in human-machine interaction in modern manufacturing environments-Results of a qualitative interview study. *Stress Health*. (2019) 35:187–99. doi: 10.1002/smi.2853
- Sony M, Mekoth N. Employee adaptability skills for Industry 4.0 success: a road map. *Prod Manuf Res*. (2022) 10:24–41. doi: 10.1080/21693277.2022.2035281
- Munir A, Aved A, Blasch E. Situational awareness: techniques, challenges, and prospects. *AI*. (2022) 3:55–77. doi: 10.3390/ai3010005
- Stanton NA, Chambers PRG, Piggott J. Situational awareness and safety. *Safety Sci*. (2001) 39:189–204. doi: 10.1016/S0925-7535(01)00010-8
- Salmon PM, Plant KL. Distributed situation awareness: from awareness in individuals and teams to the awareness of technologies, sociotechnical systems, and societies. *Appl Ergon*. (2022) 98:8. doi: 10.1016/j.apergo.2021.103599
- Wang X, Meng FB. Statistical analysis of large accidents in China's coal mines in 2016. *Nat Hazards*. (2018) 92:311–25. doi: 10.1007/s11069-018-3211-5
- Vorm ES, Combs DJY. Integrating transparency, trust, and acceptance: the intelligent systems technology model (ISTAM). *Int J Hum-Comput Interact*. (2022) 5:1–18. doi: 10.1080/10447318.2022.2070107
- Parasuraman R, Riley V. Humans and automation: use, misuse, disuse, abuse. *Human Factors*. (1997) 39:230–53. doi: 10.1518/00187209778543886
- Andras P, Esterle L, Guckert M, Han TA, Lewis PR, Milanovic K, et al. Trusting intelligent machines deepening trust within socio-technical systems. *IEEE Technol Soc Mag*. (2018) 37:76–83. doi: 10.1109/MTS.2018.2876107

44. Beller J, Heesen M, Vollrath M. Improving the driver-automation interaction: an approach using automation uncertainty. *Hum Factors*. (2013) 55:1130–41. doi: 10.1177/0018720813482327
45. Gebru B, Zeleke L, Blankson D, Nabil M, Nateghi S, Homaifar A, et al. A review on human-machine trust evaluation: human-centric and machine-centric perspectives. *IEEE T Hum Mach Syst*. (2022) 52:952–62. doi: 10.1109/THMS.2022.3144956
46. Korber M, Baseler E, Bengler K. Introduction matters: manipulating trust in automation and reliance in automated driving. *Appl Ergon*. (2018) 66:18–31. doi: 10.1016/j.apergo.2017.07.006
47. Wang YX, Fu G, Lyu Q, Wu YL, Jia QS, Yang XY, et al. Reform and development of coal mine safety in China: an analysis from government supervision, technical equipment, and miner education. *Resour Policy*. (2022) 77:14. doi: 10.1016/j.resourpol.2022.102777
48. Khastgir S, Birrell S, Dhadyalla G, Jennings P. Calibrating trust through knowledge: introducing the concept of informed safety for automation in vehicles. *Transp Res Pt C Emerg Technol*. (2018) 96:290–303. doi: 10.1016/j.trc.2018.07.001
49. Wang C, Wang JK, Wang XH, Yu H, Bai L, Sun Q. Exploring the impacts of factors contributing to unsafe behavior of coal miners. *Safety Sci*. (2019) 115:339–48. doi: 10.1016/j.ssci.2019.02.003
50. Cheng LH, Guo HM, Lin HF. The influence of leadership behavior on miners' work safety behavior. *Safety Sci*. (2020) 132:7. doi: 10.1016/j.ssci.2020.104986
51. Zhao Y, Zhang MG, Liu T, Mebarki A. Impact of safety attitude, safety knowledge and safety leadership on chemical industry workers' risk perception based on structural equation modelling and system dynamics. *J Loss Prevent Process Industries*. (2021) 72:14. doi: 10.1016/j.jlp.2021.104542
52. Yang L, Birhane GE, Zhu JQ, Geng JC. Mining employees safety and the application of information technology in coal mining: review. *Front Public Health*. (2021) 9:12. doi: 10.3389/fpubh.2021.709987
53. Yu M, Li JZ. Psychosocial safety climate and unsafe behavior among miners in China: the mediating role of work stress and job burnout. *Psychol Health Med*. (2020) 25:793–801. doi: 10.1080/13548506.2019.1662068
54. Bennett-Levy J, Lee NK. Self-practice and self-reflection in cognitive behaviour therapy training: what factors influence trainees' engagement and experience of benefit? *Behav Cognit Psychther*. (2014) 42:48–64. doi: 10.1017/S1352465812000781
55. Maass U, Kuhne F, Hahn D, Weck F. Group cohesion in group-based personal practice. *Behav Cognit Psychther*. (2022) 50:28–39. doi: 10.1017/S1352465821000369
56. Leitmo K, Vesto HSB, Bakali JV, Nissen-Lie HA. The role of attachment anxiety and avoidance for reduced interpersonal problems in training group analytic therapy. *Group Dyn Theory Res Pract*. (2020) 24:26–41. doi: 10.1037/gdn0000112
57. Zhang JS, Fu J, Hao HY, Fu G, Nie FC, Zhang WY. Root causes of coal mine accidents: characteristics of safety culture deficiencies based on accident statistics. *Process Saf Environ Protect*. (2020) 136:78–91. doi: 10.1016/j.psep.2020.01.024
58. Schmidt P, Biessmann F, Teubner T. Transparency and trust in artificial intelligence systems. *J Decis Syst*. (2020) 29:260–78. doi: 10.1080/12460125.2020.1819094
59. Chavallaz A, Wastell D, Sauer J. System reliability, performance and trust in adaptable automation. *Appl Ergon*. (2016) 52:333–42. doi: 10.1016/j.apergo.2015.07.012
60. Piechulla W, Mayser C, Gehrke H, König W. Reducing drivers' mental workload by means of an adaptive man-machine interface. *Transport Res Part F Traffic Psychol Behav*. (2003) 6:233–48. doi: 10.1016/j.trf.2003.08.001
61. Liu RL, Cheng WM, Yu YB, Xu QF, Jiang AW, Lv T. An impacting factors analysis of miners' unsafe acts based on HFACS-CM and SEM. *Process Saf Environ Protect*. (2019) 122:221–31. doi: 10.1016/j.psep.2018.12.007



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# How exaptation mediates the effects of customer participation on low-cost innovation: The role of strategic flexibility

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With the advent of emerging markets, the need for low-cost innovation to meet the rising demands of people at the base of the pyramid has increased significantly. Although the critical influence of customer participation on new product development has been recognized, there have been few studies on the effects of customer participation on low-cost innovation. This study builds a moderated mediation model and explores the roles of customer participation on low-cost innovation. Based on the exaptation and strategic flexibility theories, the mediating role of exaptation and the moderating role of strategic flexibility are emphasized. A survey of 348 firms revealed that customer participation positively impacted both exaptation and low-cost innovation. In addition, exaptation mediated the correlation between customer participation and low-cost innovation. Resource flexibility negatively moderated the correlation between customer participation and exaptation and negatively moderated the mediating effect of exaptation. Furthermore, coordinate flexibility positively moderated the correlation between customer participation and exaptation and positively moderated the mediating effect of exaptation.

## KEYWORDS

customer participation, exaptation, low-cost innovation, coordinate flexibility, resource flexibility

## Introduction

Innovation warrants the continuous investment of resources. Even companies in the USA and Europe have a product innovation success rate of only 5–10%. Thus, many of the world's top 500 enterprises, such as GM and Panasonic, have altered their innovation models to fulfill users' needs at the bottom of the pyramid in emerging markets through low-cost innovation (Zhu and Chen, 2014). Hence, realizing low-cost innovation characterized by shorter time, lower cost, and lower risk has become a crucial strategic choice to address the problems of insufficient supply, weak consumption capacity, and the pursuit of cost-effective products and services in emerging markets. The role and value of customer participation in innovation have been increasingly recognized, seen in the proposal

of consumption-centered innovation theory and the transformation of the innovation paradigm of a single subject centered on the enterprise to open innovation of multiple subjects, especially the transformation from product-led logic to service-led logic. The establishment of offline experience stores by Apple, Huawei, Xiaomi, and other companies and the actions of Dell, P&G, Haier, amongst others, to build interactive virtual communities reflect the significant contribution of customer participation to enterprise innovation. Customer participation can provide innovation sources, demand preference, and correction suggestions for market-oriented product innovation (Zhang and Liao, 2020), weakening information asymmetry and transaction costs, and saving innovation costs. Conversely, customer participation can be embedded in product design, R&D, manufacturing, and marketing (Lin and Huang, 2013; Liu et al., 2020), improving product market matching and decreasing the risk of innovation failure. Accordingly, customer participation could be a feasible path for low-cost innovation. However, there is little comprehensive discussion on the topic in the literature.

A comprehensive analysis of the correlation between customer participation and low-cost innovation requires an exploration of the mediating mechanism and situational conditions of the correlation between them. Exaptation is a concept from evolutionary biology that can be applied as a reverse innovation mechanism for the creation of markets from products and finding answers before looking for problems. However, although this paradigm of innovation through the transfer of product functions often occurs in the process of product innovation, it has received little attention (Ren et al., 2019). Per Dew et al., (2004), Ganzaroli and Pilotti, (2011), Andriani et al., (2017), specifically, the roles of customer innovation and consumer feedback as positive driving forces for exaptation. Customers not only contribute relevant market information but also provide an extended forum for the interaction between customers and enterprises. Exaptation closely correlates with customer participation. In addition, exaptation contributes significantly to innovation, which is more likely to create low-cost innovation, even producing significant changes or opening up a new market (Ren et al., 2019). Thus, investigating the mechanisms through which customer participation drives low-cost innovation from the viewpoint of exaptation will help to elucidate the “black box” of the relationship between customer participation and low-cost innovation. In contrast, the information and knowledge obtained through customer participation, such as demand preference, cognition, evaluation, and innovative ideas, should be effectively integrated into the exaptation process to indirectly promote low-cost innovation, allowing enterprises to survive and grow in a complex, changeable, uncertain, and unpredictable environment. In this case, the identification, evaluation, absorption, and application of customer information, as well as the ability of enterprises to reconstruct resources, capabilities, business processes, and strategies, determine the circumstances in which customer participation can exert a significant indirect impact on low-cost innovation (Zhang and Chen, 2014; Li and Gao, 2017). In a transition economy, the

strategic flexibility of an organization, balancing internal and external needs, responding to environmental changes and allowing the flexible allocation and reconfiguration of organizational resources, processes, and strategies (Sanchez 1995; Hu and Yu 2017), allows the incorporation of information and ideas derived from customer participation into exaptation, thereby promoting internal product R&D, technology, and knowledge innovation. Hence, research on customer participation-driven low-cost innovation and strategic flexibility will elucidate the mediating mechanism of exaptation and determine the moderation mechanism of customer participation affecting low-cost innovation.

The academic value of this study is primarily reflected in the following: (i) the study discusses the creation of low-cost innovation from a new perspective. Current research has largely focused on investigating low-cost innovation in terms of intellectual capital, innovation networks, and resource bricolage, with a limited investigation of the effects of customer participation. In addition, this study demonstrates a positive correlation between customer participation and low-cost innovation, thus contributing to existing knowledge and future research into low-cost innovation. (ii) Based on the exaptation theory, this study examines the mediating role of exaptation between customer participation and low-cost innovation. The previous literature has not explored the mechanism mediating the relationship between customer participation and low-cost innovation. Thus, this study introduces the exaptation variable, demonstrating that customer participation could improve low-cost innovation through exaptation, further enriching the new idea of the correlation between customer participation and low-cost innovation. (iii) This study integrates strategic flexibility into the theoretical model of customer participation and low-cost innovation, discusses the moderating role of strategic flexibility, and explores the boundary conditions of customer participation affecting low-cost innovation.

## Theoretical background

Low-cost innovation describes the use of various methods by enterprises to realize innovation in a low-cost manner and decrease costs through innovation (Tang et al., 2022). Low-cost innovation is realized through specialization, imitation learning, R&D, design innovation, technological innovation, and diffusion (Chen and Ren, 2011). Other studies have highlighted that low-cost innovation embodies comprehensive innovation efficiency based on transforming and integrating traditional management elements, such as technology, design, market, and organization. Its essence is to fulfill the value needs of customers faster and more effectively. Moreover, it is an innovative model with comparative advantages within the homogeneous industrial market. In addition, low-cost innovation is not a low-resource investment in an absolute sense but an innovation process characterized by low financial and time costs, as well as a low market risk compared with competitors (Cai et al., 2014). Several



previous studies have investigated mechanisms associated with low-cost innovation from different angles. At the qualitative research level, [Hou and Zhang \(2013\)](#) examined the mechanism of low-cost innovation, including the use of embedded networks, resource absorption, and emergent innovation, from the viewpoint of a resource view. [Chen and Chen \(2013\)](#) analyzed the formation of low-cost innovation from the strategic level, including the demands of enterprise innovation practice and the theory of endogenous comparative advantage to support the evolution of low-cost innovation. [Suneel \(2018\)](#) claimed that technology diffusion-oriented policies and weak industry-university linkages play a vital role in low-cost innovation from the standpoint of the industry-university research. At the empirical research level, [Zhu and Chen \(2014\)](#), [Zha et al. \(2015\)](#), [Shi and Su \(2018\)](#), and [Tang et al. \(2022\)](#) investigated the creation of low-cost innovation from the viewpoints of innovation networks, learning from failures, knowledge management, intellectual capital, and resource bricolage. Clearly, the realization of low-cost innovation has become a significant issue in academic circles.

Academics have interpreted the concept of customer participation from different viewpoints. From the standpoint of resources, some studies proposed that customer participation is realized by investing different resources into the products or services ([Kelley et al., 1990](#)). From the behavior perspective, several studies also claimed that customer participation denotes a type of behavior involvement of customers in the process of product design, development, production, and delivery ([Chi et al., 2012](#)), which exists in the continuous interaction between employees and customers ([Li and Hsu 2018](#)). From the value creation perspective, other studies defined customer participation as any form of customer participation in service value creation ([Yi et al., 2011](#)). In comparison, the definitions of [Yao and Wang \(2012\)](#) are more comprehensive and specific, defining customer participation in terms of enterprise involvement of customers in various ways during the development of new products. Customers not only provide new ideas about products but can also design and develop new products in association with enterprises and can even take the lead in testing and using new products. Current research has demonstrated the importance of customer participation in product innovation, new product development, and dual innovation through information exchange, and this participation in the creation and collaborative cooperation has generally been recognized by the academic community ([Yao and Wang 2011](#); [Cees and Fardad 2014](#); [Liu et al., 2020](#); [Zhang and Cai 2020](#); [Sun et al., 2022](#); [Tian et al., 2022](#)). A close correlation exists between customer participation and enterprise innovation; however, the existing literature lacks research on the correlation between customer participation and low-cost innovation. In situations of economic transformation, an understanding of the ways in which customer participation impacts and influences the path of low-cost innovation is key.

Schumpeter claimed that innovation involves new products, new processes, and the application of existing technologies in new fields ([Li 2005](#)). Existing research has systematically

discussed new products and processes; however, the application of the existing technologies in new fields, that is, the phenomenon of exaptation, has received little attention ([Ren et al., 2019](#)). The concept of exaptation originates from evolutionary biology, and [Mokyr \(2000\)](#) first introduced exaptation into management, interpreting it as “the unexpected success of a technology used in another field.” Subsequently, [Gregory \(2008\)](#) considered exaptation to denote existing components, which initially had no or additional functions, rearranged and combined into a new, more complex form, giving them new functions. [Arthur \(2007\)](#) explained exaptation as when a new environment appears, or new requirements appear in an application field, the old technology or old basic principles are used to adapt to the new environment through “extension.” In addition, [Ganzaroli and Pilotti \(2011\)](#) described exaptation in terms of the exploitation of the availability of existing functions to perform a new function or select an environment to stimulate their potential. Drawing on these researchers’ viewpoints, this study holds that exaptation denotes the process that existing products and technologies have new functions through the application of new fields and new environments, or through integration and reconstruction. Existing studies have demonstrated that as an innovation method with situational characteristics, exaptation plays a key driving role in enterprise technological innovation, produces major changes in a specific field, creates a new technology track, or opens up a new industry, and can provide innovation power and support for the long-term sustainable development of enterprises ([Ren et al., 2019](#)). Undeniably, exaptation is an unexpected result, with some luck factors; however, it can also increase the probability of exaptation through the influence of enterprise level ([Ren et al., 2019](#); [Li et al., 2021](#)). For example, enterprises can stimulate exaptation through three links—expansion pool, expansion activities, and expansion forum ([Garud et al., 2018](#))—and improve the likelihood of exaptation by accumulating diversified knowledge and enhancing the ability to seize opportunities ([Dew et al., 2004](#); [Andriani et al., 2017](#)). Other studies demonstrated that purposeful research and coincidence triggered exaptation and discussed the feasibility of applying exaptation to drug emergency research and development ([Li et al., 2022](#)). Customer innovation is a critical factor in the antecedent research on exaptation. Research has shown that customers may discover many paths to exaptation, and customer participation closely correlates with exaptation because customers can modify existing products based on their experience, psychological framework, educational background, and other subjective judgments, or use them in a way with novel functions, resulting in exaptation ([Andriani et al., 2017](#)). [Ganzaroli and Pilotti \(2011\)](#) highlighted that linking the existing knowledge system with customer needs and realizing the two-way interaction between producers and customers is helpful to realize exaptation. The research logic of exaptation-driven innovation from the standpoint of customer participation remains unclear, and there is a lack of empirical research, which still warrants further investigation.



Katsuhiko and Hitt (2004) claimed that strategic flexibility denotes the ability of enterprises to identify changing factors in the environment and quickly invest resources in the new environment. Sanchez (1995) further divided strategic flexibility into resource flexibility and coordination flexibility. Resource flexibility denotes the flexibility of resources owned by enterprises, which is reflected in the multi-purpose, shareability, and convertibility of enterprise resources. Coordination flexibility is reflected in organizations' ability to share, transform, and network resources. Existing studies have reported that strategic flexibility not only exerts a positive predictive impact on product innovation (Yang et al., 2016; Feng and Liu 2021), strategic innovation, management innovation (Han and Gao 2017), strategic change (Chen et al., 2018), and competitive advantage (Xu 2021) but also a certain moderating effect on innovation and other related outcome variables. Ye et al., (2015) reported that strategic flexibility could moderate the correlation between knowledge heterogeneity and enterprise innovation performance. Li and Gao (2017) explored the moderating effect of strategic flexibility on the correlation between knowledge-sharing and cooperative original innovation. Li et al., (2018) pointed out that strategic flexibility increases the impact of environmental scanning on dual innovation. This study introduces strategic flexibility into the theoretical model and discusses the moderation mechanism of customer participation driving low-cost innovation from the viewpoint of resource flexibility and coordination flexibility.

Although the studies mentioned above have obtained good theoretical results, some problems still warrant further discussion. (i) Most studies have fully explored the role of customer participation in driving product innovation, technological innovation, and other outcome variables. Low-cost innovation, specifically, as a crucial form of innovation, merits further investigation in terms of its relationship with customer participation. (ii) Previous studies have investigated the mechanism linking customer participation, product development, and dual innovation from the viewpoints of information-sharing (Yao and Wang 2011), correlation-embedding (Yao and Wang 2012), organizational learning (Yao et al., 2015), and pressure (Liu et al., 2020). Introducing exaptation into the theoretical framework of the correlation between customer participation and low-cost innovation and elucidating the way in which exaptation mediates the relationship between them is worth investigating. (iii) Previous studies have paid little attention to moderation of the correlation between customer participation and low-cost innovation. This study analyzes both the nature of this relationship and changes in its strength in terms of strategic flexibility, which would help to make up for the lack of research on the moderating mechanism between customer participation and low-cost innovation. Accordingly, to make up for limitations in current research, this study introduces two variables, namely, strategic flexibility and exaptation, and constructs a moderated mediation model, together with an examination of the mechanism underlying the impact of customer participation on low-cost innovation. First, the study discusses the impact of customer participation on

low-cost innovation. Second, it analyzes the mediating role of exaptation between customer participation and low-cost innovation. Third, strategic flexibility is introduced as a moderator of the correlation between customer participation and low-cost innovation. This study not only investigates the internal logic and situational mechanism of customer participation affecting low-cost innovation but also provides new insights into China's manufacturing enterprises to implement the path of low-cost innovation.

## Hypotheses

### Customer participation and low-cost innovation

As a crucial knowledge source of technological innovation, customer participation can be understood as the degree to which customers are involved in activities involved in the development of new products, reflecting customers' innovative wisdom, creativity, and innovative value (Fang 2008). It can not only provide information on consumer preferences, market demands, and development opportunities, decrease "information stickiness," reduce market mismatch risk, and enhance the likelihood of successful innovation (Zhang and Liao 2020) but can also establish a means for collaborative innovation and development between enterprises, which is helpful to promote market-oriented technological innovation as well as improving innovation and the development of new products.

Customer participation can not only contribute novel and creative ideas to product innovation but can also lead to the development of new products with low financial and time investments and low market risk (Lin and Huang 2013). Füller et al., (2006) highlighted that customers could provide enterprises with high-quality problem solutions or innovative ideas and creative suggestions, markedly decreasing the market risk of innovation. Tao et al., (2019) and Zhang and Cai (2020) showed that customers could become involved in the product development process by generating creative ideas, designs, and development, as well as through product testing, both online and offline, thus reducing the cost of information acquisition and transfer through rapid and efficient information exchange, transmission, and sharing, which has the characteristics of "learning by doing" and "trial and error," to improve the success rate of innovation and decrease the cost of innovation and time to market. Zhang and Liao (2020) claimed that customers participating in R&D provide enterprises with demand, design, evaluation, and other information, which decreases the information asymmetry between enterprises and customers. Meanwhile, enterprises and customers are integrated into the product innovation process, which can develop new products at low cost in the shortest time and shorten the commercial application cycle of new products. Accordingly, we hypothesize that:

*H1: Customer participation exerts a significant positive impact on low-cost innovation.*

*H2: Customer participation exerts a significant positive impact on exaptation.*

## Mediation effect of exaptation

As a crucial source of innovation, exaptation involves not only the interaction of elements, such as the accretion of diversified knowledge, construction of innovative culture, and organizational structure convenient for open innovation but is also an innovation model requiring customer participation. Cees and Fardad (2014) highlighted that enterprises not only absorb, integrate, and apply their diversified knowledge and give play to their creativity through customer participation in the innovation process but also promote the commercialization process of innovation activities faster and more economically. This study claims that the impact of customer participation on exaptation can be summarized into two aspects: ① the role of information supply. Customers can modify existing products through their subjective judgment or use them in novel ways to fulfill specific needs. When these needs emerge from the mixture of personal experience, psychological framework, education, and other activities, they create a new environment, which leads to exaptation (Andriani et al., 2017). In the 1990s, based on customer feedback, Haier rapidly launched washing machines with functions such as washing sweet potatoes, fruits, and clams, and there are cases in the software market where users modified existing software to solve specific problems, illustrating the mechanism through which customers proposed new ideas and additional requirements through product prototype experience to promote exaptation. It is necessary to connect the existing knowledge system with possible new fields and new needs (Ganzaroli and Pilotti 2011); that is, customer participation can activate this specific knowledge and technologies through its unique ability to transfer knowledge, increasing the likelihood of new applications of existing products or technologies (Tian et al., 2022). ② The significance of value creation. Huikkola et al., (2013) showed that when customers cooperate with enterprises in R&D, they tend to be involved in the lifecycle of innovation activities, contributing human capital, enhancing subjective initiative and creativity, and performing organizational learning and knowledge-sharing activities to enhance novel applications of existing products and technologies. In addition, the discovery of new uses for the product and changing its functional modules can lead to exaptation. For example, laughing gas was initially used for entertainment and was later used in the medical field, an example of customer participation in innovation (Ren et al., 2019). As shown by Yao et al., (2015), customer participation in innovation leads to more frequent interaction between personalized customer needs and enterprise technology, enabling expansion and a knowledge reserve, and possible application opportunities for exaptation through situational mechanisms (Andriani et al., 2017). Accordingly, we hypothesize that:

Exaptation has the advantages of faster speed, lower cost, and less risk, promoting low-cost innovation, and even opening a new technology track at low cost (Ren et al., 2019; Li et al., 2021). First, the development of existing resources (e.g., technologies and products) can save financial costs. Exaptation demonstrates that can use existing products and technologies for low-cost innovation (Mitsuru and Tomoatsu 2014). Exaptation can decrease the cost of new product development and new technology acquisition. In contrast, unlike new products, new processes, and other innovations, exaptation allows the functional transfer of existing products or the successful application of existing technologies in new fields. Mining or extracting the potential value of existing technology is often much cheaper than developing new products for a new function. Second, as a reverse innovation method (scheme precedes problem), exaptation is a crucial strategic tool for the execution of low-cost innovation. Enterprises can dynamically couple the current reserves of knowledge and technology with external environmental opportunities through exaptation, actively adapt to the market environment, and match new market opportunities, decreasing the market risk of product innovation. In addition, Andriani et al., (2017) explored exaptation in the pharmaceutical industry, reporting that each drug has 2.2 new functions, one of which is also highly innovative. In other words, each product contains potential options that can be transformed into new markets. The cultivation of shadow options expands the product's versatility (Cattani 2006; Li et al., 2021), decreases the R&D risk, and provides the possibility and feasibility for low-cost innovation. Accordingly, we hypothesize that:

*H3: Exaptation exerts a significant positive impact on low-cost innovation.*

According to Hypotheses 2 and 3, this study believes that customer participation can act on low-cost innovation through exaptation; that is, exaptation mediates the correlation between customer participation and low-cost innovation. Specifically, as a key innovation model, exaptation effectively links the correlation between customer participation and low-cost innovation. Frequent interactions between enterprises and customers can develop extensive, unique, and heterogeneous knowledge resources, augment the knowledge base of enterprises, and help to combine the existing knowledge system with possible new fields, as well as the prediction of new environments where adaptation is possible (Ren et al., 2019). Moreover, customer information can help enterprises identify market demand and market opportunities (Sun et al., 2022), thereby helping to apply scientific discoveries in novel ways and new environments. In contrast, exaptation is often more economical than deliberately developing a new product by tapping the potential value of an enterprise's product or technology, that is, it saves the innovation cost between customers

and enterprises, curtails the process of customers participating in low-cost innovation, and then increases the speed of product innovation (Zhang and Liao 2020). In addition, as Cattani (2006) highlighted, exaptation provides a new tool for enterprise innovation, namely, the “shadow option.” When the accrued knowledge of the enterprise and the appropriate situation induce the transfer of function, the shadow option may develop into the actual value of the enterprise. In terms of the “shadow option,” building a mixed organization of customers and enterprises can identify shadow options more quickly, promote the two-way interaction between enterprises and customers, have extra space to develop unexpected new models, and decrease R&D risks, thereby providing the possibility for low-cost innovation. As described by Peng et al., (2011), to perform product innovation in the fields of high-end CNC machine tools and all-motor CNC systems, the Haitian Group specifically utilized customer information and knowledge on market demands and development trends, revitalizing some of the company’s existing technical assets (expansion adaptation), and developed market-leading technical service solutions (low-cost innovation) with low time and financial costs. Hence, customer participation indirectly affects low-cost innovation *via* exaptation. Accordingly, we hypothesize that:

*H4: Exaptation mediates between customer participation and low-cost innovation.*

## The moderating effect of strategic flexibility

The realization of customer participation-driven exaptation requires mechanisms to stimulate function transfer to promote low-cost innovation. Strategic flexibility is a situational variable connecting inside and outside and denotes the ability of enterprises to quickly identify crucial changes in the external environment and respond, adjust strategic decisions, and put resources into new schemes (Sanchez 1995; Li and Gao 2017). The concept included both resource and coordination flexibility. Resource flexibility aims to expand the application scope of resources and tap their potential uses to increase the choice of enterprises when the environment changes. Coordination flexibility reflects a firm’s ability to use resources effectively, emphasizing its ability to define, build, and integrate existing resources to support enterprise strategy.

Although resource flexibility has the advantage of enhancing the diversified use of existing resources to enhance the ability to cope with the environment, the view of “resource is commitment,” as proposed by Kraatz and Zajac (2001), often produces the result of strategic “locking,” which makes it challenging for enterprises to identify distant opportunities for exaptation from customer participation in innovation (Ren et al., 2019). The “capability trap” created by resource flexibility makes enterprises more inclined to

stick to existing resources, hinders the acquisition, learning, absorption, and utilization of new knowledge, such as external market demand, and weakens the process of customer participation-driven exaptation. In addition, when enterprises are faced with the challenge of using only their own products and technologies for exaptation, further developmental opportunities should be found within both developmental trends in the industry and changes in market demand (Zhang and Liao 2020).

Coordination flexibility applies resources to new fields by identifying the direction of resource allocation, followed by reconstruction and determination of the use of resources (Hu and Yu 2017) to promote the realization of customer participation-driven exaptation. Coordination flexibility focuses on the compound innovation of existing knowledge, products, and technologies, allowing the acquisition of distant development opportunities through customer participation, enhancing the ability to tap the diversified uses of existing products and technologies, and expanding new resource applications (Li et al., 2021), and thus promoting exaptation. In contrast, coordination flexibility augments the organizational learning and absorption ability, promotes enterprises to better understand and absorb the demand information from front-end customers, and through the integrated application of existing resources and customer knowledge resources (Jiang et al., 2022), promotes the interactive coupling among existing products, technologies, and new needs, identifies and seizes opportunities to support the realization of exaptation, to increase the probability of successful implementation of exaptation. Hence, we hypothesize the following:

*H5a: Resource flexibility negatively moderates the correlation between customer participation and exaptation.*

*H5b: Coordination flexibility positively moderates the correlation between customer participation and exaptation.*

Based on the previous hypothesis, strategic flexibility (resource flexibility and coordination flexibility) moderates the correlation between customer participation and exaptation, and exaptation plays a mediating role between customer participation and low-cost innovation. This study further deduces that strategic flexibility (resource flexibility and coordination flexibility) moderates the mediating role of exaptation, creating a moderated mediation model. Specifically, customer participation can drive low-cost innovation through exaptation; however, the indirect effect of customer participation on low-cost innovation closely correlates with strategic flexibility (resource flexibility and coordination flexibility). Under high resource flexibility, the firm’s fixed thinking and organizational inertia play a leading role in innovation. Resource flexibility weakens the probability that customers’ new demands and opportunities merge with the firm’s internal knowledge to produce the function transfer of products or technologies,

thereby inhibiting the indirect effects of customer participation and low-cost innovation. Under high coordination flexibility, the ability of the enterprise to allocate and reconfigure resources plays a key role in innovation. Coordination flexibility enhances the development opportunities for customers and promotes the likelihood of the application of existing products in new fields, thereby strengthening the indirect correlation between customer participation and low-cost innovation. That is, coordination flexibility increases the indirect effect of customer participation transmitted to low-cost innovation through exaptation, and resource flexibility weakens the indirect effect of customer participation transmitted to low-cost innovation through exaptation. Thus, we hypothesize the following:

*H6a:* Resource flexibility negatively moderates the mediating role of exaptation between customer participation and low-cost innovation.

*H6b:* Coordination flexibility positively moderates the mediating role of exaptation between customer participation and low-cost innovation.

Figure 1 shows the theoretical framework.

## Data and methods

### Sample data collection

A questionnaire survey method was used to obtain the sample data, and the hypotheses were tested by investigating the managers and technicians engaged in product innovation and industry-university research cooperation in China's manufacturing enterprises. A questionnaire survey was conducted on Shanxi, Jiangsu, Shanghai, Henan, and Hebei manufacturing enterprises. We obtained sample data on customer participation, exaptation, strategic flexibility, and product innovation. Specifically, a total of 450 survey

questionnaires were distributed, of which 374 sample data were collected, and 26 invalid questionnaires containing incomplete answers and logical errors, were excluded. Finally, 348 valid questionnaires were obtained. Our sample comprised the industry including textile and clothing (18.10%), food processing (28.16%), pharmaceutical manufacturing (34.77%), and others (18.96%); the age of the enterprise was 5–15 years (14.37%), 16–30 years (70.40%), >30 years (15.23%); the nature of ownership included state-owned enterprises (51.72%), private enterprises (21.26%), foreign-funded enterprises (3.45%), collective enterprises (7.76%), and other enterprises (15.80%); the scale of enterprises included ≤300 people (3.16%), 300–1,000 people (10.63%), 1,000–2,000 people (19.83%), 2,000–3,000 people (53.74%), and >3,000 people (12.64%).

## Measures

### Customer participation

We drew on the research design of Fang (2008), Yao et al., (2015), and Zhang and Cai (2020), and modified the scale in combination with the situation in this study. Finally, the scale was measured with six items: “customer participation or involvement is very important to research and development activities.”

### Exaptation

Exaptation was measured with a three-item scale developed by Tang et al., (2022), such as “A technology of the enterprise has been successfully applied in another field.”

### Strategic flexibility

We drew on the research design described by Sanchez (1995) combined with features unique to this study to modify the measurement items, and finally determined two dimensions, namely, resource flexibility and coordination flexibility. Resource flexibility had three measurement items, while coordination flexibility had four measurement items. For example, “enterprises can effectively deal with resource usage issues in a dynamic environment.”

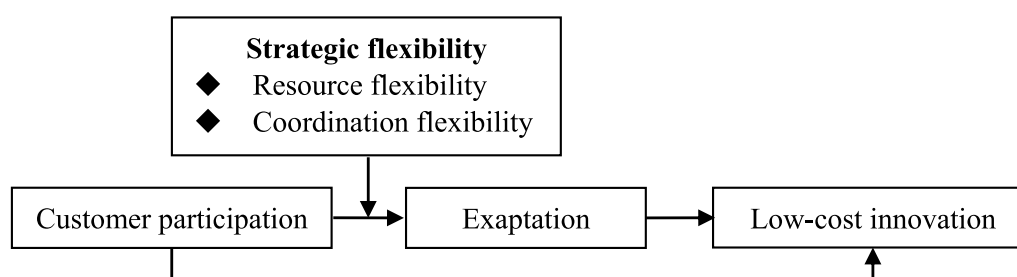


FIGURE 1  
Theoretical model.



## Low-cost innovation

Low-cost innovation was measured with a four-item scale developed by Shi and Su (2018). For example, “enterprises develop new products and services in a low-cost manner.”

The previous literature has shown that enterprise characteristic variables could influence product innovation, including enterprise age, enterprise size, enterprise nature, and industry distribution (Xu et al., 2016; Hu and Yu 2017). Thus, these variables were controlled in this study.

## Results

### Reliability, validity, and common method bias

Using Cronbach  $\alpha$  to test the reliability, we observed that the Cronbach  $\alpha$  coefficients of customer participation, exaptation, resource flexibility, coordination flexibility, and low-cost innovation were 0.823, 0.758, 0.678, 0.719, and 0.741, respectively, suggesting that the scale had good reliability (Table 1). In addition, the standardized factor loading coefficients of all latent variables were  $>0.5$ , and the square root of the average variance extraction (AVE) value of all variables was more significant than the correlation coefficient with other variables (Table 2), suggesting that the research scale had a good level of validity. Meanwhile, using AVE as a convergence validity test tool, the AVE values of customer participation, exaptation, resource flexibility, coordination flexibility, and low-cost innovation were 0.648, 0.750, 0.608, 0.610, and 0.507, respectively, all  $>50\%$ , suggesting that the main variables had good convergence validity. Moreover, we used the Harman method to test the homologous deviation, showing that the first factor explained 34.155% of the variation without rotation, which was  $<50\%$  of the statistical requirements, indicating no significant common method deviation in the data.

### Descriptive statistics and correlation coefficient

According to the correlation test results (Table 2), customer participation was positively correlated with low-cost innovation, and the rationality of H1 could be preliminarily judged. A positive correlation was observed among customer participation, exaptation, and low-cost innovation. This suggests that exaptation might play a mediating role between customer participation and low-cost innovation, suggesting the rationality of hypotheses 2–4. In addition, a significant correlation was noted among strategic flexibility (resource flexibility and coordination flexibility), exaptation, and low-cost innovation, providing a basis for future empirical research. In addition, variance inflation factors (VIF) greater

than 10 suggest a collinearity problem. As shown in Table 2, the VIFs between customer participation, exaptation, resource flexibility, coordination flexibility, and low-cost innovation were 1.621, 1.621, 1.551, and 1.975, respectively. The variance inflation factors (VIF) of the variables in Table 2 were much less than 10, indicating that there was no serious multicollinearity between the variables in this paper.

### Mediating effect test

A hierarchical linear regression method was used for hypothesis testing; Table 3 shows the detailed results. Specifically, model 2 examined the impact of customer participation on low-cost innovation, showing that customer participation had a significant positive impact on low-cost innovation ( $\beta = 0.580$ ,  $p < 0.001$ ), thereby verifying H1. Model 1 tested the effect of customer participation on exaptation, showing that customer participation had a significant positive impact on exaptation ( $\beta = 0.490$ ,  $p < 0.001$ ), thereby verifying H2. Model 3 tested the impact of exaptation on low-cost innovation. The regression results showed that exaptation had a significant positive impact on low-cost innovation ( $\beta = 0.492$ ,  $p < 0.001$ ), thereby verifying H3. A significant regression coefficient for customer participation in low-cost innovation was obtained in model 4 after the addition of the ( $\beta = 0.446$ ,  $p < 0.001$ ), and the absolute value of the regression coefficient was smaller than the regression coefficient of customer participation in low-cost innovation in model 2. This showed that exaptation partially mediated the effect of customer participation on low-cost innovation, thereby verifying H4.

We also used bootstrap sampling (bootstrap sample size = 2000) to generate the asymmetric confidence interval (CI) for indirect relationships. The results showed that the mediating effect of exaptation was 0.127, and 95% CI was [0.060, 0.216], excluding 0, suggesting that exaptation exerted a significant mediating effect. The direct effect of customer participation on low-cost innovation was 0.446, with a 95% CI of [0.351, 0.542], excluding 0, a further indication that exaptation mediated the process of customer participation in driving low-cost innovation. Hence, H4 is further verified.

### Moderating effect test

The independent and moderator variables were centrally processed when testing the moderating effect to obtain their interaction terms. First, according to models 5 and 6 in Table 3, the product term of customer participation and resource flexibility was significant and negative ( $\beta = -0.112$ ,  $p < 0.05$ ), suggesting that resource flexibility negatively moderated the correlation between customer participation and exaptation. Hence, H5a is verified. According to models 7 and 8 in Table 3, the product term of coordination flexibility and exaptation was significant and positive ( $\beta = 0.173$ ,  $p < 0.01$ ), suggesting that coordination flexibility positively



TABLE 1 Measure reliability and convergent validity.

Measures	OL	CA	AVE
<b>Customer Participation</b>		0.823	0.534
Customers often provide information about needs and preferences	0.795		
The participation or involvement of customers is very important for R&D activities	0.754		
It is an important part of the product innovation process	0.753		
Customers' creative efforts play an important role in product innovation	0.700		
Customers often put forward R&D plans	0.695		
Customers often conduct independent research and development	0.682		
<b>Exaptation</b>		0.720	0.609
A technology of the enterprises has been successfully applied in another field	0.837		
A product of the enterprises has gained new functions in the new environment	0.831		
Enterprises have new functions through the combination of existing product functions	0.743		
<b>Resource Flexibility</b>		0.678	0.609
Enterprises produce different products and services from the same resource in a wide range	0.812		
The conversion cost and difficulty of producing different products and services from the same resource are small	0.793		
The conversion time for enterprises to produce different products and services from the same resource is short	0.733		
<b>Coordination Flexibility</b>		0.719	0.543
Enterprises can find future opportunities and react faster than existing and potential competitors	0.779		
Enterprises can find new resources or their combinations faster than existing and potential competitors	0.745		
Enterprises can explore new markets faster than existing and potential competitors	0.735		
Enterprises can effectively deal with resource use problems in a dynamic environment	0.686		
<b>Low-cost Innovation</b>		0.730	0.525
Enterprises develop new products and services at low cost	0.766		
Enterprises carry out process innovation or process innovation in a low-cost way	0.762		
Enterprises develop and utilize existing technologies and capabilities in a low-cost way	0.751		
Enterprises improve the speed of innovation with low cost	0.692		

OL, Outer Loadings; CA, Cronbach alpha; AVE, Average Variance Extracted.

moderated the correlation between customer participation and exaptation. Hence, H5b is verified. Second, the bootstrap method further tested the moderating effect of strategic flexibility, showing that the interaction coefficient of customer engagement and resource flexibility was significant ( $\beta = -0.170$ ,  $p < 0.05$ ), with a 95% CI of  $[-0.302, -0.037]$ , excluding 0. When the resource flexibility was low, the indirect effect was significant ( $r = 0.453$ , BootLCI  $[0.323, 0.582]$ ). When the resource flexibility was high, the indirect effect was

significant ( $r = 0.239$ , BootLCI  $[0.118, 0.361]$ ). Hence, H5a is further verified. Similarly, the interaction coefficient of customer participation and coordination flexibility was significant ( $\beta = 0.189$ ,  $p < 0.001$ ), 95% CI  $[0.081, 0.298]$ , excluding 0. When the coordination flexibility was low, the indirect effect was significant ( $r = 0.204$ , BootLCI  $[0.102, 0.307]$ ). When the coordination flexibility was high, the indirect effect was significant ( $r = 0.415$ , BootLCI  $[0.274, 0.556]$ ). Hence, H5b is further verified.

TABLE 2 Means, standard deviations, and correlation coefficients.

	Mean	Standard deviation	VIF	1	2	3	4	5
Customer participation	4.064	0.543	1.621	<b>0.731</b>				
Exaptation	4.326	0.530	1.621	0.489**	<b>0.765</b>			
Resource flexibility	4.068	0.629	1.551	0.438**	0.476**	<b>0.780</b>		
Coordination flexibility	4.175	0.557	1.975	0.578**	0.561**	0.553**	<b>0.737</b>	
Low-cost innovation	4.145	0.543	-	0.573**	0.478**	0.438**	0.554**	<b>0.702</b>

N = 348, \*\*p < 0.01; \*p < 0.05 (two-tailed test). The diagonal bold data is the square root value of the corresponding AVE value of each variable.

TABLE 3 Regression analysis results.

Variable	Exaptation	Low-cost innovation				Exaptation			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	
Enterprise age	0.020	0.014	−0.003	0.009	0.017	0.019	0.009	0.002	
Enterprise scale	−0.068	−0.004	0.051	0.015	−0.045	−0.044	−0.039	−0.033	
Ownership nature	0.074	−0.066	−0.090	−0.087	0.076	0.069	0.060	0.068	
Industry distribution	0.021	−0.079	−0.079	−0.084	0.028	0.031	0.021	0.004	
Customer participation	0.490***	0.580***		0.446***	0.347***	0.354***	0.251***	0.322***	
Exaptation			0.492***	0.272***					
Resource flexibility					0.321***	0.288***			
Customer participation × resource flexibility						−0.112*			
Coordination flexibility							0.411***	0.439***	
Customer participation × coordination flexibility								0.173**	
ΔR <sup>2</sup>	0.250	0.340	0.246	0.396	0.333	0.344	0.361	0.382	
F	22.754***	35.306***	22.313***	37.280***	28.313***	25.466***	32.101***	30.078***	

\*\*\*Significant at the 0.001 level; \*\*significant at the 0.01 level; \*significant at the 0.05 level.

## Test of the moderated mediation model

Table 4 shows the results of the moderated mediation effect test. At low resource flexibility, the mediating effect of exaptation was significant ( $\beta = 0.121$ ; 95% CI [0.058, 0.212], including 0). At high resource flexibility, the mediating effect of exaptation was significant ( $\beta = 0.064$ ; 95% CI [0.023, 0.137], including 0). The index value of the judgment index was  $-0.045$ , and 95% CI was  $[-0.103, -0.013]$ , excluding 0, suggesting that the moderated mediation model was established. Hence, H6a is verified. Similarly, at low coordination flexibility, the mediating effect of exaptation was significant ( $\beta = 0.055$ ; 95% CI [0.013, 0.126], including 0). At high coordination flexibility, the mediating effect of exaptation was significant ( $\beta = 0.111$ ; 95% CI [0.059,

0.189], including 0). The index value of the judgment index was 0.050, and 95% CI was [0.010, 0.095], excluding 0, suggesting that the moderated mediation model is established and H6b is verified.

## Conclusions, implications, and directions

### Conclusion

Based on the exaptation and strategic flexibility theories, this study constructed and verified a moderated mediation model and discussed the influence mechanism and path of customer

TABLE 4 Test results of the moderated mediation model.

Mediation variable	Moderator	Indirect effects under different conditions				Moderated mediation effect			
		Effect	SD	Lower limit set	Upper limit	index	SD	Lower limit set	Upper limit
Exaptation	LRF	0.121	0.038	0.058	0.212	−0.045	0.021	−0.103	−0.013
	HRF	0.064	0.028	0.023	0.137				
Exaptation	LCF	0.055	0.029	0.013	0.126	0.050	0.025	0.010	0.095
	HCF	0.111	0.032	0.059	0.189				

LRF, low resource flexibility; HRF, high resource flexibility; LCF, low coordination flexibility; HCF, high coordination flexibility.

participation driving low-cost innovation. Accordingly, the following conclusions are drawn:

First, customer participation exerted a direct and significant impact on low-cost innovation. The theoretical deduction, data test, and analysis revealed that customer participation positively impacted low-cost innovation. The research conclusion echoes and expands the view that “customer participation is an important prevariable of product innovation” put forward by Zhang and Chen (2014) and Zhang and Cai (2020). In addition, it shows the critical role played by customer participation in driving low-cost innovation. Under the open innovation mode, multi-agent interactive innovation has become a critical ecology of low-cost innovation. As a crucial source of enterprise innovation, customer participation can decrease the transaction cost and failure rate of innovation and provide reliable demand resource support for the success of product innovation and shorten the R&D cycle of new products, to promote low-cost innovation. The research conclusions refine the mechanism of the effect of customer participation on innovation and provide new ideas for the identification of paths toward low-cost innovation.

Second, exaptation mediates the correlation between customer participation and low-cost innovation. Relevant studies have discussed the mediating mechanism of customer participation affecting product innovation from the standpoint of organizational learning and knowledge-sharing (Yao et al., 2015; Zhang and Cai 2020). Few studies have investigated the internal mechanisms through which customer engagement affects low-cost innovation. Based on a new perspective, this study demonstrates that exaptation is an integral path for how customer participation affects low-cost innovation; that is, it verified that customer participation is a key predictor of exaptation (Ganzaroli and Pilotti 2011) and explained the important value of exaptation to low-cost innovation. As a crucial source of innovation, the formation of exaptation warrants maintenance, activation, and situational placement of the expansion pool, expansion activities, and expansion forum (Garud et al., 2018). In addition, customer participation can provide diversified knowledge, such as demand preference, transfer, and feedback information, and provide resources and power for establishing an expansion pool and implementing expansion activities. Meanwhile, the cooperation between customers and enterprise R&D departments to participate in innovation provides likely scenario stimulation for product function transfer. The diversified knowledge of enterprises

and the search for distant opportunities in the interaction between enterprises and customers can induce function transfer (Andriani et al., 2017), resulting in product innovation behavior. In this sense, the research conclusions reveal the internal logic of customer participation driving low-cost innovation.

Third, the indirect correlation between customer participation and product innovation through exaptation will exhibit differences due to different strategic flexibility. Consistent with the findings of Li and Gao (2017), the present study introduces strategic flexibility into the correlation between “customer participation and low-cost innovation,” constructs a moderated mediation model, and further analyzes the composition path of different strategic flexibility dimensions on the impact of low-cost innovation. The test results revealed that when coordination flexibility and resource flexibility increase, the indirect effect of customer participation on low-cost innovation increases or decreases. Moreover, it should be emphasized that the previous literature took strategic flexibility as an overall variable to examine its moderation mechanism on customer participation and product innovation (Zhang and Chen 2014) and did not distinguish the differential role of different dimensions of strategic flexibility in moderating the correlation between customer participation and low-cost innovation. This study demonstrates that the correlations between coordination and resource flexibility are moderated differently. The research conclusions expand the existing theoretical framework of the role of customer participation-driven low-cost innovation and provide a new perspective for exploring the function boundary of the correlation between them.

## Theoretical implications

First, existing research on the correlation between customer participation and low-cost innovation is limited, as is the study of factors that affect the relationship. To overcome the limitations of previous studies and enable the assessment of the correlation between them from a more comprehensive standpoint, this study introduces the concept of exaptation to analyze the mechanism underlying the effect of customer participation on low-cost innovation, systematically clarifies the impact of customer participation on low-cost innovation, and demonstrates that exaptation plays a crucial bridging role between customer participation and low-cost innovation. In addition, this study builds

on the research of Ren et al., (2019), and its conclusion further verifies and expands the viewpoint that “customer participation is an important pre-variable of product innovation” (Zhang and Cai 2020), and furthers the understanding of how customer participation can promote low-cost innovation. Moreover, the study addresses the problem of insufficient attention to the mediating mechanism of the correlation between the two at a macro-level and expands the application field of exaptation theory.

Second, the study reveals the moderating role of strategic flexibility (resource flexibility and coordination flexibility) in the correlation between customer participation and exaptation and demonstrates that resource flexibility and coordination flexibility can further moderate the mediating role of exaptation through different mechanisms. Then, to some extent, this study explains the problem of how to better promote customer participation and promote low-cost innovation through exaptation; this enables an understanding of the boundary conditions of customer participation and deepens the understanding of the crucial role of customer participation in the process of low-cost innovation from different perspectives. Meanwhile, the research conclusions make up for the lack of moderating mechanism of indirect correlation between customer participation and low-cost innovation and expand the application scope of strategic flexibility.

## Practical implications

First, attach importance to customer participation value and provide creative support for low-cost innovation. This would involve obtaining information on the macro-environment, industry dynamics, and market through questionnaire surveys, copywriting research, interviews, and other methods, focusing on changes in technology and customer demand and strengthening the connections between products, technology, and customer demand through various product fairs, trade fairs, entry fairs, and other forms to support product innovation. Second, establishing an interactive innovation community between enterprises and customers using mixed online/offline modes, improving communication channels and sharing mechanisms, unifying customer perception, evaluation, participation, and low-cost innovation, enhancing the likelihood of the application of existing knowledge in new fields by absorbing the knowledge of front-end consumption, and providing a knowledge-driven and situational interaction platform for low-cost innovation.

Second, drive the process of exaptation to promote low-cost innovation. First, pay attention to the important value of exaptation as the source of innovation and realize that expansion adaptation can also produce innovation, even breakthrough innovation, through the transformation of existing products (Andriani et al., 2017), assimilating traditional innovation ideas and opening up innovation paths. Second, stimulate exaptation and improve expansion adaptability through various ways. Notably, store diversified knowledge and apply existing knowledge to new situations to enhance the likelihood of exaptation.

Alternatively, build an organizational structure conducive to internal and external smoothness, create a cultural atmosphere of sharing, communication, tolerance, and openness, and improve employees' creativity and innovation.

Third, augment strategic, flexible management and provide trigger conditions for the transformation from customer participation to exaptation. If enterprises want to obtain the knowledge and power to promote exaptation from customer participation, they must break through the organizational inertia and “asset trap” that might be caused by resource flexibility and realize the agglomeration, integration, and transformation of resources in innovation; this is because it is hard to work only by occupying resources (Xu et al., 2016), so they must combine resource flexibility with the trigger conditions of expansion adaptation. In contrast, enterprises should improve coordination flexibility, augment the flexible allocation of resources and flexible allocation of processes, enhance environmental adaptability, dynamic ability, and creative problem-solving ability, and improve conditions for customer participation, and exaptation to provide resources, capabilities, and market opportunities.

## Limitations and future research

Despite its contribution to theory and practice, this study has several potential limitations. First, this study incorporated customer participation as an entire concept into the theoretical model and did not test the effect of customer participation on low-cost innovation from different dimensions (Zhang and Cai 2020). Thus, future research can further refine the research hypotheses from different perspectives and, more precisely, understand the different roles of different dimensions of customer participation in promoting exaptation and low-cost innovation. Second, as this study used cross-sectional data to study the impact of customer participation on low-cost innovation, it is difficult to examine the impact of customer participation on low-cost innovation although the time-varying process. In the future, practical sequence data can be used to explore the relationship between variables more accurately. Third, exaptation is a new research field, and the scale design of exaptation is a critical research topic; however, research on the topic is limited, indicating an urgency for further extensive investigation.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

## Author contributions

CT: construction of theoretical model and drafting the manuscript. YS: acquisition of data. XZ: analysis of data. YL:

revising the manuscript critically for important intellectual content. All authors contributed to the article and approved the submitted version.

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## References

- Andriani, P., Ali, A., and Mastrogiorgio, M. (2017). Measuring exaptation and its impact on innovation, search, and problem solving. *Organ. Sci.* 28, 320–338. doi: 10.1287/orsc.2017.1116
- Arthur, W. B. (2007). The structure of invention. *Res. Policy* 36, 274–287. doi: 10.1016/j.respol.2006.11.0058
- Cai, R., Chen, Q., and Chen, W. (2014). Path research on low-cost innovation and implementation under grounded theory analysis of longitudinal cases. *Sci. Sci. Manag. S. & T* 35, 120–129.
- Cattani, G. (2006). Technological pre-adaptation, speciation, and emergence of new technologies: how corning invented and developed fiber optics. *Indust. Corpor. Change* 15, 285–318. doi: 10.1093/icc/dtj016
- Cees, B., and Fardad, Z. (2014). R&D cooperation, partner diversity, and innovation performance: an empirical analysis. *J. Prod. Innov. Manag.* 31, 292–312. doi: 10.1111/jpim.12096
- Chen, G., and Chen, Q. (2013). The formation of low-cost innovation and the choice of innovation ways. *Stud. Dialect. Nat.* 29, 36–41. doi: 10.19484/j.cnki.1000-8934.2013.03.007
- Chen, Q., Feng, Y., and Liu, L. (2018). Study on enterprise strategic change driven by strategic flexibility from an ambidextrous perspective. *Manag. Rev.* 30, 275–291. doi: 10.14120/j.cnki.cn11-5057/f.2018.09.026
- Chen, Q., and Ren, J. (2011). Them ethodology of scientific research programm er foundation of innovative low cost strategy. *Stud. Sci. Sci.* 29, 349–358. doi: 10.16192/j.cnki.1003-2053.2011.03.006
- Chi, K. Y., Chan, K. W., and Lam, S. S. K. (2012). Do customers and employees enjoy service participation? Synergistic effects of self-and other-efficacy. *J. Mark.* 76, 121–140. doi: 10.1509/jm.11.0205
- Dew, N., Sarasvathy, S. D., and Venkataraman, S. (2004). The economic implications of exaptation. *J. Evol. Econ.* 14, 69–84. doi: 10.2139/ssrn.348060
- Fang, E. E. (2008). Customer participation and the trade-off between new product innovativeness and speed to market. *J. Mark.* 72, 90–104. doi: 10.1509/jmkg.72.4.90
- Feng, W., and Liu, R. (2021). Interaction orientation, strategic flexibility and service innovation performance of manufacturing enterprises. *Sci. Res. Manag.* 42, 80–89. doi: 10.19571/j.cnki.1000-2995.2021.03.008
- Füller, J., Bartl, M., Ernst, H., and Muehlbacher, H. (2006). Community based innovation: how to integrate members of virtual communities into new product development. *Electron. Commer. Res.* 6, 57–73.
- Ganzaroli, A., and Pilotti, L. (2011). Exaptation as source of creativity and innovation[R]. Departmental Working Papers. 351
- Garud, R., Gehman, J., and Giuliani, A. P. (2018). Serendipity arrangements for exapting science-based innovations. *Acad. Manag. Perspect.* 32, 125–140. doi: 10.5465/amp.2016.0138
- Gregory, T. R. (2008). The evolution of complex organs. *Evolut. Educat. Outreach* 1, 358–389. doi: 10.1007/s12052-008-0076-1
- Han, C., and Gao, S. (2017). Study on the relationship among strategic flexibility, strategic innovation and management innovation. *J. Manag. Sci.* 30, 16–26. doi: 10.3969/j.issn.1672-0334.2017.02.002
- Hou, F., and Zhang, X. (2013). Connect-absorb-develop mechanism under low-cost innovation strategy of enterprise. *Sci. Sci. Manag. S&T* 34, 136–142.
- Hu, P., and Yu, B. (2017). Boundary-spanning search, capability reconfiguration and firms' innovation performance—Moderating role of strategic flexibility. *R&D Manag.* 29, 138–147. doi: 10.13581/j.cnki.rdm.2017.04.012
- Huikkola, T., Ylimäki, J., and Kohtamäki, M. (2013). Joint learning in R&D collaborations and the facilitating relational practices. *Ind. Mark. Manag.* 42, 1167–1180. doi: 10.1016/j.indmarman.2013.07.002
- Jiang, L., Zhang, H., and Li, S. (2022). Research on the mechanism of cross-border search on the innovation performance of enterprises-based on the perspective of knowledge integration and strategic flexibility. *Sci. Technol. Manag. Res.* 42, 193–203.
- Katsuhiko, S., and Hitt, M. A. (2004). Strategic flexibility: Organizational preparedness to reverse ineffective strategic decisions. *Acad. Manag. Exec.* 18, 44–59. doi: 10.5465/ame.2004.15268683
- Kelley, S. W., Donnelly, J. H., and Skinner, S. J. (1990). Customer participation in service production and delivery. *J. Retail.* 66, 313–335. doi: 10.4135/9781452231327.n10
- Kraatz, M. S., and Zajac, E. J. (2001). How organizational resources affect strategic change and performance in turbulent environments: theory and evidence. *Organ. Sci.* 12, 632–657. doi: 10.1287/orsc.12.5.632.10088
- Liu, D., Gao, W., and Min, L. (2020). Challenge or hindrance? The impacts of customer participation on employees' ambidextrous innovative behavior. *Foreign Econ. Manag.* 42, 3–20. doi: 10.16538/j.cnki.fem.20200420.301
- Li, B., and Gao, S. (2017). Reciprocity, knowledge sharing and collaborative original innovation—moderating effects of strategic flexibility. *R&D Manag.* 29, 76–86. doi: 10.13581/j.cnki.rdm.2017.03.007
- Li, N., Gao, S., and Shu, C. (2018). Nonlinear influencing mechanisms of environmental scanning on ambidextrous innovation: the moderating role of strategic flexibility. *Manag. Rev.* 30, 45–58. doi: 10.14120/j.cnki.cn11-5057/f.2018.04.005
- Li, M., and Hsu, C. (2018). Customer participation in services and employee innovative behavior: the mediating role of interpersonal trust. *Int. J. Contemp. Hosp. Manag.* 30, 2112–2131. doi: 10.1108/ijchm-08-2016-0465
- Lin, M. J. J., and Huang, C. H. (2013). The impact of customer participation on NPD performance: the mediating role of interorganization relationship. *J. Bus. Industr. Market.* 28, 3–15. doi: 10.1108/08858621311285679
- Li, Q. (2005). Schumpeter's innovative and entrepreneurial ideas, dissemination and comments. *Sci. Sci. Manag. S&T* 26, 76–81. doi: 10.3969/j.issn.1002-0241.2005.08.017
- Li, T., Ma, J., and Dong, X. (2022). Integrated technology expansion and adaptation in the context of ecosystem. *Stud. Sci. Sci.* 40, 1452–1461. doi: 10.16192/j.cnki.1003-2053.20211201.001
- Li, T., Ma, J., and Li, Y. (2021). Pay attention to drug R&D based on exaptation, strengthen the technology support of prevention and control in major epidemic situation. *Forum Sci. Technol. China* 1, 127–135. doi: 10.13580/j.cnki.fstc.2021.01.015
- Mitsuru, K., and Tomoatsu, S. (2014). Research into ambidextrous R&D in product development, new product development at a precision device maker: a case study. *Tech. Anal. Strat. Manag.* 26, 279–306. doi: 10.1080/09537325.2013.850658
- Mokyr, J. (2000). “Evolutionary phenomena in technological change” in *Technological Innovation as an Evolutionary Process*. ed. J. Ziman (Cambridge: Cambridge University Press).

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- Peng, X., Wu, X., and Wu, D. (2011). The evolution of enterprise networks based on the dynamic process of the second innovation and the evolution of the balance model of the organizational learning—a case study on haitian in 1971–2010. *Manage. World* 4, 138–149. doi: 10.19744/j.cnki.11-1235/f.2011.04.014
- Ren, S., Gao, T., and Xu, H. (2019). Exaptation as a source of innovation: a literature review. *Foreign Econ. Manag.* 41, 17–30. doi: 10.16538/j.cnki.fem.2019.01.002
- Sanchez, R. (1995). Strategic flexibility in product competition. *Strateg. Manag. J.* 16, 135–159. doi: 10.1002/smj.4250160921
- Shi, Z., and Su, N. (2018). Relationship among innovation network, learning from failures and low-cost innovation: theoretical model and empirical. *On Econ. Probl.* 4, 97–103. doi: 10.16011/j.cnki.jjw.2018.04.016
- Sun, J., Ma, B., and Zhao, L. (2022). The impact of different forms of customer participation on enterprise green service innovation. *Foreign Econ. Manag.* 44, 48–63. doi: 10.16538/j.cnki.fem.20220516.401
- Suneel, K. (2018). Challenges in moving from incremental to radical low-cost innovation in emerging and transition countries: institutional perspectives based on rechargeable battery innovation in China and point-of-use water purification innovation in India. *Int. J. Innov. Manag.* 23, 195–208. doi: 10.1142/s1363919619500282
- Tang, C., Shi, Y., and Cai, R. (2022). Correlations of resource bricolage and exaptation with low-cost breakthrough innovations: moderating effect of organizational agility. *Front. Psychol.* 13, 1–12. doi: 10.3389/fpsyg.2022.846629
- Tao, X., Zhang, X., Fan, Z., and Fan, C. (2019). Research on the influence mechanism of customer participation on new product development performance. *China Soft Sci.* 4, 125–132.
- Tian, H., Tian, J., and Zhang, Y. (2022). Customer participation in value co-creation, customer knowledge transfer and ambidextrous innovation. *Sci. Technol. Progr. Countermeas.* 39, 121–130.
- Xu, J., Guan, J., and Lin, Y. (2016). Research on the relationship between green innovation and enterprise performance from the perspective of complementary assets—the moderating role of strategic flexibility and organizational redundancy. *Sci. Technol. Progr. Policy* 33, 76–82. doi: 10.6049/kjbydc.2016040218
- Xu, Z. (2021). Theoretical explanation of strategic flexibility to build enterprise competitive advantage. *Commun. Finance Account.* 16, 165–170. doi: 10.16144/j.cnki.issn1002-8072.2021.16.033
- Yang, Z., Gao, S., and Zeng, N. (2016). Effect of strategic flexibility on exploratory innovation and exploitative innovation: the moderating effect of environmental uncertainty. *Sci. Res. Manag.* 37, 1–10. doi: 10.19571/j.cnki.1000-2995.2016.01.001
- Yao, S., Lai, Y., and Jin, Y. (2015). Research on driving mechanism of customer participation on enterprises' R&D performance: a perspective of organizational learning. *Sci. Sci. Manag. S&T* 36, 95–104.
- Yao, S., and Wang, Y. (2011). Mechanism of impact of customer participation in new product development on technological innovation performance of enterprises: an empirical research in B-B context. *Sci. Sci. Manag. S&T* 32, 34–41.
- Yao, S., and Wang, Y. (2012). Customer participation in new product development and its influence on performance: the mediating mechanism of relational embeddedness. *J. Indust. Engin. Manag.* 26:39–48 +83. doi: 10.13587/j.cnki.jieem.2012.04.011
- Ye, J., Ren, H., and Hao, B. (2015). The impact of internal and external knowledge heterogeneity on innovation performance: the moderating effects of strategic flexibility. *Stud. Sci. Sci.* 33, 574–584. doi: 10.16192/j.cnki.1003-2053.2015.04.012
- Yi, Y., Natarajan, R., and Gong, G. T. (2011). Customer participation and citizenship behavioral influences on employee performance, satisfaction, commitment, and turn-over intention. *J. Bus. Res.* 64, 87–95. doi: 10.1016/j.jbusres.2009.12.007
- Zha, C., Chen, W., Tang, C., and Shen, X. (2015). Empirical study on relationship among intellectual capital, learning from failures and low-cost innovation. *Technol. Econom.* 34:35–43 + 60.
- Zhang, X., and Chen, M. (2014). Research on the relationship between customer participation, strategic flexibility and product innovation. *Sci. Technol. Progr. Policy* 31, 105–109.
- Zhang, J., and Cai, H. (2020). The impact of customer participation on new product development performance in virtual community – the moderating role of virtual social capital. *Sci. Technol. Progr. Policy* 37, 16–25. doi: 10.6049/kjbydc.2019030501
- Zhang, J., and Liao, C. (2020). Customer participation, knowledge sharing and new product development performance in virtual communities. *Manag. Rev.* 32, 117–131. doi: 10.14120/j.cnki.cn11-5057/f.2020.04.010
- Zhu, X., and Chen, W. (2014). Knowledge governance, learning from failure, low cost exploitative innovation and low cost exploratory innovation. *Sci. Sci. Manag. S&T* 35, 78–86.



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# Hand hygiene compliance and associated factor among nurses working in public hospitals of Hararghe zones, Oromia region, eastern Ethiopia

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**Background:** Healthcare workers are in constant contact with a wide variety of materials and surfaces, including waste, body fluids, mucous membranes, food, their own bodies, and the skin of patients. As a result, their hands are colonized by different groups of pathogens. Hand hygiene of healthcare workers is recognized to be the main factor in reducing healthcare-associated infections. Therefore, this study aimed to assess hand hygiene adherence and related factors among nurses working in public hospitals in eastern Ethiopia.

**Methods:** An institutional based cross-sectional study was conducted in Hospital, Hararghe zone, Eastern Ethiopia from July 1 to 30, 2021. A total of 451 study participants were randomly selected, after the proportional allocation of study participants to each selected hospital. The data was collected using self-administered questionnaire and observation checklist. SPSS version 26 was used to analyze the data. Bivariable and multivariable analysis were employed to assess the association between outcome and independent variables. Finally, a *p*-value of < 0.05 was used as a cutoff point for statistical significance.

**Results:** Out of 436 eligible nurses, the overall hand hygiene compliance was 37.4% [95% CI (0.33, 0.42)]. The overall compliance among those working in medical, surgical, OR ward, OPD, Gynecology/obstetrics, emergency ward, Intensive care units, Pediatrics, and other wards/departments was 46.8, 44.8, 35.7, 28.2, 20.7, 45.1, 23.1, 40.5, and 29.4%, respectively. The mean knowledge score was 21.6% (SD: 2.08). Furthermore, there was a statistically significant association between hand hygiene compliance and gender, work experience, training in hand hygiene, availability of running water, and knowledge of hand hygiene.

**Conclusion:** The current study found overall compliance with hand hygiene accounted for 34.7%. Therefore, an exemplary worker may initiate others to

do so, and strong managerial and leadership commitment may also help the workers stick to the rules and regulations to follow the multimodal hand hygiene practice as per WHO recommendation.

#### KEYWORDS

hand hygiene, nurses, hospitals, infection prevention, health care workers

## Introduction

Hand hygiene is recognized to be the main factor in reducing health care-associated infections (HCAIs). Centers for Disease Control and Prevention (CDC) reported that healthcare workers do not wash their hands as often as possible, which contributes to the increasing number of HCAIs (1). According to the WHO, because healthcare workers constantly contact numerous substances and surfaces such as trash, bodily fluids, mucous membranes, food, their own bodies, and patients' skin, their hands become colonized by various bacteria. There are reports that 7 and 10% of hospitalized patients acquire at least one health-care associated infection in developed countries and developing countries, respectively (2–4). The Code of Standards and Conduct of the Nursing and Midwifery Council demands nurses and midwives to maintain a high level of practice and care at all times (5).

Healthcare Associated Infections are continuing to be a public health problem across the world because they are significantly associated with increased risks of mortality and morbidity (4). At least 1.7 million patients in the United States acquired HCAIs in 2017 alone, and around 99,000 of them died (4). Studies reveal that improving hand hygiene reduces HCAIs and Methicillin-resistant *Staphylococcus aureus* (MRSA) transmission rates (6, 7).

Improper hand hygiene is one of the leading causes of health care-associated infections. Compliance to hand hygiene among health care workers (HCW) in general is unacceptably low, especially in developing countries. Nosocomial infections, for example, are a major source of morbidity, death, and health-care expenditures among hospitalized patients globally (8, 9).

Furthermore, HCAIs cause prolonged hospital stays, increased microorganisms' resistance to antimicrobials, high costs, and increased mortality. Hand hygiene plays a great role in preventing HCAIs. There are different factors that hinder effective hand hygiene practice, including using gloves, inaccessibility and unavailability of alcohol-based hand rub, and inadequate water supply (4, 10–12). Moreover, lack of understanding of good hand hygiene practice, inadequate staff, overcrowding, and a lack of access to hand washing facilities, have been cited as contributing factors to poor compliance

with hand hygiene among healthcare workers in developing countries (13, 14).

In Ethiopia, a few studies, conducted in central and northern parts, show a very low compliance rate for good hand hygiene by healthcare providers compared to the WHO 5 min for hand hygiene (12–18). Evidence on the hygiene practices of nurses in rural areas of the eastern part is limited. Therefore, this study was aimed to assess hand hygiene compliance and associated factors among nurses working in public hospitals in Eastern Ethiopia.

## Materials and methods

### Study setting and period

The Hararghe zone is located in the eastern part of Ethiopia in the Oromia regional state. The zone has seven public hospitals (four general hospitals and three primary hospitals) and 121 health centers. All hospitals provide inpatient, outpatient, emergence, and delivery services (19). The study was conducted from July 1 to 30, 2021.

### Study design

An institution-based cross-sectional study was conducted to assess hand hygiene compliance and associated factors among nurses working in public hospitals in the Hararghe Zones.

### Source and study population

All nurses working in public hospitals in the Hararghe zones were considered the source population. All randomly selected licensed nurses who had more than 6 months of working experience and are currently working in selected public hospitals were considered as the study population.

### Inclusion and exclusion criteria

This study included all nurses who had worked for at least 6 months at public hospitals in the Hararghe Zones. Nurses

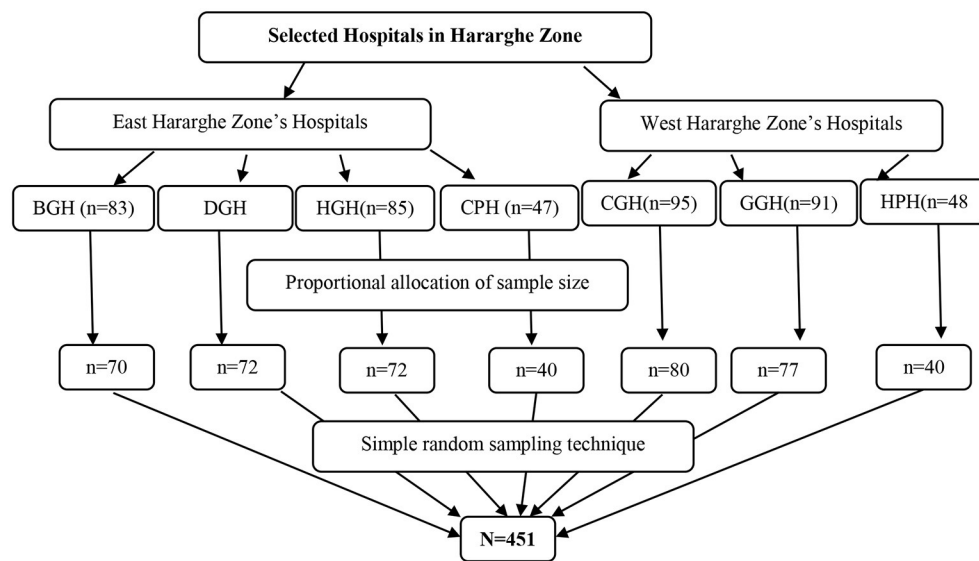


FIGURE 1

Sampling techniques used to select study participants for the current study, 2021. BGH, Bisidimo General Hospitals; DGH, Deder General Hospitals; HGH, Haramaya General Hospitals; CPH, Chelenko Primary Hospitals; CGH, Chiro General Hospitals; GGH, Gelemso General Hospitals; HPH, Hirna Primary Hospitals; N, Total sample size.

who were absent during the data collection for various reasons were excluded.

## Sample size determination

The sample size (n) was computed using the double population proportion formula using Epi-info version 7.01. The sample size calculation was based on a prior study that showed the availability of hand hygiene guidelines in the health care facility has an association with hand hygiene compliance (18), 95% confidence level, power of 80%, a 1:1 ratio of having hand hygiene guidelines among compliant and non-compliant nurses, and a 10% non-response rate. The final sample size estimated for this study was 451.

## Sampling method and procedure

All seven public hospitals in the Eastern and Western Zones were considered for the current study. In the current study five general hospitals (Bisidimo, Deder, Haramaya, Chiro and Gelemso general hospitals) and two primary hospitals (Chelenko and Hirna Primary Hospitals) were included. The sample size distribution for each hospital was based on the proportion of nurses on duty at the time of data collection. Finally, a random sampling technique was used to select study participants from each facility (Figure 1).

TABLE 1 Socio-demographic characteristics of the study participants in Hararghe zones public hospitals, eastern Ethiopia, 2021.

Variables	Category	Frequency	Percent
Sex	Male	298	68.5
	Female	137	31.5
Age	18-24	89	20.4
	25-34	323	74.1
	≥ 35	24	5.5
Marital status	Single	185	42.4
	Married	247	56.7
	Divorced	3	0.70
	Widowed	1	0.20
Educational level	Diploma	140	32.1
	Degree	284	65.1
	Master and above	12	2.8
Working department/ward/unit	Medical	62	14.2
	Surgical	58	13.3
	OR	42	9.6
	OPD	78	17.9
	Gynecology/obstetrics	29	6.7
	Emergency	82	18.8
	ICU	26	6.0
	Pediatrics	42	9.6
	Others	17	3.9

ICU, Intensive Care Unit; OR, Operation room; OPD, Out Patient Department.

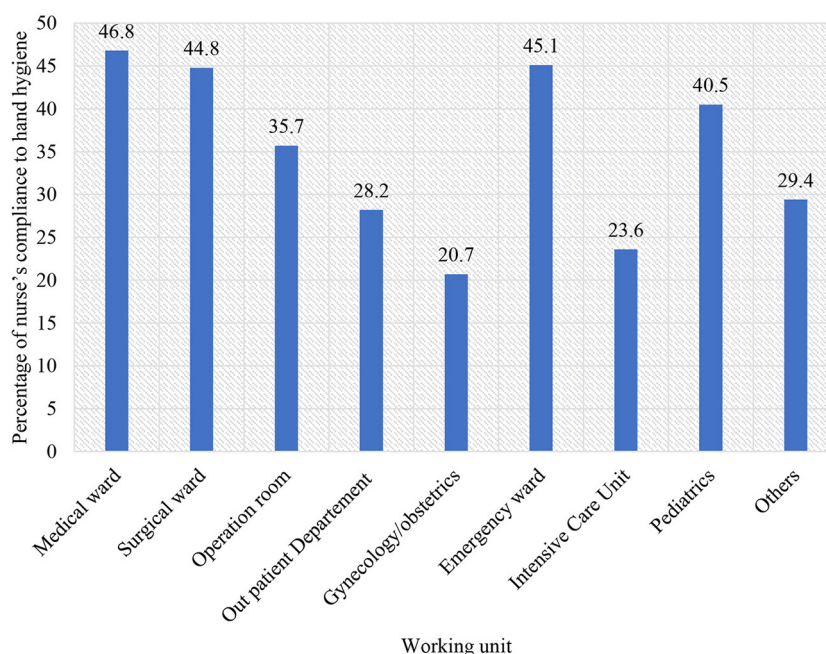


FIGURE 2

Hand hygiene compliance among nurses based on the working unit in Hararghe zones public hospitals, Eastern Ethiopia, 2021.

## Data collection tools and procedure

The WHO hand hygiene compliance assessment questionnaire (20) was used to develop the standard self-administered questionnaire and observational checklist. The questionnaire was customized and developed to assess current hand hygiene compliance and associated factors. The tools include hand hygiene knowledge (12 items), administrative characteristics (eight items), the availability of a hand hygiene facility (nine items) *via* yes/no, nurses' hand hygiene practices *via* 5-point Likert scales (14 items), and ticking off what they do. It was prepared in the English language. Three data collectors and one supervisor were recruited and trained on data collection tools, consent, and ethical issues during data collection.

## Data quality control

The questionnaire was pretested on 5% of the participants outside the study area or in included hospitals to check its clarity, sequence, applicability, and validity. Then, the questions found unclear was modified based on the response provided during pretest before data collection. Each day, the completeness and consistency of the questionnaires were checked to ensure the quality of the collected data. Finally, the data were cross-checked using double data entry.

## Data processing and analysis

EPI-info version 7.2.4.0 was used to enter and clean data, which was then exported to SPSS version 26.0 for analysis. Frequencies and percentages of different variables were computed. To investigate variables associated with nurse compliance, a binary logistic regression model analysis was performed, and the goodness of fit for the fitted model was evaluated using the Hosmer-Lemeshow test. An odds ratio with a 95% confidence interval was computed to assess the presence and degree of association between the dependent and independent variables. In the binary analysis, a variable with a  $p$ -value  $< 0.25$  was a candidate for multivariable analysis. A  $p$ -value of  $< 0.05$  in multivariable analysis was used to declare a statistically significant association.

## Results

### Socio-demographic characteristics

The number of nurses included in the study was 436, with a response rate of 97%. The mean age of participants was  $27 \pm 4.5$  SD years. Most of them were male (68.5%), had  $<5$  years of experience (72.2%), and 56.7% of participants were married (Table 1).



**TABLE 2** Nurses' knowledge of hand hygiene in Hararghe zones public hospitals in Eastern Ethiopia, 2021.

Variable	Category	Frequency	Percent
A-BHR should not be used when hands are visibly soiled.	Yes	291	66.7
	No	115	26.4
	I don't know	30	6.9
A-BHR will still be effective if applied for less than 60 s.	Yes	296	67.9
	No	95	21.8
	I don't know	45	10.3
Hand hygiene is required following the removal of gloves after patient contact.	Yes	355	81.4
	No	74	17.0
	I don't know	7	1.6
Single-use cloth towels and paper towels are acceptable for drying hands in patient care areas.	Yes	249	57.1
	No	161	36.9
	I don't know	26	6.0
Hand hygiene must be performed before contact with patient, following emptying of a drainage reservoir, and prior to and following venipuncture.	Yes	370	84.9
	No	57	13.1
	I don't know	9	2.1
When using an A-BHR to decontaminate hands they should be rubbed together until dry.	Yes	366	83.9
	No	42	9.6
	I don't know	28	6.4
Handling of paperwork is not one of the recommended situations for performing hand hygiene	Yes	247	56.7
	No	158	36.2
	I don't know	31	7.1
Hand hygiene is required following contact with the bed linen of a patient with MRSA.	Yes	350	80.3
	No	64	14.7
	I don't know	22	5.0
Hand creams and lotions are recommended for health care workers' hands.	Yes	291	66.7
	No	125	28.7
	I don't know	20	4.6
Gloves should not be reused when caring for different patients.	Yes	338	77.5
	No	81	18.6
	I don't know	17	3.9
The average cost of a hospital acquired infection in developed countries is approximately \$10,000	Yes	199	45.6
	No	116	26.6
	I don't know	121	27.8
Approximately 20% of intensive care patients develop hospital acquired infection in developed countries	Yes	223	51.1
	No	87	20.0
	I don't know	126	28.9

A-BHR, Alcohol based hand rub; MRSA, Microbial Resistant Staphylococcus Aureus.

**TABLE 3** Nurses' hand hygiene practice based on World Health Organization "My five moments of hand hygiene" in public hospitals in Hararghe zones, Eastern Ethiopia, 2021.

"My five moments of hand hygiene" indicators	Hand hygiene performed (%)	Compliance (%) (37.4%)	X <sup>2</sup> (p-value)
Before aseptic procedure	289 (66.3)	49.8	< 0.001
Before touching patients	132 (30.3)	81.1	
After body fluid exposure	408 (93.6)	38.2	
After touching patient	197 (45.2)	67.5	
After touching patient surroundings	312 (71.6)	51.6	

## Hand hygiene compliance

Overall hand hygiene compliance was 37.4% [163/436, 95% CI (0.33, 0.42)] among nurses working in the hospitals. The overall hand hygiene compliance with respect to the current working ward/department was as follows: the overall compliance of working in a medical ward was 46.8%, surgical ward was 44.8%, Operation Room (OR) was 35.7%, Out Patient Department (OPD) was 28.2%, gynecology/obstetrics ward was 20.7%, emergency ward was 45.1%, Intensive Care Unit (ICU) department was 23.1%, Pediatrics department was 40.5%, and nurses working in another ward/department was 29.4% (Figure 2).

## Knowledge about hand hygiene among nurses

The mean knowledge score was 21.6% (SD: 2.08). Among the participants, 67% [ $n = 294$ , 95% CI (0.63, 0.72)] of the participants scored 21.6% or more and were considered to have good knowledge. The most effective action for preventing nosocomial infections is proper hand washing. As a result, we asked nurses for alcohol-based hand rub preference when hands are visibly soiled and duration of hand rub knowledge. The correct answer that alcohol-based hand rubs should not be used when hands are visibly soiled and effective if applied for <60 s was known by 66.7 and 67.9% of nurses, respectively (Table 2).

## Hand hygiene practices among nurses based on "my five moments of hand hygiene"

Regarding hand hygiene practices among HCWs (nurses), based on the "my five moments of hand hygiene" approach of

TABLE 4 Bivariate and multivariable logistic regression on factors associated with hand hygiene compliance among Nurses in Hararghe Zones public hospitals 2021.

Variables	Hand hygiene compliance			COR (95% CI)	AOR (95% CI)
	Category	Good	Poor		
Sex	Male	117	181	Ref.	Ref.
	Female	46	91	0.78 (0.51, 1.19)	0.60 (0.37, 0.97)*
Educational status	Diploma	52	88	Ref.	Ref.
	Degree	106	178	1.01 (0.66, 1.53)	0.91 (0.57, 1.47)
	Masters and above	5	7	1.21 (0.36, 4.00)	0.92 (0.22, 3.92)
Work experience	≤ 5 years	110	205	Ref.	Ref.
	6–10 years	47	57	1.54 (0.98, 2.41)	1.71 (1.03, 2.86)*
	11–15 years	3	7	0.79 (0.20, 3.15)	0.54 (0.12, 2.39)
	≥ 16	3	4	1.39 (0.31, 6.36)	1.53 (0.25, 9.50)
Hospital has enough budget for infection prevention activities	No	47	116	Ref.	Ref.
	Yes	116	157	1.83 (1.20, 2.76)*	1.23 (0.75, 2.01)
Trained on hand hygiene	No	89	152	Ref.	Ref.
	Yes	74	121	0.92 (0.62, 1.35)	0.45 (0.26, 0.77)*
Presence of infection prevention committee in hospital	No	69	160	Ref.	Ref.
	Yes	94	113	0.96 (0.65, 1.41)	1.12 (0.66, 1.87)
Regular feedback on hygiene performance from close supervisors	No	85	174	Ref.	Ref.
	Yes	78	99	1.61 (1.09, 2.39)*	1.25 (0.73, 2.12)
Any motivations of hand hygiene practice in hospital	No	72	176	Ref.	Ref.
	Yes	91	97	2.29 (1.54, 3.41)**	1.54 (0.92, 2.58)
Presence of monitoring and evaluation of hand hygiene compliance in hospital	No	77	172	Ref.	Ref.
	Yes	86	101	1.90 (1.28, 2.82)**	1.39 (0.80, 2.41)
Availability of running water in working department/ward	No	38	140	Ref.	Ref.
	Yes	125	133	0.29 (0.19, 0.45)**	2.19 (1.30, 3.71)*
Presence of alcohol hand rub for workers	No	28	107	Ref.	Ref.
	Yes	135	166	3.11 (1.94, 4.99)**	1.70 (0.96, 3.02)
Presence of a functional sink with soap for hand washing	No	47	147	Ref.	Ref.
	Yes	116	126	2.89 (1.90, 4.36)*	1.37 (0.83, 2.28)
Presence of posters for hand hygiene	No	41	101	Ref.	Ref.
	Yes	122	172	1.75 (1.14, 2.69)*	1.32 (0.79, 2.19)
Presence of hand washing guide line	No	53	144	Ref.	Ref.
	Yes	110	129	2.32 (1.55, 3.47)**	1.44 (0.89, 2.33)
Knowledge of hand hygiene	Poor	34	108	Ref.	Ref.
	Good	129	165	2.48 (1.58, 3.89)**	2.25 (1.35, 3.73)*
Attitude toward hand hygiene	Negative	70	126	Ref.	Ref.
	Positive	93	147	1.14 (0.77, 1.68)	0.82 (0.51, 1.30)

\* $p < 0.05$ , \*\* $p < 0.001$ .

the WHO, revealed that 66.3, 93.6, and 71.6 of nurses performed hand hygiene before aseptic procedure, after body fluid exposure, and after touching patient surroundings, respectively (Table 3).

## Factors associated with nurses' compliance with hand hygiene

The bivariate analysis showed that having a sufficient budget for infection prevention in the hospital, regular feedback

on hygiene performance, administrative motivations for hand hygiene practice, the presence of monitoring and evaluation in hand hygiene compliance, the availability of water in the working department/ward, the presence of ABHR for workers, the presence of the HH guide line, and knowledge of hand hygiene were all found to be significantly associated with hand hygiene compliance of nurses. The multivariable analysis showed that male nurse professionals' compliance with hand hygiene was 40% more likely compared to female nurse professionals (AOR: 0.60, 95% CI: 0.37, 0.97). The odds of nurses with work experience of 6–10 years complying with

hand hygiene are 1.71 higher compared to those who have had <5 years of work experience (AOR: 1.71, 95% CI: 1.03, 2.86) (Table 4).

## Discussion

This study reveals that the overall hand hygiene compliance of nurses in the public hospitals of the Hararghe zones was low at 37.4% (95% CI: 0.33, 0.42). The main factors associated with hand hygiene compliance of nurses were gender, work experience, training in hand hygiene, availability of running water, and knowledge of hand hygiene. Professionals' compliance with hand hygiene is low compared to the 50% compliance as per WHO recommendation (21).

Compliance was low across all working wards/departments, with the surgical ward having the highest compliance (46.8%). The low level of hand hygiene compliance in this study implicates the poor implementation of WHO's multimodal hand hygiene improvement strategies in hospitals. This could directly be related to the lack of hand hygiene promotion and monitoring, low hand hygiene training opportunities, and unavailability of hand washing facilities and materials at the point of patient care (15, 16, 22).

The finding of this study on hand hygiene compliance is higher with studies in Gondar University hospital (16.5%) (15), Gondar public primary hospitals (14.9%) (13), Dessie referral Hospital (17.6%) (22), Debre Birhan referral hospital (22.0%) (17), Wachemo University teaching hospital, in which hand hygiene compliance was reported at 9.2% (23) and a study conducted in Nigeria (31%) (24). In contrast, it was lower than previous findings from a general hospital in Addis Ababa (50.4%) (18). Indeed, the finding of this study is lower than a prior study conducted at a self-reported referral hospital in Kenya (80%). The possible assumptions for the disparity might be due to differences in hospital setting and capacity, availability and accessibility of hand washing facilities, and nurse's awareness and acceptance level.

Regarding the relation between gender and self-reported hand hygiene practices, this study reveals female nurses to have significantly lower hand hygiene practices than male nurses. These results are supported by previous studies in accordance with other studies, which also showed similar significant differences in the performance of hand hygiene between males and females (10).

In the current study, the results did not reveal any kind of association between hand hygiene practice and the educational level of participants. In contrast, a prior study showed there is a significant association between educational level and hand hygiene practice (18).

In this study, work experience was one of the factors that had a significant association with hand hygiene compliance of nurses. Those who had 6–10 years of working experience had

1.71 times more hand hygiene compliance than those who had  $\leq 5$  years of experience. Having training on hand hygiene was also one of the factors that was significantly associated with the compliance. The result reveals that those who were trained on hand hygiene had 0.45 times more practice on hand hygiene compliance than those who did not have training. This finding is in line with prior studies conducted in different hospitals (13, 15, 18), and Nigeria (24).

In this study, 67% of participants had good knowledge of hand hygiene. The result shows that in the current study, participants show a higher knowledge level on hand hygiene than a study conducted in Meshhad, Iran in which only 10.6% of participants and 10.9% of nurses scored good knowledge (25). The possible assumption for the disparity might be the higher percentage of participants (53.4%) in the prior study who had been trained on hand hygiene than the participants in the current study (44, 7%). This implies that having training may improve the knowledge of healthcare providers on hand hygiene and, as a result of improved knowledge, healthcare providers become more compliant toward the gold standards of WHO recommendation on hand hygiene (10, 18).

Knowledge of nurses are found positively associated with compliance. Consequently, nurses who had a good knowledge on hand hygiene were 2.25 times more compliant than those who had poor knowledge. This result is supported by a study conducted in Gondar primary hospital and in Kuwait (13, 26) in which healthcare workers who had good knowledge were more compliant with hand hygiene than those who had poor knowledge. Therefore, addressing healthcare providers knowledge about hand hygiene, as well as strategies for cognitive, emotional, and behavioral approaches, such as patient involvement in hand hygiene intervention by applying the multimodal training program are important to improve the level of compliance (25).

This study shows that the availability of running water in the working department/ward was also significantly associated with hand hygiene compliance. The nurses who were working in wards/departments where running water is available had 2.19 more compliance than their counterparts.

In the current study, compliance with hand hygiene was in line with the level suggested by WHO's indications (21, 27), except for hand hygiene after touching body fluid. Consistent to WHO's indication, higher levels of compliance were observed before touching a patient, before an aseptic procedure, after touching a patient, and after touching patient surroundings. On the other hand, compliance with hand hygiene was relatively lower after body fluid exposure. This finding implies that, while healthcare providers were protected from healthcare-associated infections for themselves and their patients, they were at a higher risk of infection than patients. The possible assumption for this exposure might be the reason for low hand hygiene compliance. Therefore, it is recommended to strictly adhere to hand hygiene standards to prevent the spread of infections (28).

## Limitations

The main limitation of this study is that the results are based on a self-reported questionnaire. There could be an overestimation of hand hygiene compliance. As a result, an observation-based assessment of hand hygiene practice to hand hygiene compliance can determine the extent to which professionals reported and observed practices differ. Another limitation of the study is that no proxy measures like hospital-acquired infection rates of different departments or access to hand hygiene facilities of nurses in different departments were not assessed in the study to validate the self-reported hand hygiene practice. The study also acknowledged biases from the study design and nature of participants, like fewer older age ( $\geq 35$ ) study participants.

## Conclusion

This study was conducted to assess the self-reported practices of hand hygiene among nurses working in public hospitals in the Hararghe Zones, Oromia Region, Ethiopia. The current study depicts overall compliance of hand hygiene of 34.7% and, as per the WHO “five moments of hand hygiene” approach, 66.3, 93.6, and 71.6% of nurses performed hand hygiene before aseptic procedure, after body fluid exposure, and after touching patient surroundings, respectively.

Female nurses, those with limited work experience, and those who did not receive hand hygiene training require on-the-job training and educational intervention to improve their compliance with hand hygiene practices and knowledge of hand hygiene practices. Furthermore, motivating exemplary workers may encourage others to do the same, and strong managerial and leadership commitment may also help workers adhere to the rules and regulations to follow the WHO recommendation for multimodal hand hygiene practice.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

1. Center for Disease Control and Prevention (CDC). Clean Hands Count for Safe Healthcare. Centers for Disease Control and Prevention. (2020). Available online at: <https://www.cdc.gov/> (accessed May 17, 2021).
2. World Health Organization (WHO). Data Report on the burden of endemic health care-associated infection worldwide [Internet]. Who.int. (2020). Available online at: [https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507\\_eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf) (accessed May 17, 2021).
3. Mathai E, Allegranzi B, Kilpatrick C, Pittet D. Prevention and control of health care-associated infections through improved hand hygiene. *Indian J Med Microbiol.* (2010) 28:100–6. doi: 10.4103/0255-0857.62483
4. Boyd AT, Cookson ST, Anderson M, Bilukha OO, Brennan M, Handzel T, et al. Centers for disease control and prevention public health response to humanitarian emergencies, 2007–2016. *Emerg Inf Dis.* (2017) 23:S196. doi: 10.3201/eid2313.170473

## Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

HU conceived the idea, collected the data, and played a major role in this research. HU, AG, TW, GD, KB, DM, AB, and SM contributed to data analysis, writing, and editing the document. HU, AG, DM, and GD gave valuable ideas for the manuscript and revised it. All the authors read and approved the final version to be published and agreed on all aspects of this work.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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5. Council NM. *The Code: Standards of Conduct, Performance and Ethics for Nurses and Midwives*. London: NMC. (2008).
6. Allegranzi B, Nejad SB, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. *Lancet*. (2011) 377:228–41. doi: 10.1016/S0140-6736(10)61458-4
7. Sreeramaju P, Dura L, Fernandez ME, Minhajuddin A, Simacek K, Fomby TB, et al. *Using a Positive Deviance Approach to Influence the Culture of Patient Safety Related to Infection Prevention*. Open Forum Infectious Diseases. Oxford: Oxford University Press. (2018). doi: 10.1093/ofid/ofy231
8. Alsubaie S, bin Maither A, Alalmaei W, Al-Shammari AD, Tashkandi M, Somily AM, Alaskaa A, BinSaeed AA. Determinants of hand hygiene noncompliance in intensive care units. *Am J Inf Control*. (2013) 41:131–5. doi: 10.1016/j.ajic.2012.02.035
9. Erasmus V, Daha TJ, Brug H, Richardus JH, Behrendt MD, Vos MC, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. *Inf Control Hospital Epidemiol*. (2010) 31:283–94. doi: 10.1086/650451
10. Mohaithef MA. Assessing hand hygiene practices among nurses in the kingdom of Saudi Arabia. *Open Pub Health J*. (2020) 13:1. doi: 10.2174/1874944502013010220
11. Ahmed J, Malik F, Memon ZA, Arif TB, Ali A, Nasim S, et al. Compliance and knowledge of healthcare workers regarding hand hygiene and use of disinfectants: a study based in Karachi. *Cureus*. (2020) 18:12. doi: 10.7759/cureus.7036
12. Jemal S. Knowledge and practices of hand washing among health professionals in Dubti Referral Hospital, Dubti, Afar, Northeast Ethiopia. *Adv Prev Med*. (2018) 22:5290797. doi: 10.1155/2018/5290797
13. Engdaw GT, Gebrehiwot M, Andualem Z. Hand hygiene compliance and associated factors among health care providers in Central Gondar zone public primary hospitals, Northwest Ethiopia. *Antimicrob Resist Inf Control*. (2019) 8:1–7. doi: 10.1186/s13756-019-0634-z
14. Güran M, Akçay NI. Hand hygiene as an incomplete challenge for developing countries: discussions based on knowledge and perceptions of nurses in North Cyprus example and published studies. *Marmara Med J*. (2020) 33:67–74. doi: 10.5472/marumj.737740
15. Abdella NM, Tefera MA, Eredie AE, Landers TF, Malefia YD, Alene KA. Hand hygiene compliance and associated factors among health care providers in Gondar University Hospital, Gondar, North West Ethiopia. *BMC Pub Health*. (2014) 14:1–7. doi: 10.1186/1471-2458-14-96
16. Kolola T, Gezahegn T, A. twenty-four-hour observational study of hand hygiene compliance among health-care workers in Debre Berhan referral hospital, Ethiopia. *Antimicrob Resist Infect Control*. (2017) 6:1–5. doi: 10.1186/s13756-017-0268-y
17. Pfäfflin F, Tufa TB, Getachew M, Nigusie T, Schönfeld A, Häussinger D, et al. Implementation of the WHO multimodal hand hygiene improvement strategy in a University Hospital in Central Ethiopia. *Antimicrob Resist Infect Control*. (2017) 6:1–0. doi: 10.1186/s13756-016-0165-9
18. Abdo ZA, Shentema MG, Awono MT, Tefera YL. Compliance to hand hygiene and its associated factors among health care provider in general hospital in Addis Ababa, Ethiopia. *BLDE Univ J Health Sci*. (2020) 5:32. doi: 10.4103/bjhs.bjhs\_45\_19
19. East Harargye Zonal Health Bureau. *Annual Statistics of Health and Health Related Information's*. Oromia: East Hararghe Zonal Health Bureau (2021).
20. World Health Organization (WHO). *Monitoring tools*. Who.int. Available online at: <https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene/monitoring-tools> (accessed May 17, 2021).
21. Safety WP. *WHO Guidelines on Hand Hygiene in Health Care*. Geneva: World Health Organization. (2009).
22. Tesfaye G, Gebrehiwot M, Girma H, Malede A, Bayu K, Adane M. Application of the gold standard direct observation tool to estimate hand hygiene compliance among healthcare providers in Dessie referral hospital, Northeast Ethiopia. *Int J Environ Health Res*. (2021) 13:1–4. doi: 10.1080/09603123.2021.1975657
23. Meshesha AA, Tiruneh YA, Asegid A, Ayele Y. Hand hygiene compliance and associated factors among health professionals in Wachemo University hospital, Hossaena, south West Ethiopia. *Int J Innov Res Dev*. (2017) 6:28–35. doi: 10.24940/ijird/2017/v6/i10/OCT17022
24. Onyedibe KI, Shehu NY, Pires D, Isa SE, Okolo MO, Gomerep SS, et al. Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study. *Antimicrob Resist Infect Control*. (2020) 9:1–9. doi: 10.1186/s13756-020-0693-1
25. Zakeri H, Ahmadi F, Rafeemanesh E, Saleh LA. The knowledge of hand hygiene among the healthcare workers of two teaching hospitals in Mashhad. *Elect Phys*. (2017) 9:5159. doi: 10.19082/5159
26. Al-Wazzan B, Salmeen Y, Al-Amiri E, Bouhaimed M, Al-Taiar A. Hand hygiene practices among nursing staff in public secondary care hospitals in Kuwait: self-report and direct observation. *Med Princ Prac*. (2011) 20:326–31. doi: 10.1159/000324545
27. Pittet D, Allegranzi B, Boyce J. World health organization world alliance for patient safety first global patient safety challenge core group of experts. The World Health Organization guidelines on hand hygiene in health care and their consensus recommendations. *Inf Control Hosp Epidemiol*. (2009) 30:611–22. doi: 10.1086/600379
28. Nieradko-Iwanicka B. Hygiene—gold standard not only in prevention of COVID-19 infection. *Reumatologia*. (2020) 58:191. doi: 10.5114/reum.2020.98429





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# Effective practices for improving service professionals' ethical behaviors: A multiple method study

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**Introduction:** Enhancing frontline professional service employees' ethics has been an increasingly important issue for organizations in sustaining their reputation and long-term profitability. While many organizations have implemented general ethics programmes such as ethics codes and ethical training, unethical scandals regularly still appear in many service organizations. This research offers new insights into the practices that can effectively enhance marketing practitioners' ethical behaviors and the pertinent contextual factors that have a bearing on the effectiveness of ethics programmes.

**Methods:** It uses a multi-method methodology to conduct two studies in the Chinese banking setting. Based on the rank of revenue and profitability published by Fortune magazine of year 2021, in Study 1, we choose five main Chinese banking organizations to conduct case studies to explore the framework of effective ethics programmes of banks. In Study 2 we use the valid instruments from the literature to measure the involved constructs and employs data from randomly selected 146 frontline banking teams in five main Chinese banking organizations to examine the effectiveness of three specific ethics practices and ascertain the moderating role of role stress in such effectiveness.

**Results and discussion:** Our findings indicate the effective behavior control practices within organizations' ethics programmes and the implications of having a stressful workplace when adopting such practices. In addition, we integrate organizational concepts regarding behavior control and employee ethics, and use two empirical methods to systematically explore the effectiveness of ethics programmes. This paper advances the management and marketing literature and has significant managerial implications for improving frontline service professionals' ethical behaviors.

## KEYWORDS

behavior control, ethics, professional service organizations, role stress, multi-method

## Introduction

Human morality involves many aspects, such as, people readily use the information about another's morality when judging their competence and immoral behavior could be caused by work environment and performance evaluation, eventually affecting the outcomes of their daily activities (Stellar and Willer, 2018; Liu et al., 2021; Huang et al., 2022). In particular, the emergence of fiercely competitive business environments and the rise of a wide variety of publicity media are underscoring the rising importance of market practitioners' ethics because it significantly affects an organization's customer retention capability, corporate reputation, and financial performance (Erwin, 2011; Michaelson and Tosti-Kharas, 2019). There is some literature that focuses on organizational unethical behavior. With such behavior (e.g., occupy public resources for personal purposes), individuals intend to achieve some benefits from the organization, which directly harms to organizational benefits (Hong et al., 2021; Liu et al., 2021). Also, the literature proposes that formal and institutional documents (e.g., industry regulations or standards) and the implementation of practices such as ethical leadership in organizations can reduce unethical incidents (Erwin, 2011; Lehnert et al., 2016).

However, in service operations, frontline employees' unethical behavior could bring the benefits to organizations and their own interests in short time, which, however, have more possibility to affect the development of the organizations negatively in long time (Hirschfeld and Van Scotter, 2018; Silveira, 2022; Wang et al., 2021). Such unethical behavior is difficult to be monitored in a short time, which leads that current formal and institution documents proposed by the literature seems to have limited role in reducing these behaviors. Indeed, the ethical scandals still regularly occur in many service organizations (Silveira, 2022). For example, Wells Fargo (an American multinational financial services company) fired 5,300 employees due to their unethical behaviors in creating millions of banks and credit card accounts that customers did not authorize (Auletto and Miller, 2007). GlaxoSmithKline PLC (a British pharmaceutical company) paid 3 billion dollars fine for some employees' unethical and illegal marketing activities (Plumridge, 2014). China's Minsheng Bank sold forged wealth management products to customers including elderlies, which caused investor protest and police investigations (Huang and Guo, 2017). Indeed, a survey from 217 large global companies demonstrated that observed unethical behaviors are keeping upward, although they have spent much money to reduce unethical behaviors (e.g., one million dollars invested in ethics program for every billion revenue) (Bazerman and Tenbrunsel, 2011). This evidence highlights a need for more relevant insights to help organizations to improve the effectiveness of their ethics programs, so enhancing their employees' ethical behaviors.

Based on Merchant and Van der Stede (2012)'s framework, practices within ethics programs can be categorized into personnel and culture control practices (e.g., ethical training, ethics codes, ethical committee development etc.), action control practices (e.g., process control, auditing systems etc.), and result control practices (e.g., reward schemes, punishment approaches etc.). Indeed, the findings on the effectiveness of ethics programs are mixed and inconsistent. The National Business Ethics Survey (NBES) of 2013 showed that nearly 80% of surveyed organizations conducted culture control practices, e.g., providing ethical training and communicating internally about wrongdoing behaviors and 67% of them conducted action control practices, e.g., installing ethical performance evaluation system. This indicates that organizations have recognized the importance of ethics programs and begun to pay strategic attention to adopting pertinent practices for their ethics programs. Also, empirical studies have demonstrated that ethics programs (e.g., ethical training, principles of conduct and evaluation system etc.) can improve marketing practitioners' ethical behaviors (Weaver et al., 1999; Somers, 2001). However, some findings in the 2013 NBES survey show that half of the organizations with ethics programs still perceived that unethical behaviors are very prevalent in their workplaces, and employees in organizations with ethics programs reported more unethical behaviors than those in organizations with no such programs in place. Thus, there are two gaps. (1) Indeed, most currently popular ethics programs for organizational unethical behavior have not been fully effective in positively inducing service employee ethical behaviors. (2) Such mixed and inconsistent could be due to the different components of the ethics programs that organizations have implemented and the different contingencies associated with their workplaces. To fill the gaps, our study takes into account the wide range of practices incorporated into the ethics programs and the leveraging roles of special characteristics of services operations.

Thus, we propose three research questions: (1) Whether the ethics programs of service organizations are effective in enhancing employee behaviors? (2) What are contextual characteristics to influence the effectiveness of such practices? (3) What is the specific relationship among the practices, contextual factors, and employee ethical behaviors? Revealing that organizations generally follow a range of control practices in their ethics programs, the NBES survey does not clarify which practices are more effective (Merchant and Van der Stede, 2012). Thus, we use empirical exploratory approach research methods for the first two research questions and use a large-scale survey for the last research question based on sufficient data. Therefore, we adopt a multi-method approach by collecting data from the banking industry of China.

Study 1 uses five main Chinese banking organizations based on the rank of revenue and profitability published by Fortune magazine of year 2021 to identify the potentially effective practices that can indeed enhance employee ethical behaviors

in the context of this study and their relevant contextual factors. The findings highlight the effectiveness of action control practices within ethics programs and the contingent effects of several contextual characteristics. Study 2 seeks to develop a deeper understanding of the relationships among behavior control practices, employee ethical behaviors, and contextual factors in randomly selected 146 frontline banking teams from five main Chinese banking organizations. The use of a survey in Study 2 helps addressing the potential problem of limited generalizability of Study 1.

The contribution of this research lies in its connections of ethics programs with psychological characteristics of frontline employees (i.e., role stress) to explore how behavior control practices (i.e., risk control, process control formality, and information technology intensity) can take effect role in influencing employees' ethical behaviors, which can enrich the ethical and psychological literature. Our findings not only add new insights to the relevant literature, but also provide useful managerial guidelines for professional organizations (in particular, banks) to enhance their ethical performance.

## Theoretical background

### The practices of ethics programs

Ethics programs are organizational control systems that constrain employee behaviors to assure ethics and law compliance, and are generally made up of elements such as ethics codes, ethics committees, information systems, training programs, and disciplinary processes (Weaver et al., 1999). These elements have different orientations. For example, some elements focus on coercive control, e.g., punishment, system monitoring, and rules, while some elements focus on the support for employees' development of attitudes and commitment, e.g., ethical training and ethics codes (Weaver et al., 1999; Michaelson and Tosti-Kharas, 2019; Teresi et al., 2019; Hauser, 2020; Vveinhardt, 2022). In the framework of Merchant and Van der Stede (2012), the organization control system is categorized into personnel and culture control practices, action control practices, and result control practices. Personnel and culture control practices refer to socializing personnel's values and beliefs to match the organizations' preference by training them and giving them guidelines and resources that facilitate tasks to be conducted properly, e.g., ethical training and ethical committee development (Kaptein, 2009; Merchant and Van der Stede, 2012; Murcio and Scalzo, 2021). Action control practices refer to managing the specific routine and some actions by the process control approach and a series of systems, e.g., process control and certain auditing systems (Van Hooft et al., 2005; Kaptein, 2009; Merchant and Van der Stede, 2012; Eendenich and Trapp, 2020). Result control practices refer to managing behaviors by the provision of

reward incentives and punishments according to realized results and specific practices, e.g., reward and punishment approaches (Kaptein, 2009; Merchant and Van der Stede, 2012; Jannat et al., 2022; Shang and Yang, 2022). The literature on the practices of ethics programs has proposed some common practices and their categorizations, but has not been definitive about the major practices within each category of ethics programs. Thus, identification and classification of ethics practices will contribute new and useful insights to the literature.

### Service employee ethical behaviors and ethics programs

Employee ethical behavior refer to individuals' behaviors that comply with widely accepted moral norms at the workplace, e.g., helping co-workers and having concern for customer interest (Moore et al., 2012). The literature indicates that employee ethical behaviors can be encouraged through both informal (e.g., cultivating ethical culture and employee ethical cognition) and formal ways (ethical training, ethics codes, and evaluation system) (Kaptein, 2009; Moore et al., 2012; Tian and Peterson, 2016; Qing et al., 2019). Studies focusing on the former mainly apply theories such as Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1991; Dewberry and Jackson, 2018), Four-component Analysis (Rest, 1983), and Cognitive Moral Development Theory (Treviño et al., 2006). They have already identified a range of important factors, e.g., ethical culture and moral identity (Treviño et al., 2006; Moore et al., 2012; Watley, 2014; Metwally et al., 2019; Cabana and Kaptein, 2021) and tended to focus on using cognitive approaches to facilitate individuals' moral development to determine how to judge, proceed, and solve ethical dilemmas. Informal ways (e.g., culture) take a long time to influence employee behaviors (Moore et al., 2012; Warren et al., 2014). In the psychological filed, some literature also proposes the importance of ethical leadership and ethical training to enhance business ethics (e.g., Murcio and Scalzo, 2021; Wang et al., 2021). Thus, many organizations also choose to adopt formal ethics programs (e.g., ethical education and training) (Izzo, 2000; Remišová et al., 2019) to enhance employees' behaviors, leading to the proposition that ethics programs are indispensable to organizations in developing employee ethics. However, many empirical studies focus on the effectiveness of one element in ethics programs (e.g., ethics codes) and have obtained only limited insights into how to influence employee behaviors. For example, ethics codes can clearly reflect employee ethical requirements and offer guidelines for employee ethical decision-making, while the debate on whether they can reduce the unethical behaviors continues to exist. Indeed, the literature on employee ethical behaviors is still very limited in its understanding of the control

practices within these ethics programs that are effective in enhancing employee ethical behaviors.

## Research methods

### Research design

Firstly, based on Merchant and Van der Stede (2012)'s framework and some literature, the practices within ethics programs can be categorized into personnel and culture control practices (e.g., ethical training, ethics codes, and ethical committee development), action control practices (e.g., reward schemes and punishment approaches). Among such many ethical practices, which practices have commonly introduced in the professional industry and which ones are the potentially effective practices that can indeed enhance employee ethical behaviors in the context of professional service, and which are their relevant contextual factors need be examined. Thus, we set Study 1 as exploratory approach research methods to highlight which practices within ethics programs can take effect role in reducing unethical behaviors and which key contextual characteristics have some leverage roles. The samples can be selected from five main Chinese banking organizations based on the rank of revenue and profitability published by Fortune magazine of year 2021. And then, we set Study 2 to seek to develop a deeper understanding of the relationships among identified key practices within ethical program, employee ethical behaviors, and contextual factors in randomly selected 146 frontline banking teams in five main Chinese banking organizations. Also, the use of a survey in Study 2 helps addressing the potential problem of limited generalizability of Study 1.

### Study 1

While professional service companies (e.g., financial institutes) are critically important for almost all economies and such organizations always have varying types of ethics programs in place, the literature on ethics programs has offered no systematic framework guiding ethics program decisions in professional service companies (Weaver et al., 1999). No wonder many professional organizations may find it difficult to identify which ethics programs are effective in the specific ethical problems they are facing and what are the main contextual factors influencing the relevant implementations. This suggests the need for inductive research to help answer these questions.

### Case selection and research setting

The research setting focuses on the Chinese financial banking industry. There are three reasons. Firstly, financial

banking industry is a typical service industry and involves significant characteristics of service operations with customized service and no inventory, flexible and uncertain processes, and co-production with customers (Bowen and Ford, 2002; Safizadeh et al., 2004). Secondly, most ethical scandals publicized by a wide variety of media are highly related to the employees of financial industry; it is partly attributed to their customized professional service (Fusaro and Miller, 2002; Zhou, 2006). Lastly, The Peoples' Bank of China (2002), China's major policy bank, regularly issue business codes and guidelines with banks documents to control professional behaviors. Thus, the financial banking industry represents an appropriate context to explore our study.

Based on the rank of revenue and profitability published by Fortune magazine of year 2021, this paper chooses five Chinese banking organizations, i.e., A, B, C, D, and E, which are listed under Fortune global top 500 business. The financial revenue of these five banks is at least 70,000 million USD per year and their regulations and codes of operational procedures are issued and improved every year. So from these banks, more information about these problems can be obtained, e.g., which practices have been implemented in ethics programs from a professional service context; which practices are effective to strengthen employee ethical behaviors; and which contextual factors mainly influence their effectiveness. Considering that professional service sectors are increasingly relying on frontline teams to generate sales opportunities and implement the various kinds of tasks needed (Mills et al., 1983; Schultz et al., 1999), this paper randomly chose ten frontline teams with high comprehensive performance rank involving one or two team leaders and several team members from the five sample banks. Table 1 shows the position, the number of informants in this position, the times of interview and the stage of data collection. Taking into account the cognitive bias between employee and leader, we identified two excellent teams per sample bank, i.e., ranked as top two, with superior comprehensive performance including ethical aspects. The teams were nominated by managers from the respective headquarters who asked their teams to inform us on the effectiveness of practices in ethics programs.

### Data collection

The data for this study was collected from several sources. First, we obtained qualitative and primary data by interviewing ten leaders and 30 frontline employees selected from five major banks, i.e., A, B, C, D, and E. All the interviews were semi-structured and face-to-face, and each of them lasted about 3 h. Quotes from the interviews with Chinese informants were recorded and then translated into English for analysis. Example questions include "What are the constituent practices of the ethics program?", "What is the rationale in formulating the program?", "Which practices are the most effective?", "What contextual factors influence the effectiveness of the program?" Second, we obtained

TABLE 1 Informant information.

Corporate name	Position	Informants no.	Interviews no.	Stage of data collection
A bank (two teams)	Vice banker of bank branch	1	2	3
	Frontline employees	3	1	2
	Directors of credit card	1	1	2
	Frontline employees	3	1	2
B bank (two teams)	Customer manager	1	2	3
	Frontline employees	4	1	2
	Banker of bank branch	1	1	2
	Front line employees	3	1	2
C bank (two teams)	Manager of bank branch	1	2	3
	Frontline employee	2	1	2
	Customer manager	1	1	3
	Frontline employee	3	1	2
D bank (two teams)	Banker of branch	1	2	3
	Frontline employee	3	2	3
	Customer manager	1	1	2
	Frontline employee	4	1	2
E bank (two teams)	Customer manager	1	1	2
	Frontline employees	3	2	3
	Customer manager	1	1	2
	Frontline employees	2	1	2
Total no.		40	26	

information on how the sample banks decided their business regulations and how they solved some common ethics issues by examining their daily operation routines records, internal control documents, and some related archival data (e.g., violation investigation files). Finally, after conducting the preliminary analysis, we clarified some inconsistencies and ambiguities with the corresponding respondents via telephone and e-mail.

Data analysis

We adopted data triangulation (Yin, 2003) to collect and compare data from different respondents (team leaders and team members) to enhance the validity and reliability of the case study. At the same time, following Yin (2003), we conducted between-method triangulation based on the multiple resources used (interview, communication via email, archival data and internal corporate documentation) to capture exploratory phenomena (Langley, 1999). We analyzed and compared the data by using cross-case analyses and generalized the results into findings (Caniato et al., 2012). Specifically, we used open coding to analyze the quantitative data. The steps involved identifying the similarities or common characteristics of the data and texts by reading, observing, and comparing the data, and grouping the common characteristics under same group. We labeled the concepts and categories based on the dimensions of control practices described in Merchant and Van der Stede (2012)’s

framework and properties of data, marked the text, and set proper codes as identification tags. See Tables 2–4 for the findings.

Findings

Main practices of ethics programs in professional organizations

We coded the main practices of ethics programs from our five cases in Table 2. They could be coded as formal guidelines related to operational routines, monitoring technologies, education and training, punishment and reward approach, ethics codes, workmate co-assessment, whistle-blowing, risk aversion, information system, customer evaluation system, and reporting system. Following the framework of control systems (Merchant and Van der Stede, 2012), these were categorized into three different kinds of control systems (see Table 3): cultural/personnel control systems includes ethics codes, education, and training. Action control systems include guidelines for daily tasks, monitoring technologies/information system, workmate co-assessment, whistle-blowing, risk aversion, and customer evaluation system. Result control systems include reward and punishment approaches. These findings enrich the literature on ethics programs that include three or four dimensions. In addition, based on these practices, we further identified the types of programs that were most effective for enhancing ethical behaviors from the coding results.



TABLE 2 Content analysis of control practices relevant to ethical behavior in the professional service context.

Company	Representative quotations	Open coding for practices
Bank A	<p>... There are four systems to control employee behaviors including behavior-based system, supervision system, education and training, and punishment and reward approach. . .</p> <p>... Behavior-based system mainly use formal guidelines and codes to control employee behaviors. Supervision system uses monitoring technologies. . . the types of training are various such as on-line training, on-site training and one employee-one supervisor training. . . punishment and reward approach focus on implementing the reward and punishment on some ethical and unethical behaviors.</p>	<p>(1) Formal guidelines for operational routine.</p> <p>(2) Monitoring technologies.</p> <p>(3) Training and education.</p> <p>(4) Punishment and reward approach.</p>
Bank B	<p>... Our organization has some ethics programs such as ethics codes, daily routine policies, monitoring system and ethical training. The monitoring system includes workmate co-assessment and whistle-blowing. We adopt the approach of the case education as ethical training. . .</p> <p>... Organization has decision-making risk control mainly for managers. . .</p>	<p>(1) Ethics codes.</p> <p>(2) Daily routine policies.</p> <p>(3) Workmate co-assessment system.</p> <p>(4) Whistle blowing.</p> <p>(5) Case education.</p> <p>(6) Decision-making risk control.</p>
Bank C	<p>... Our organization developed ethics codes and implemented the behavior control for employees, for example giving some guidelines for their tasks or cultivating their risk recognition. . . We also use some customer evaluation system to monitor employee behaviors. . .</p>	<p>(1) Ethics codes.</p> <p>(2) Formal guidelines for tasks.</p> <p>(3) Risk recognition.</p> <p>(4) Customer evaluation system.</p>
Bank D	<p>... There are several systems to reduce unethical behaviors. Behavior control system comprising some guidelines and the methods of risk aversion, training system comprised of ethical case education, monitoring system comprising information system statistical analysis and customer evaluation. . . We use the reward approach to encourage ethical behaviors.</p>	<p>(1) Formal guidelines for routines.</p> <p>(2) Risk aversion.</p> <p>(3) Ethical case education.</p> <p>(4) Information system.</p> <p>(5) Reward approach.</p>
Bank E	<p>... Generally, we have ethics codes and policies on daily tasks to constrain employee behaviors. . . we also adopt the risk control for managers and employees in service decision-making. . . we also set the reporting system to report the unethical behaviors. . .</p>	<p>(1) Ethics codes.</p> <p>(2) Policy relevant with behaviors.</p> <p>(3) Risk attitude control.</p> <p>(4) Reporting system.</p>

### Effective control practices of ethics programs

**Table 3** lists the specific practices classified into cultural/personnel control system that have limited effectiveness. For example, ethics codes are too general and outdated to be able to guide their behaviors. Further, training and education is generally so boring for employees that its effectiveness can be poor. Also, result control system (e.g., reward and punishment approach) have limited effectiveness, since the metric of reward and punishment, i.e., behavior-oriented outcomes, are difficult to be measured accurately. However, the formal guidelines for daily routines, risk aversion and certain information measures in the action control system shown in **Table 3** are effective in enhancing employee ethical behaviors. According to the literature on behavior control and agency theory (Smith and Karwan, 2010; Goodale et al., 2011), the three effective practices from the case study are consistent with the dimensions of behavior control, i.e., process control formality, risk control, and information system intensity. Specifically, formal guidelines for service processes aimed at reducing uncertainties arising during performing tasks can be defined as process control formality. The adoption of risk aversion and the pursuit of stable profits in products and services can be conceptualized as risk control. More and more organizations will make a trade-off between performance improvement and risk aversion. Considering risk control in the process of product and service innovation is necessary (Shin et al., 2022). Finally, the degree of accessibility, the frequency,

and richness of the information system embedded in the service process can be conceptualized as information system intensity.

### Main contextual factors highly relevant with the effectiveness of these practices

**Table 4** indicates that the main contextual factors of influencing ethics practices are task conflict, goal conflict work stress, time pressure and workload, difficult achievable task goals and role ambiguity. Based on role stress theory, we can say that these factors can reflect the employee suffering from role stress. Job stress is an important signal that frontline employees are likely to experience serious burnout, which is a kind of role stress (Choi et al., 2019). Also, time pressure, workload, and difficult achievable task goals can be included in role overload. Task conflict and intra-group conflict can be perceived as role conflict. Paucity of information and guidelines in the work environment are defined as role ambiguity (Nordenmark, 2004). Our findings suggest that role stress in professional organizations is an important element of job climate. In addition, from the quotations, we find that service professionals suffering from role stress climate perceive that behavior control practices are not beneficial to their tasks (e.g., increasing sales quotas) but just help the management to avoid problems or blame from the public. Because of such negative attitudes toward control practices, we predict that frontline professionals may not genuinely follow the control practices while completing

TABLE 3 Content analysis of the effectiveness of the concluded practices.

Type of control	Relevant practice	Representative quotations	Open coding	Effectiveness
Culture/personnel control	Ethics codes	... Most ethics practices are too general to guild ethical dilemma. ... we seem to find it difficult to identify specific ethics guidelines telling us how to act. ... we couldn't decide on how to implement them to form culture or climate. ...	(1) Too general. (2) Difficult to find/implement. (3) Outdated.	Limited
	Case education and training	... These training and education initiatives are effective in terms of proficiency of task operations but have no significant effect on ethics in the service. Mostly, we meet the exam requirements rather than alter our behaviors. ...	(1) No significant effect. (2) Just meet the requirements of examination/certification.	Limited
Action control	Guidelines for daily tasks	... I think business codes and control mechanisms are effective, because they are more specific and involve how to implement them in our specific operational routine activities. ... I think control mechanisms involving operational routines relevant with daily tasks are effective. ...	(1) More specific. (2) Effectively. control behaviors	Effective
	Monitoring technology/information systems	... It is difficult to monitor employee behaviors because their service operation is the process of lip service. ... Intangible service seems too difficult to be monitored by some technology. ... ... Information systems can reflect some mistakes in our operational behaviors, and thus is somewhat useful to enhance our ethical behaviors. ... Some statistical analysis can constrict behaviors. ...	(1) Difficult to monitor. (2) Lip service. (3) Intangible service. (4) Statistical analysis. (5) Reflecting employee behaviors.	Biased effective
	Workmate co-assessment system	... Due to close relationships with workmates, they hardly do the actual assessment. ... it's a just superficial task. ... they are more willing to keep the consistence with his workmate. ... but sometimes this practice can get accurate evaluation.	(1) Hardly do the actual assessment. (2) A superficial form. (3) Be consistent with their workmates. (4) Sometimes getting accurate evaluation.	Biased effective
	Whistle-blowing	... Close relationships among workmates makes employee unwilling to whistle-blowing. ... For whistle-blowing system, we perceive that it has no effect, because we have good relationship with our workmate and are not willing to see the punishment they receive., sometimes we may be afraid of getting marginalized by other co-workers or team members, because we didn't know the consequences of whistle-blowing.	(1) Good/close relationship with workmates. (2) Afraid of being marginalized. (3) Hardly predicting the consequences of whistle-blowing.	Limited
	Risk aversion	... I think our risk-related decision-making for managers is very effective. ... Risk control can help employees to reduce the risky decisions. ...	Reduce risky decisions	Effective
	Customer evaluation system	... Customers participating in some assessment can facilitate employees to implement ethical behaviors. ...	Encourage employees' ethical behaviors	Effective
	Reward approach	The reward related to ethics behaviors is too subjective and we seem to have no idea about its metric and how to implement them, even if we want to implement them.	(1) Too subjective. (2) Difficult to implement. (3) Lack of metrics.	Limited
Result control	Punishment approach	As for punishment regulations, managers generally give warnings rather than implement the regulations, because they prefer to give us correction opportunities and to avoid disruptions in the routine operations.	Only warning.	Limited

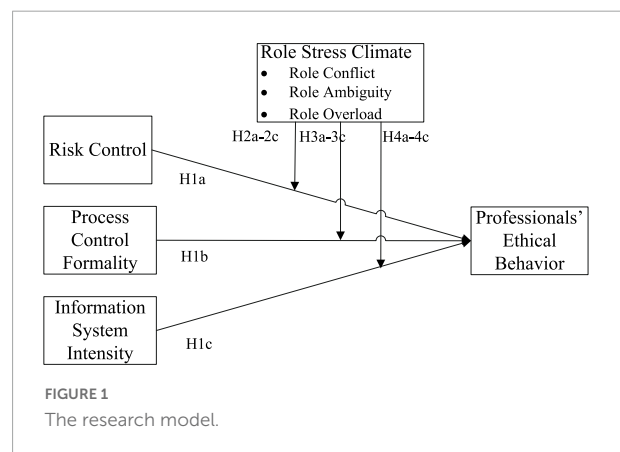
TABLE 4 Perceived main contextual factors impacting the effectiveness of control practices.

Main representative quotations	Open coding
<p>... Sometimes there is some role conflict between corporate policies and customer expectation so we find it hard to follow control practices to deal with these dilemmas. When these dilemmas occur, most of the team members (or managers) firstly consider self-interests. ... we at times find our team goals (mostly, about efficiency and accuracy) and our individual goals (mostly, sales quota) actually are contradicting. ...</p> <p>In most situations, we have some work stress and burden, and are required to complete the work as soon as possible. So we are concerned less about cost, reputation problems and long-term profit, and just expect to get normal wages and benefit monthly. We perceive that it's not necessary to follow these ethical control practices that can serve the management (and some front-line employees)</p> <p>There is some disorder and unfair competition among banks, so every bank has to set a high or even very difficult to achieve task goal to maintain existing status. Every employee also receives rigid assignments that are difficult to complete. If they could not complete them within the specified time requirement, they will get some punishment, such as wage reduction, demotion. Time pressure and workload make employee seek more shortcuts (e.g., misrepresenting product information to customers) rather than following the control guidelines (some managers).</p> <p>We are tired every day and have no time to consider how to follow ethical control programs. We just focus on completing our tasks, in order not to jeopardize our wages or get demoted. Even if we introduced all aspects of some products, the banks wouldn't give us more money. Most ethical control programs protect management to avoid getting blamed (some front-line employees).</p> <p>Indeed, our members don't know clearly how to use control practices to achieve their sales quota. We focus primarily on observable results and get them in the simplest way (frontline employees).</p>	<p>(1) Role conflict. (2) Goal conflict.</p> <p>Work stress and burden</p> <p>(1) Time pressure and workload. (2) Difficult to achieve task goals.</p> <p>Tired</p> <p>The paucity of information and guidelines</p>

their daily tasks. Role stress climate may be an important factor impacting the effectiveness of behavior control practices.

## Discussion

The findings from Study 1 demonstrate that our sample organizations had implemented a variety of ethics programs including cultural and personnel control systems (e.g., ethics codes and employee training and education), action control systems (e.g., process control and risk aversion) and result control systems (reward and punishment approaches) to enhance employee ethical behaviors. Also, managers and employees had perceived that behavior control practices (e.g., process control formality, risk control, and information system monitoring) were effective in solving agency problems in frontline contexts. Thus, it can be said that agency problems (e.g., employee engaging in certain behaviors in response to personal interests at the expense of corporate reputation and profitability) represent a major factor influencing the professionals' ethical behaviors. In addition, we find that the main professional contextual factors relate to role stress, i.e., role ambiguity, role conflict, and role overload, which may impede employees from implementing the practices effectively. These results suggest that there should be some relationships among behavior control practices, employee ethical behaviors, and role stress climate. However, since our qualitative results are based on ten teams from five banks, they cannot be generalized to teams from different professional service organizations. Also, the qualitative findings do not give specific insights about the relationships among behavior control practices, ethical behaviors, and role climate. To address these issues, we conducted a quantitative study.



## Study 2

Bases on Study 1, the objectives of Study 2 were to examine (1) whether behavior control practices, i.e., risk control, control process formality, and information system intensity, are positively associated with professionals' ethical behaviors and (2) whether role stress climate weakens the effectiveness of behavior control practices in ensuring professionals' ethical behaviors. Because behavior control and role stress climate are highly relevant to agency theory and role stress theory. Study 2 first integrated the two theories with the ethical literature to develop our hypotheses (see Figure 1) and then collected data from 146 frontline professional teams working from 5 major China's banking industry conducted by case study and used them as analysis units to test our hypotheses. The findings of Study 2 complement the qualitative analysis and offer the precise

relationships among control practices, ethical behaviors, and contextual factors.

## Hypothesis development

### Relationship between behavior control practices and service professionals' ethical behavior

From a review of the literature on agency theory, risk control, process control formality, and information system intensity are included in behavior control practices with the objective to alleviate the agency problem, i.e., moral hazard (Morgan et al., 2007; Goodale et al., 2008). Indeed, in the context of professional organizations (e.g., high levels of discretion and autonomy, employee specialized knowledge, and a view to enhancing selling performance) (Goodale et al., 2008; Von Nordenflycht, 2010; Lewis and Brown, 2012), the question of the moral hazard associated with ethical performance frequently arises (e.g., employees exaggerate the attributes of products to achieve sales due to information asymmetry). Behavior control practices from the perspectives of organizational climate, task structure, information system, and operational procedures are usually established to restrict employee behaviors and offer clear behavioral guidelines and task requirements regarding how frontline professionals serve customers and how they can avoid risky behaviors (Goodale et al., 2011), which can lower the frontline service professionals' discretion levels and reduce opportunities for risky decision-making, thereby assuring the organization's reputation and long-term profitability.

Specifically, risk control and process control formality involve setting up organizational boundaries related to acceptable behavior definitions, performance-related expectations, codes to be met, and regulations to be followed so as to prevent employees' work deviations from what is expected from different perspectives, mainly attitude and process (Das and Joshi, 2007). In circumstances with clear guidelines and restrictions, professionals are usually inclined to carry out activities and behave ethically in a manner consistent with their organization's regulations and standards (e.g., ethics codes), thereby solving the agency problem of moral hazards and enhancing professionals' ethical behaviors. Complicated information systems can track many operational problems such as monitoring employees' total service process, and obtaining customer feedback effectively. This can help operational managers glean more information about employee behaviors, thereby encouraging employees to follow ethical guidelines and reduce risky decision-making on their part. Thus, considering the complexity of service processes in professional organizations, behavior control practices embracing risk control, process control formality, and information system intensity can become effective means to improve employee ethical performance.

From this perspective, the study proposes the following hypothesis:

H1: Behavior control practices with respect to (a) risk control, (b) process control formality, and (c) information system intensity in professional organizations can effectively enhance professionals' ethical behaviors.

### Moderating effect of role stress climate

Our case studies showed us that role stress climate has become an important element of job climate in professional organizations. Professionals with role conflicts between activities relevant with performance assessment requirements (e.g., sales quota) and activities with organization reputation (e.g., ethically serving customers), may not comply with the risk control practices to cautiously pursue long-term organizational reputation, but give priority to activities with short-term performance requirements. Also, they may believe that step-by-step structured practices have been developed to mitigate operational risks and increase organizational brand value rather than protect them and meet their personal performance requirements. This leads to certain negative attitudes while following process procedures. When frontline teams with role overload feel detached from their jobs and become unwilling to respond to customers (Nordenmark, 2004; Yagil et al., 2008), they are unlikely to adopt the cautious attitude needed to deal with relevant tasks and become cynical about cumbersome and repetitive step-by-step procedures and processes, i.e., process behavior formality. When professionals with role ambiguity are lack of enough information and guidelines, it is difficult to require them to follow risk control practices and methods to engage in proper decision-making. In addition, although there may be information systems tracking and monitoring employee behaviors, professionals suffering from role stress climate use their limited time and capacity to complete only top-priority tasks to stay on in their positions. Behaving ethically is highly relevant from the viewpoint of the long-term profitability and reputation of the organization rather than merely from the viewpoint of employees' personal performance assessment. This limits the ability of information system control and monitoring aimed at encouraging ethical behaviors. For example, in China's banking industry, on top of the frontline professionals' regular service activities, employees have to carry out more activities such as reading legal statements to customers, conducting customer screening surveys, and completing forms for documentation purposes. Indeed, some studies demonstrate that ethical behaviors or proactive behaviors have close linkage with role stress (e.g., Strauss et al., 2017). Thus, when frontline professionals experience role stress, risk control, process control formality and information system

control will play a curtailed role in improving their ethical performance.

H2: The role stress climate arising from (a) role conflict, (b) role ambiguity, and (c) role overload of frontline professionals in organizations has a negative impact on the relationship between risk control and their ethical behaviors.

H3: The role stress climate arising from (a) role conflict, (b) role ambiguity, and (c) role overload of frontline professionals in organizations has a negative impact on the relationship between process control formality and their ethical behaviors.

H4: The role stress climate arising from (a) role conflict, (b) role ambiguity, and (c) role overload of frontline professionals in organizations has a negative impact on the relationship between information system intensity and their ethical behaviors.

## Research methods

### Research samples and procedures

In Study 2, we collected the sample from nine major banks located in seven economically developed cities of China. The banks included five state-owned commercial banks, three second-tier nationwide commercial banks, and one city-based commercial bank. To develop the sampling frame, we first examined the Internet web-pages of the target banks to search for the contact information of their frontline departments. By making calls to those departments, we identified the team leaders and explained to them the objective of our study. In the event, we came up with a sampling frame comprising 400 frontline teams among the target banks. We also adopted a multiple-informant method to collect data from one leader and three randomly-selected members in each team.

Since employee ethical behavior is a new construct, we paid extra attention to gather insights from the case study to identify the relevant items and improving their readability. Also, the findings from our case studies indicate that team leaders should be suitable to fill in constructs on the frontline employees' ethical behaviors and the teams' adoption of control mechanisms, whereas the team members are likely to be more knowledgeable regarding the stress they experience at the workplace. Thus, the leader questionnaire included the constructs of employee ethical behavior and those regarding control practices, whereas the member questionnaire included the constructs of role stress. To enhance the response rate in the survey, we issued three rounds of reminders. At the end, we received usable data from 146 teams (each team has one leader questionnaire and three member questionnaires), resulting in a response rate of 36.5%.

### Measures

This study used a multi-item, seven-point Likert scale anchored at 1 = "totally disagree" and 7 = "totally agree" to measure all the constructs and discuss the construct items in the following.

*Risk control* refers to frontline service professionals' risk-taking attitudes. We used four items adapted from Das and Joshi (2007) and Goodale et al. (2011). Sample items included "our team adopts a cautious posture in order to minimize the probability of making costly decisions in the operation process" and "explores some knowledge from the internal and external environments via cautious and incremental behavior" ( $\alpha = 0.840$ ).

*Process control formality* refers to the extent to which frontline service professionals need to follow formal and systematic procedures while carrying out their service processes. We used the four items developed by Das and Joshi (2007) and Goodale et al. (2011). Sample items included "our team follows formally laid-down procedures" and "...gets in line and adheres closely to formal job descriptions" ( $\alpha = 0.915$ ).

*Information system intensity* refers to the frequency and richness of system monitoring, evaluating, and dealing with problems in service processes. This study adopted the five items developed by Smith and Karwan (2010). Sample items included "information system supports professional operation activities" and "A database is maintained for tracking and monitoring mistakes and failed performance" ( $\alpha = 0.937$ ).

*Role stress climate* refers to respondents' shared perceptions of role stress in their work climate, including three main and different stressors, namely, role ambiguity, role conflict, and role overload. This study adopted these items from Rizzo et al. (1970) and Beehr et al. (1976). Sample items of role conflict [ $\alpha = 0.932$ , ICC (1) = 0.575, ICC (2) = 0.803], role overload [ $\alpha = 0.936$ , ICC (1) = 0.654, ICC (2) = 0.850] and role ambiguity [ $\alpha = 0.960$ , ICC (1) = 0.343, ICC (2) = 0.610] included "We receive incompatible requests from our customers and our organization," "too much work for one person to do" and "no clear, planned goals and objectives for our job," respectively.

*Professional ethical behavior* refers to the extent to which employees are able to (1) perform their activities in accordance with ethical standards, (2) cope with ethical dilemmas to maintain ethical standards, and (3) propose approaches to resolve future ethics-related problems. We developed six items ( $\alpha = 0.967$ ) by adapting the concepts of work role behaviors (Griffin et al., 2007) and performance appraisal (Behrman and Perreault, 1982). Sample items included "our team concerns customer benefits when conduct codes are not adequate" and "...contributes during team discussions for improving ethics in the team."

*Control variables* consist of the informant's age and education level, functional department, the position of the team leader (e.g., teller, retail and integrated service manager,



financial manager, account manager, and credit manager), and the duration for which the informant has worked on the team. According to the literature, employee age, education, working tenure, bank's department and the position of the leader may influence professional ethical behavior (Birkelund, 2000; Werner et al., 2005; Lin and Wei, 2006). By removing the effects of these control variables in our analyses, we were able to test our hypotheses more accurately.

### Reliability and validity

Since the unit of analysis of this study is a frontline professional team, we first employed the intra-class correlation coefficient (ICC) statistics ICC (1) and ICC (2) to assess the viability of aggregating individual-level data from three team members to the team level (James, 1998). The results shown in the Measures part indicate that all the individual-level data can be aggregated to form team-level data based on James (1982)'s suggestion that the value of ICC (1) should be above 0.12 and Boyer and Verma (2000)'s suggestion that the generally acceptable level of ICC (2) in the field of OM should be above 0.60. Regarding reliability, the lowest  $\alpha$ -value is 0.84 (see the Measures part), which is acceptable (George and Mallery, 2003). To assess its general validity, we compared the major model's fit results with those from the competing models. The resulting fit indices indicated that the major model had a better fit than the competing models and its results for the fit indices were above the suggested threshold values (Byrne, 2013). In addition, the results on composite reliability (CR) and average variance extracted (AVE) ranging from 0.824 to 0.97 and from 0.543 to 0.900, respectively, revealed adequate discriminant validity and convergent validity in the constructs examined. Finally, we addressed the potential impact of common method bias by employing the two approaches recommended by Podsakoff et al. (2003). We conducted two statistical tests. The first was Harman's one-factor test where the results indicated that only 42.06% of the common method variance could be explained by this major factor. Thus, we obtained adequate evidence that common-method bias was unlikely to be a significant concern with our data. Table 5 displays the means, standard deviations, and correlations associated with all the variables.

### Hypothesis test

We employed hierarchical regression analysis to test our hypotheses. Table 6 shows the regression results where the  $F$  values in all the models are highly significant ( $p < 0.01$ ). In Models 2, 3, and 4 shown in Table 6, the results indicate that the control mechanisms, i.e., risk control, process control formality, and information system intensity, are positively and significantly associated with employee ethical performance ( $\beta = 0.300$ ,  $p < 0.01$ ;  $\beta = 0.379$ ,  $p < 0.01$ ;  $\beta = 0.199$ ,  $p < 0.05$ ), thus supporting Hypotheses 1a–1c.

To test Hypotheses 2a–2c, 3a–3c, and 4a–4c, we estimated the interaction effects in the regression model using the

TABLE 5 Means, standard deviations, and correlations among the study variables.

Variables	Mean	S.d.	1	2	3	4	5	6	7	8	9	10	11	12
(1) Education level	2.11	0.37												
(2) Age	1.36	0.34	−0.041											
(3) Post	2.04	0.99	−0.194*	0.069										
(4) Department size	2.88	0.80	−0.107	0.193*	0.049									
(5) Working time	3.59	0.53	−0.127	0.170*	−0.126	0.263**								
(6) Risk control	5.44	0.87	−0.096	0.058	0.111	0.099	0.182*							
(7) Process control formality	5.68	1.09	−0.169*	0.092	0.256**	0.230**	0.141	0.444**						
(8) Information system intensity	5.41	1.02	−0.216**	0.004	0.063	0.067	0.187*	0.355**	0.406**					
(9) Role conflict	4.03	1.39	0.096	−0.018	−0.140	0.018	−0.151	−0.354**	−0.224**	−0.291**				
(10) Role ambiguity	2.37	0.88	−0.046	−0.121	0.036	−0.062	−0.162	−0.269**	−0.129	−0.231**	0.474**			
(11) Role overload	3.88	1.55	0.168*	−0.072	−0.280**	−0.024	−0.208*	−0.242**	−0.250**	−0.233**	0.702**	0.403**		
(12) Employee ethical behavior	5.58	1.16	−0.062	0.165*	−0.016	0.081	0.271**	0.338**	0.377**	0.236**	−0.212*	−0.321**	−0.160	1

\* $p < 0.05$ , \*\* $p < 0.01$ .

TABLE 6 Hierarchical regression results for Hypotheses 1–3.

Dependent variable Operational performance	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<b>Step 1: Control variables</b>							
Education	−0.026	−0.012	0.008	0.011	0.031	0.003	0.019
Age	0.123	0.120*	0.116*	0.131*	0.061	0.105	0.101
Post	0.003	−0.034	−0.090	−0.008	0.022	−0.058	0.020
Department size	−0.011	−0.023	−0.078	−0.012	0.020	−0.067	−0.007
Working time	0.250**	0.196*	0.208*	0.215*	0.181*	0.181*	0.189*
<b>Step 2: Independent variables</b>							
Risk control		0.300**			0.279**		
Process control formality			0.379**			0.401**	
Information system intensity				0.199*			0.134
<b>Moderating variables</b>							
Role conflict					0.039	−0.053	0.031
Role ambiguity					−0.321**	−0.246**	−0.276**
Role overload					0.041	0.102	0.081
<b>Step 3: Two-way moderator effect</b>							
Risk control * Role conflict					0.058		
Risk control * Role ambiguity					−0.357**		
Risk control * Role overload					−0.013		
Process control formality * Role conflict						0.112	
Process control formality * Role ambiguity						0.009	
Process control formality * Role overload						−0.191*	
Information system intensity * Role conflict							0.074
Information system intensity * Role ambiguity							−0.172 <sup>+</sup>
Information system intensity * Role overload							−0.067
<i>F</i>	2.72*	4.87**	6.26**	3.31**	5.10**	4.62**	2.97**
<i>R</i> <sup>2</sup>	0.089	0.174	0.213	0.125	0.315	0.294	0.211
$\Delta R^2$	Nil	0.085	0.039	−0.088	0.190	−0.021	−0.083

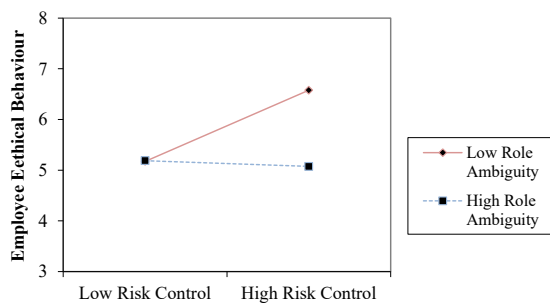
<sup>+</sup>  $p < 0.1$ , \* $p < 0.05$ , \*\* $p < 0.01$ .

cross-product terms and entering each cross-product term separately to avoid multicollinearity (Gopal et al., 2012). As for Model 5, the results pertaining to the significant coefficient of the interaction term ( $\beta = -0.357$ ,  $p < 0.01$ ) and the observed significant increment in  $R^2$  in Models 5 over Model 2 (0.141) supported Hypothesis 2b, indicating that role ambiguity can indeed weaken the association between risk control and professional ethical behavior. Figure 2 shows when employees suffer more role ambiguity, risk control takes less effect on their ethical behaviors. In Model 6, the results pertaining to the two-way interaction coefficient ( $\beta = -0.191$ ,  $p < 0.05$ ) are significant and negative. Model 6 accounts for a large amount of variance in the dependent variable ( $R^2 = 0.294$ ), and is well above and beyond the amount explained by their corresponding main effect in Model 3 ( $R^2 = 0.213$ ). These evidences supported Hypothesis 3c that role overload has a negative impact on the relationship between process control formality and their ethical

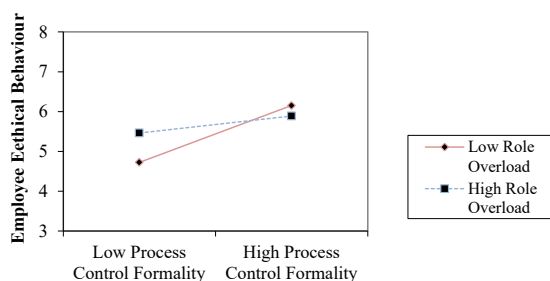
behavior. Figure 3 shows when employees suffer more role overload, process control formality takes less role in improving their ethical behaviors. In Model 7, the results regarding the significant coefficient of the interaction term ( $\beta = -0.172$ ,  $p < 0.1$ ) and the significant rise in  $R^2$  in Model 12 over Model 4 (0.086) support Hypothesis 4b, indicating that role ambiguity can weaken the association between information system intensity and professional ethical behaviors. Figure 4 shows when employees suffer more role ambiguity, information system intensity have less effect on their ethical behaviors. Note that the coefficients of the interaction terms in other Models are not significant.

## Discussion

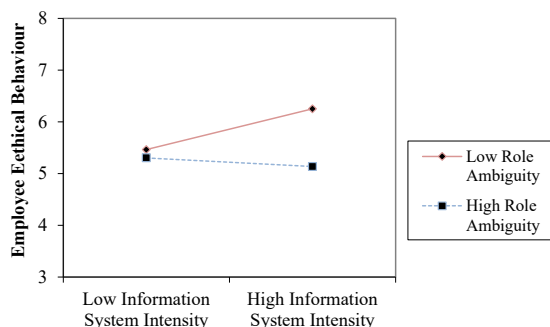
Study 2 has examined the effectiveness of behavior control practices on employee ethical behaviors under the major context, i.e., role stress climate. Its findings



**FIGURE 2**  
The moderating effect of role ambiguity on the relationship between risk control and employee ethical behaviors.



**FIGURE 3**  
The moderating effect of role overload on the relationship between process control formality and employee ethical behaviors.



**FIGURE 4**  
The moderating effect of role ambiguity on the relationship between information system intensity and employee ethical behaviors.

suggest that behavior control practices can indeed improve professional ethical behavior, which is consistent with the finding of Study 1. Good behavior control practices offer clear behavioral guidelines on service operations. Specifically, low control behavior often leads to antisocial behavior (Tehrani and Yamini, 2020). For example, lowering professionals' discretion levels will affect their attitudes

toward goal conflicts and risky behaviors, thereby reducing risky decision-making on their part, as well as encouraging them to be more concerned about customer benefits and long-term organizational profitability. Also, our results from Study 2 indicate that role ambiguity has a negative influence on the relationship between risk control and ethical behaviors, and between information system intensity and ethical behaviors. A climate charged with role ambiguity often lacks sufficient information so that professionals cannot clearly learn how to proceed with their tasks efficiently while striving to meet performance expectations from their organization (Singh, 1998). Under such circumstances, risk control and information system intensity play limited roles in restricting their risky decision-making, which encourages them to behave unethically. In addition, our findings indicate that role overload can moderate the relationship between process control formality and professionals' ethical behaviors negatively. Besides, our findings concerning the moderating effects of role overload and role conflict on the relationship between risk control and a professional's ethical behaviors and the relationship between information system intensity and professional's ethical behaviors are not significant.

## Conclusion

In this manuscript, to effectively enhance marketing practitioners' ethical behaviors and the pertinent contextual factors that have a bearing on the effectiveness of ethics programs, we use a multi-method methodology to conduct two studies in the Chinese banking setting. Specifically, we connect ethics programs with psychological characteristics of frontline employees, i.e., role stress, to explore how behavior control practices can take effect role in influencing employees' ethical behaviors.

We answer the three research questions as follows: For the first research question, we investigate whether the ethics programs of service organizations are effective in enhancing employee behaviors. We find that not all ethics programs are effective in enhancing employee behaviors. Specifically, the cultural/personnel control system, training, education, and result control system have limited effectiveness. However, the formal guidelines for daily routines, risk aversion and certain information measures in the action control system are effective in enhancing employee ethical behaviors. For the second research question, we study the contextual characteristics that influence the effectiveness of the relevant practices. We find that the main contextual factors of influencing ethics practices are task conflict, goal conflict work stress, time pressure and workload, difficult achievable task goals

and role ambiguity. For the third research question, we examine the specific relationship among the practices, contextual factors, and employee ethical behaviors. We show that the control mechanisms, i.e., risk control, process control formality, and information system intensity, are positively and significantly associated with employee ethical performance. Role ambiguity can indeed weaken the association between risk control and professional ethical behavior, as well as information system intensity and professional ethical behaviors. And role overload has a negative impact on the relationship between process control formality and their ethical behavior.

## General discussion

While many service organizations claim to implement several control systems as ethics programs, ethical scandals are being reported at disturbingly regular intervals. The hesitation of many organizations not to proactively engage in ethics programs is backed by some literature demonstrating that control systems seem to have no effect in reducing unethical behaviors in survey data (Mendoza, 2013). This paper has found from the case studies conducted that many practices of ethics programs implemented by service organizations have no significant effect on employee ethical behaviors, including ethical education and reward approach relevant with ethics. Based on evidence cutting across two studies, this paper has found that behavior control practices are effective in addressing employee ethical behaviors and role stress problems as main contextual factors could be relevant with their effectiveness. Study 2 had further found that the effect of behavior control practices is weakened when role stress is high.

In a professional service sector, professionals afflicted by role overload are more likely to use their professional knowledge to try out more efficient work approaches, which means that they can become cynical about specific and structured guidelines, which can slow down work process. In short, role overload can influence the effectiveness of process control formality. Since frontline employees in the professional service sector usually have certificates of training, one can assume that their knowledge intensity is high enough. However, while experiencing role overload and role conflict, such professionals can develop a cautious attitude while carrying out routine and customized tasks, and be concerned about license cancelation arising from information system monitoring and tracing. Role ambiguity and role conflict have no moderating effects on the relationship between process control formality and the ethical performance of professionals. A plausible explanation is that when an employee does not have clear tasks, goals, and requirements, process control formality

can offer systematic methods to facilitate task completion and encourage behavior toward performing ethically. Professionals suffering from a climate of role conflict may continue to follow structured procedures to avoid situations that are likely to lead to work license cancelation. Further studies studying the impact of different types of role stress on the effectiveness of the behavior control mechanisms should be useful.

## Theoretical implications

The first theoretical contribution of this study relates to the use of the case study to arrive at specific behavior control practices toward improving professional ethical behaviors and further examine their effectiveness by field survey in the professional service sector. Although several cognitive and organizational practices capable of encouraging ethical behaviors have been identified in the literature and theories, ethical scandals have continued to appear in the professional service sector. This suggests that these general approaches may be playing a limited role. Indeed, from Study 1, this paper has found that behavior control practices such as risk control, process control formality, and information system intensity, i.e., various types of information systems, are effective among the ethics programs they have implemented and the main contextual factors in professional service are role stressors. Study 2 has integrated agency theory with findings from Study 1 to develop the hypotheses and reexamine the explicit relationship among behavior control practices, employee ethical behaviors and role stress climate comprised by different role stressors.

The second theoretical contribution of the study lies in the integration of role stress theory with the literature on behavior control and ethics to study the negative effect of role stress on the effectiveness of behavior control practices in improving ethical behaviors. Study 1 has identified that role stress climate is an important contextual factor highly relevant with the level of control practices implementation. Study 2 further finds that the effectiveness of behavior control practices in improving ethical behaviors is weakened under the role stress climate. These findings enrich role stress theory and behavior control practices.

The third theoretical contribution of the study is the finding that role stress climate caused by different stressors (role conflict, role ambiguity, and role overload) have differing moderating effects on the effectiveness of different behavior control practices. Integrating role stress theory with the findings of Study 1, this study identifies three dimensions of role stress climate (role ambiguity, role stress, and role overload) as important contextual factors impacting control practices. Study 2 finds that role ambiguity has a significant and negative influence on the effectiveness of

risk control and information system intensity in improving ethical performance, while role overload has a significant and negative influence on the effectiveness of process control formality. However, more work is needed to fully clarify the influences of different types of role stresses in the professional service sector.

## Managerial implications

The findings from Study 1 and Study 2 have pointed to certain behavior control practices capable of improving ethical behaviors in the professional service sector. First, professional organizations need to realize that behavior control practices do make employees behave ethically. Operational managers should encourage employees to exercise caution by adopting an incremental attitude while performing routinized and customized work to avoid risky decision-making. Also, organizations can use formal control procedures. Organizations should design more detailed and specific work procedures to guide professionals, thereby reducing their operational discretion. In addition, they need to consider the importance of information system intensity. The frequency and richness of information system monitoring, evaluating, and dealing with problems in service processes can be used to curb professionals' risky behaviors, thereby encouraging them to perform ethically. In summary, we suggest that managers can prioritize their investment in behavior practices to improve employee ethical behaviors, reducing the ethical scandals.

Second, professional organizations adopting behavior control practices need to consider the negative impacts of role stress, especially of role ambiguity and role overload. When organizations adopt the practices emphasizing risk control and information system intensity, they need to be clear about the task requirements and expectations of professionals. When service organizations adopt the practices of process control formality, they need to reduce task overloads and pressures on their professionals. In all, in the professional service sector (e.g., banking), it is better to adopt the practices of risk control and information system intensity because it is difficult for such organizations to reduce their employees' task overload and pressure.

Third, governments or relevant institutions should issue some regulations about operational behavior for these professional companies, for example, the practices about risk control, to help professions to be clear about the task requirements and expectations of professionals. Also, relevant government departments should provide some supports for information system establishment to further avoid the behavior risks of the professionals. When implementing such strict risk management mechanism,

governments should appeal more professional companies to reduce the role stress for employees and develop the relax work climate.

## Limitations and future work

This research points to several limitations as possible topics for future research. First, the total reliance cross-sectional data may have influenced the measurement accuracy of the variables such as ethical performance and role stress. Future researchers may use some longitudinal data to test our models more accurately. For instance, they can collect data on behavior control practices in three consecutive years along with data on the variables of ethical behaviors. That should help test the models robustly. Second, we have confined our study to the banking industry. Future studies can enrich the sample types, for example, by including other types of professional services such as health care and law offices, to test whether different types of professional services have different effects. Third, our Study 2 only examined the effective practices from our Study 1. Further study could offer more insights about whether other practices (e.g., employee education and training) have limited effectiveness by using field experiments. Finally, the research setting of our work was China. Although control practices in China are fairly similar to those in other countries, one can expect ethical problems to be influenced by culture and institutions. In future studies, it is worthwhile to consider some contextual factors relevant to ethical behaviors.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

YH, YY, and KCL contributed to conception, design of the study, and wrote sections of the manuscript. YY and KCL organized the database. YY performed the statistical analysis.



All authors contributed to manuscript revision, read, and approved the submitted version.

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## References

- Ajzen, I. (1991). The theory of planned behaviour. *Organ. Behav. Hum. Decision Proc.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T
- Auletto, K. T., and Miller, A. J. (2007). Developing more ethical leaders. *Techniques* 92, 16–21.
- Bazerman, M. H., and Tenbrunsel, A. E. (2011). Good people often let bad things happen. why? *Harvard Bus. Rev.* 89, 58–65.
- Beehr, T. A., Walsh, J. T., and Taber, T. D. (1976). Relationship of stress to individually and organizationally valued states: higher order needs as a moderator. *J. Appl. Psychol.* 61, 41–47. doi: 10.1037/0021-9010.61.1.41
- Behrman, D. N., and Perreault, W. D. Jr. (1982). Measuring the performance of industrial salespersons. *J. Bus. Res.* 10, 355–370. doi: 10.1016/0148-2963(82)90039-X
- Birkelund, R. (2000). Ethics and education. *Nursing Ethics* 7, 473–480. doi: 10.1177/096973300000700603
- Bowen, J., and Ford, R. C. (2002). Managing service organizations: does having a “thing” make a difference? *J. Manag.* 28, 447–469. doi: 10.1016/S0149-2063(02)00135-6
- Boyer, K. K., and Verma, R. (2000). Multiple raters in survey-based operations management research: a review and tutorial. *Prod. Operat. Manag.* 9, 128–140. doi: 10.1111/j.1937-5956.2000.tb00329.x
- Byrne, B. M. (2013). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*. New York, NY: Routledge. doi: 10.4324/9781410600219
- Cabana, G. C., and Kaptein, M. (2021). Team ethical cultures within an organization: a differentiation perspective on their existence and relevance. *J. Bus. Ethics* 170, 761–780. doi: 10.1007/s10551-019-04376-5
- Caniato, F., Caridi, M., Crippa, L., and Moretto, A. (2012). Environmental sustainability in fashion supply chains: an exploratory case based research. *Int. J. Prod. Econ.* 135, 659–670. doi: 10.1016/j.iipe.2011.06.001
- Choi, H., Mohammad, A., and Kim, W. G. (2019). Understanding hotel frontline employees’ emotional intelligence, emotional labor, job stress, coping strategies and burnout. *Int. J. Hospitality Manag.* 82, 199–208. doi: 10.1016/j.ijhm.2019.05.002
- Das, S. R., and Joshi, M. P. (2007). Process innovativeness in technology services organizations: roles of differentiation strategy, operational autonomy and risk-taking propensity. *J. Operat. Manag.* 25, 643–660. doi: 10.1016/j.jom.2006.05.011
- Dewberry, C., and Jackson, D. J. (2018). An application of the theory of planned behaviour to student retention. *J. Vocational Behav.* 107, 100–110. doi: 10.1016/j.jvb.2018.03.005
- Endenich, C., and Trapp, R. (2020). Ethical implications of management accounting and control: a systematic review of the contributions from the Journal of Business Ethics. *J. Bus. Ethics* 163, 309–328. doi: 10.1007/s10551-018-4034-8
- Erwin, P. M. (2011). Corporate codes of conduct: the effects of code content and quality on ethical performance. *J. Bus. Ethics* 99, 535–548. doi: 10.1007/s10551-010-0667-y
- Fishbein, M., and Ajzen, I. (1975). *Belief, Attitude, Intention and Behaviour: An Introduction to the Theory and Research*. Boston, MA: Addison-Wesley, Reading.
- Fusaro, P. C., and Miller, R. M. (2002). *What Went Wrong at Enron: Everyone's Guide to the Largest Bankruptcy in US History*. New York, NY: John Wiley & Sons.
- George, D., and Mallery, P. (2003). *SPSS for Windows Step by Step: A Simple Guide and Reference*. Boston, MA: Allyn & Bacon.
- Goodale, J. C., Kuratko, D. F., and Hornsby, J. S. (2008). Influence factors for operational control and compensation in professional service organizations. *J. Operat. Manag.* 26, 669–688. doi: 10.1016/j.jom.2007.12.001
- Goodale, J. C., Kuratko, D. F., Hornsby, J. S., and Covin, J. G. (2011). Operations management and corporate entrepreneurship: the moderating effect of operations control on the antecedents of corporate entrepreneurial activity in relation to innovation performance. *J. Operat. Manag.* 29, 116–127. doi: 10.1016/j.jom.2010.07.005
- Gopal, A., Goyal, M., Nettesine, S., and Reindorp, M. (2012). The impact of new production introduction on plant productivity in the North American automotive industry. *INSEAD Working Papers Collect.* 80, 1–34. doi: 10.2139/ssrn.1750123
- Griffin, M. A., Neal, A., and Parker, S. K. (2007). A new model of work role performance: positive behaviour in uncertain and interdependent contexts. *Acad. Manag. J.* 50, 327–347. doi: 10.5465/amj.2007.24634438
- Hauser, C. (2020). From preaching to behavioural change: fostering ethics and compliance learning in the workplace. *J. Bus. Ethics* 162, 835–855. doi: 10.1007/s10551-019-04364-9
- Hirschfeld, R. R., and Van Scotter, I. I. J. (2018). Vocational behaviour from the dark side. *J. Vocational Behav.* 110, 303–316. doi: 10.1016/j.jvb.2018.10.019
- Hong, M. C., Lin, H., Hsu, D. K., and Shi, Y. (2021). When ownership of the venture triggers cofounders’ unethical pro-venture behaviour. *J. Bus. Venturing Insights* 16:e00255. doi: 10.1016/j.jbvi.2021.e00255
- Huang, R. L., and Guo, O. (2017). *Chinese Investment Scandal Highlights Shadow Banking Risk*. Available online at [https://www.nytimes.com/2017/04/19/business/china-minsheng-shadow-banking.html?\\_ga=2.52299241.1740380992.1515321693-1587685369.1515321693](https://www.nytimes.com/2017/04/19/business/china-minsheng-shadow-banking.html?_ga=2.52299241.1740380992.1515321693-1587685369.1515321693) (accessed on 9 July, 2021).
- Huang, X., Chau, K. Y., Tang, Y. M., and Iqbal, W. (2022). Business ethics and irrationality in SME during COVID-19: Does it impact on sustainable business resilience? *Front. Environ. Sci.* 10:870476. doi: 10.3389/fenvs.2022.870476

## Conflict of interest

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- Izzo, G. (2000). Compulsory ethics education and the cognitive moral development of salespeople: a quasi-experimental assessment. *J. Bus. Ethics* 28, 223–241. doi: 10.1023/A:1006206829583
- James, H. M. (1998). Classification and grading of pressure sores. *Prof. Nurse* 13, 669–672.
- James, L. R. (1982). Aggregation bias in estimates of perceptual agreement. *J. Appl. Psychol.* 67, 219–229. doi: 10.1037/0021-9010.67.2.219
- Jannat, T., Alam, S. S., Ho, Y. H., Omar, N. A., and Lin, C. T. (2022). Can corporate ethics programs reduce unethical behaviour? threat appraisal or coping appraisal. *J. Bus. Ethics* 176, 37–53. doi: 10.1007/s10551-020-04726-8
- Kaptein, M. (2009). Ethics programmes and ethical culture: a next step in unraveling their multi-faceted relationship. *J. Bus. Ethics* 89, 261–281. doi: 10.1007/s10551-008-9998-3
- Langley, A. (1999). Strategies for theorizing from process data. *Acad. Manag. Rev.* 24, 691–710. doi: 10.2307/259349
- Lehnert, K., Craft, J., Singh, N., and Park, Y. H. (2016). The human experience of ethics: a review of a decade of qualitative ethical decision-making research. *Bus. Ethics: Eur. Rev.* 25, 498–537. doi: 10.1111/beer.12129
- Lewis, M. A., and Brown, A. D. (2012). How different is professional service operations management? *J. Operat. Manag.* 30, 1–11. doi: 10.1016/j.jom.2011.04.002
- Lin, C. Y. Y., and Wei, Y. C. (2006). The role of business ethics in merger and acquisition success: an empirical study. *J. Bus. Ethics* 69, 95–109. doi: 10.1007/s10551-006-9070-0
- Liu, X., Jackson, G., Lu, J. G., Zhang, H., and Cai, Y. (2021). Helping the organization but hurting yourself: how employees' unethical pro-organizational behaviour predicts work-to-life conflict. *Organ. Behav. Hum. Decision Proc.* 167, 88–100. doi: 10.1016/j.obhdp.2021.05.002
- Mendoza, L. C. (2013). How can management control system fairness reduce managers' unethical behaviours? *Eur. Manag. J.* 31, 209–222. doi: 10.1016/j.emj.2012.12.001
- Merchant, K. A., and Van der Stede, W. A. (2012). *Management Control Systems: Performance Measurement, Evaluation and Incentives*. Harlow: Prentice Hall.
- Metwally, D., Ruiz-Palomino, P., Metwally, M., and Gartzia, L. (2019). How ethical leadership shapes employees' readiness to change: the mediating role of an organizational culture of effectiveness. *Front. Psychol.* 10:2493. doi: 10.3389/fpsyg.2019.02493
- Michaelson, C., and Tosti-Kharas, J. (2019). Serving self or serving others? close relations' perspectives on ethics and calling. *J. Vocat. Behav.* 114, 19–30. doi: 10.1016/j.jvb.2019.02.005
- Mills, P. K., Chase, R. B., and Margulies, N. (1983). Motivating the client/employee system as a service production strategy. *Acad. Manag. Rev.* 8, 301–310. doi: 10.2307/257758
- Moore, C., Detert, J. R., Treviño, L. K., Baker, V. L., and Mayer, D. M. (2012). Why employees do bad things: moral disengagement and unethical organizational behaviour. *Personnel Psychol.* 65, 1–48. doi: 10.1111/j.1744-6570.2011.01237.x
- Morgan, N. A., Kaleka, A., and Gooner, R. A. (2007). Focal supplier opportunism in supermarket retailer category management. *J. Operat. Manag.* 25, 512–527. doi: 10.1016/j.jom.2006.05.006
- Murcio, R., and Scalzo, G. (2021). Person-centered leadership: the practical idea as a dynamic principle for ethical leadership. *Front. Psychol.* 12:708849. doi: 10.3389/fpsyg.2021.708849
- Nordenmark, M. (2004). Multiple social roles and well-being a longitudinal test of the role stress theory and the role expansion theory. *Acta Sociol.* 47, 115–126. doi: 10.1177/0001699304043823
- Plumridge, H. (2014). *Glaxo's Chief Faces Rising Pressure; Witty must Deal with Weak Sales, Bribery Allegations; Shares in Drug Maker are off 15%*. New York, NY: Dow Jones & Company, Inc.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88:879.
- Qing, M., Asif, M., Hussain, A., and Jameel, A. (2019). Exploring the impact of ethical leadership on job satisfaction and organizational commitment in public sector organizations: the mediating role of psychological empowerment. *Rev. Manag. Sci.* 14, 1405–1432. doi: 10.1007/s11846-019-00340-9
- Remišová, A., Lašáková, A., and Kirchmayer, Z. (2019). Influence of formal ethics program components on managerial ethical behaviour. *J. Bus. Ethics* 160, 151–166. doi: 10.1007/s10551-018-3832-3
- Rest, J. R. (1983). "Morality", in *Handbook of Child Psychology*, eds P. H. Mussen, J. H. Flavell, and E. M. Markman (New York, NY: John Wiley & Sons).
- Rizzo, J. R., House, R. J., and Lirtzman, S. (1970). Role conflict and ambiguity in complex organizations. *Administrative Sci. Quarterly* 15, 150–163. doi: 10.2307/2391486
- Safizadeh, M. H., Field, J. M., and Ritzman, L. P. (2004). An empirical analysis of financial services processes with a front-office or back-office orientation. *J. Operat. Manag.* 21, 557–576. doi: 10.1016/j.jom.2003.03.001
- Schultz, R. J., Evans, K. R., and Good, D. J. (1999). Intercultural interaction strategies and relationship selling in industrial markets. *Industrial Market. Manag.* 28, 589–599. doi: 10.1016/S0019-8501(98)00032-7
- Shang, L., and Yang, L. (2022). A cross-level study of the relationship between ethical leadership and employee constructive deviance: effects of moral self-efficacy and psychological safety climate. *Front. Psychol.* 13:964787. doi: 10.3389/fpsyg.2022.964787
- Shin, J., Kim, Y. J., Jung, S., and Kim, C. (2022). Product and service innovation: comparison between performance and efficiency. *J. Innovat. Knowledge* 7:100191. doi: 10.1016/j.jik.2022.100191
- Silveira, A. D. M. D. (2022). Corporate governance and ethical culture: Do boards matter? *Rev. Manage. Sci.* 16, 1085–1116.
- Singh, J. (1998). Striking a balance in boundary spanning positions: an investigation of some unconventional influences of role stressors and job characteristics on job outcomes of Salespeople. *J. Market.* 62, 69–86. doi: 10.1177/00224299806200305
- Smith, J. S., and Karwan, K. R. (2010). Empirical profiles of service recovery systems: the maturity perspective. *J. Service Res.* 13, 111–125. doi: 10.1177/1094670509351567
- Somers, M. J. (2001). Ethical codes of conduct and organizational context: a study of the relationship between codes of conduct, employee behaviour and organizational values. *J. Bus. Ethics* 30, 185–195. doi: 10.1023/A:1006457810654
- Stellar, J. E., and Willer, R. (2018). Unethical and inept? the influence of moral information on perceptions of competence. *J. Personal. Soc. Psychol.* 114, 195–210. doi: 10.1037/pspa0000097
- Strauss, K., Parker, S. K., and O'Shea, D. (2017). When does proactivity have a cost? motivation at work moderates the effects of proactive work behaviour on employee job strain. *J. Vocational Behav.* 100, 15–26. doi: 10.1016/j.jvb.2017.02.001
- Tehrani, H. D., and Yamini, S. (2020). Dataset of parenting practices, self-control and anti-social behaviours: meta-analytic structural equation modeling. *Data Brief* 32:106114. doi: 10.1016/j.dib.2020.106114
- Teresi, M., Pietroni, D. D., Barattucci, M., Giannella, V. A., and Pagliaro, S. (2019). Ethical climate(s), organizational identification, and employees' behaviour. *Front. Psychol.* 10:1356. doi: 10.3389/fpsyg.2019.01356
- The Peoples' Bank of China (2002). *Guidelines for Internal Control of Commercial Banks*. China: The Peoples' Bank of China.
- Tian, Q., and Peterson, D. K. (2016). The effects of ethical pressure and power distance orientation on unethical pro-organizational behaviour: the case of earnings management. *Bus. Ethics: Eur. Rev.* 25, 159–171. doi: 10.1111/beer.12109
- Treviño, L. K., Weaver, G. R., and Reynolds, S. J. (2006). Behavioral ethics in organizations: A review. *J. Manage.* 32, 951–990.
- Van Hooft, E. A., Born, M. P., Taris, T. W., Van der Flier, H., and Blonk, R. W. (2005). Bridging the gap between intentions and behaviour: implementation intentions, action control, and procrastination. *J. Vocational Behav.* 66, 238–256. doi: 10.1016/j.jvb.2004.10.003
- Von Nordenflycht, A. (2010). What is a professional service organization? toward a theory and taxonomy of knowledge-intensive organizations. *Acad. Manag. Rev.* 35, 155–174. doi: 10.5465/AMR.2010.45577926
- Vveinhardt, J. (2022). The dilemma of postmodern business ethics: employee reification in a perspective of preserving human dignity. *Front. Psychol.* 13:813255. doi: 10.3389/fpsyg.2022.813255
- Wang, J., Wang, X. Q., Li, J. Y., Zhao, C. R., Liu, M., and Ye, B. J. (2021). Development and validation of an unethical professional behaviour tendencies scale for student teachers. *Front. Psychol.* 12:770681. doi: 10.3389/fpsyg.2021.770681
- Warren, D., Gaspar, J., and Laufer, W. (2014). Is formal ethics training merely cosmetic? a study of ethics training and ethical organizational culture. *Bus. Ethics Quarterly* 24, 85–117. doi: 10.5840/beq2014233
- Watley, L. D. (2014). Training in ethical judgment with a modified P otter B ox. *Bus. Ethics: Eur. Rev.* 23, 1–14. doi: 10.1111/beer.12034

Weaver, G. R., Trevino, L. K., and Cochran, P. L. (1999). Integrated and decoupled corporate social performance: management commitments, external pressures, and corporate ethics practices. *Acad. Manag. J.* 42, 539–552. doi: 10.2307/256975

Werner, S., Tosi, H. L., and Gomez-Mejia, L. (2005). Organizational governance and employee pay: how ownership structure affects the organization's compensation strategy. *Strategic Manag. J.* 26, 377–384. doi: 10.1002/smj.452

Yagil, D., Luria, G., and Gal, I. (2008). Stressors and resources in customer service roles: exploring the relationship between core self-evaluations and burnout. *Int. J. Service Industry Manag.* 19, 575–595. doi: 10.1108/09564230810903479

Yin, R. K. (2003). *Case Study Research: Design and Methods*. Thousand Oak, CA: Sage.

Zhou, C. (2006). Revision of criminal law: responding to six common financial crime techniques. *China Bus. News* 1:2.



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# The influence of benevolent leadership on knowledge sharing of postgraduate supervisor: A moderated mediating model

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In order to explore the mechanism and boundary conditions of the influence of benevolent leadership on knowledge sharing, we took postgraduate supervisor as participants and constructed a moderated mediating effect model. In this study, a total of 1,083 valid questionnaires were collected by questionnaire method and the confirmatory factor analysis, correlation analysis, regression analysis, and Hayes's PROCESS macro were used to analyze the data. The results show that benevolent leadership positively affects knowledge sharing. Creative self-efficacy mediates the relationship between benevolent leadership and knowledge sharing. Professional identity moderates the relationship between benevolent leadership and creative self-efficacy, when the professional identity is ( $M - 1$  SD) and ( $M + 1$  SD), the moderating effect is significant, while when the professional identity is ( $M$ ), the moderating effect is not significant. Research stress moderates the relationship between creative self-efficacy and knowledge sharing, when research stress is ( $M - 1$  SD), ( $M$ ), and ( $M + 1$  SD), the moderating effect is significant. Professional identity and research stress jointly moderated the mediating effect of creative self-efficacy. Professional identity moderated the first half path of the mediating model, while research stress moderated the second half path of the mediating model. When the level of professional identity is high and research stress is high, benevolent leadership has the greatest positive influence on knowledge sharing through creative self-efficacy. When the level of professional identity is low and research stress is high, benevolent leadership has the greatest negative influence on knowledge sharing through creative self-efficacy. This study enriches the relevant research on benevolent leadership and knowledge sharing, explores the conditions and factors that enhance or buffer benevolent leadership, and shows that the best effect can be achieved when the leadership behavior is consistent with the situational factors.

## KEYWORDS

benevolent leadership, knowledge sharing, creative self-efficacy, professional identity, research stress

## Introduction

With the development of economy and society, the competition among universities is becoming more and more fierce, and knowledge sharing plays an increasingly important role in winning competitive advantages for universities. Postgraduate supervisors whose main task is talent cultivation and scientific research play an important role in knowledge inheritance, innovation and sharing (Lu, 2017). What methods the leaders take and what conditions they create to encourage postgraduate supervisors to share knowledge, so as to improve the quality of talent cultivation and scientific research to enhance the competitiveness of schools, has become a problem that all universities must solve. However, in the existing literature, there are few studies on knowledge sharing of postgraduate supervisors. The purpose of this study is to explore what factors influence the knowledge sharing of postgraduate supervisors, and what are the action mechanism and boundary conditions of this influence.

In the organization, not everyone is willing to share knowledge (Sedighi et al., 2016), the main reason is that individuals have the risk of being surpassed and replaced by others after knowledge sharing (Su et al., 2018, 2021, 2022). The factors that affect knowledge sharing can be divided into organizational factors and individual factors (Li et al., 2014; Xu et al., 2020). Among organizational factors, the influence of leadership on knowledge sharing deserves attention. Leaders can influence knowledge sharing not only through their own behaviors, but also through organizational culture, atmosphere, values, and institutional system (Le and Lei, 2018; Le and Than, 2020; Than et al., 2020). Benevolent leadership provide comprehensive and personalized compassion and care for the work and life of their subordinates (Cheng et al., 2002), according to the social exchange theory (Blau, 1964), subordinates will reciprocate with corresponding work achievements or altruistic behaviors (Farh et al., 2006). For postgraduate supervisors, knowledge sharing is a practical and efficient way to pay back when they reward benevolent leaders. It can be concluded that benevolent leadership has a positive role in promoting the knowledge sharing behavior of postgraduate supervisors.

Among the individual factors affecting knowledge sharing, self-efficacy is an important factor (Liu and Liu, 2011). The creative self-efficacy is the embodiment of self-efficacy in the field of creation (Tierney and Farmer, 2002, 2011), the employees with a high sense of creative self-efficacy have a stronger desire to share knowledge (Yoon and Han, 2018). Knowledge sharing is largely limited by individual abilities and qualities. When postgraduate supervisors are confident in their knowledge, ability, and creative thinking, they will have a higher sense of creative self-efficacy and a higher willingness

to share knowledge, and vice versa. Individual creative self-efficacy is influenced by leadership behavior. Benevolent leadership not only understands postgraduate supervisors, help them solve their problems, but also creates a relaxed working environment. Benevolent leadership promotes the improvement of postgraduate supervisors' creative self-efficacy. Therefore, it can be inferred that creative self-efficacy plays a mediating role between benevolent leadership and knowledge sharing.

Although benevolent leadership can positively affect creative self-efficacy, this relationship is affected by the attitude of individuals to the work they are engaged in. If individuals have a high degree of identification with the work they are engaged in, the positive influence of benevolent leadership on creative self-efficacy will be enhanced. If individuals have a low degree of identification with the work they are engaged in, the negative influence of benevolent leadership on creative self-efficacy will be enhanced (Wu et al., 2012; Li et al., 2018). The relationship between creative self-efficacy and knowledge sharing will also be affected by external conditions. Combines the actual conditions of the work of postgraduate supervisors, this manuscript considers research stress as an important environmental factor. Because research stress is a challenging stress, it can be considered that the relationship between creative self-efficacy and knowledge sharing is closer when research stress is high.

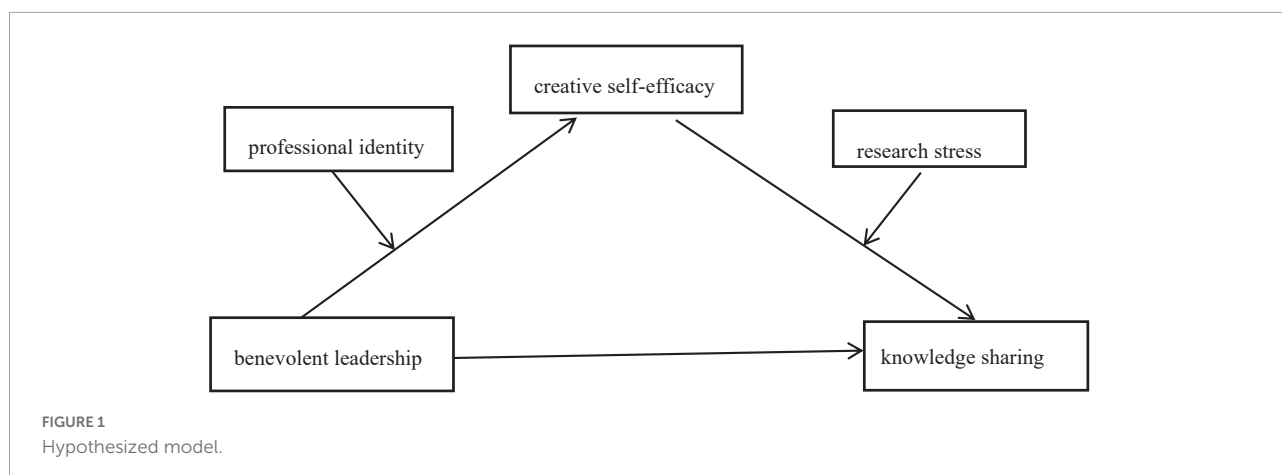
The influence of different leadership styles on knowledge sharing has been studied in the previous literature, the differences between this study and previous studies are as follows: First, take the postgraduate supervisors as the participant for research. Second, benevolent leadership is studied as a separate variable from the content of paternalistic leadership. Third, design two moderating variables, not only to examine the role of each moderating variable, but also to explore the jointly role of the two moderating variables. This study focuses on the following questions: the influence of benevolent leadership on knowledge sharing of postgraduate supervisors; the mediating effect of creative self-efficacy; the moderating effect of professional identity and research stress; how professional identity and research stress jointly moderate the mediating effect of creative self-efficacy between benevolent leadership and knowledge sharing. The specific theoretical model is shown in Figure 1.

## Theory and hypotheses

### The influence of benevolent leadership on knowledge sharing

Benevolent leadership refers to the individual, comprehensive, and long-term care shown by leaders for the personal well-being of their subordinates (Cheng et al., 2004).





The benevolent of leaders refers to the individual care shown by leaders to their subordinates. This kind of benevolent is not distributed to all subordinates equally, but varies according to the contributions and interests of subordinates (Farh and Cheng, 2000). The idea that human nature is good and people-oriented is the philosophical basis for the generation of benevolent leadership. Benevolent leadership leads others through virtue and emphasizes the interaction of social relations. When all parties can fulfill their roles dutifully, they can maintain the harmony of relations (Zhang et al., 2013b). Although the dimension of personalized care in transformational leadership is similar to that of benevolent leadership, the difference between them is still relatively large. Transformational leadership originates from the Western cultural background. The meaning of the dimension of personalized care mainly refers to the concern of leaders for the problems of subordinates in work, providing guidance, support, and help for subordinates in work, but rarely involving the problems of subordinates in personal life. However, while caring about the work level of their subordinates, benevolent leadership also extend it to the life level. In particular, when their subordinates' families encounter difficulties in life, leaders will generally give assistance within their capabilities, such as helping their families to seek medical treatment and helping their children to go to school (Li et al., 2016). Benevolent leaders' concern and help for their subordinates in their work and life will inevitably promote their subordinates to have positive behaviors and positive returns. Previous studies have shown that benevolent leadership has a significant positive predictive effect on work engagement (Xu et al., 2018), altruistic behavior (Gumusluoglu et al., 2019), work performance (Jin et al., 2016), psychological empowerment (Chan, 2017), psychological well-being (Erkutlu and Chafra, 2016), creativity behavior (Lin et al., 2018).

Knowledge sharing is that individuals provide task information and experience to help others, through the process

of working with others to solve problems, develop new ideas and implement new processes (Ipe, 2003). In essence, knowledge sharing is a process in which individuals exchange knowledge and create new knowledge together (Wang and Noe, 2010). Knowledge sharing is a voluntary behavior of individuals. It is a process in which knowledge owners voluntarily transfer knowledge to others so that others can use the knowledge (Saeed et al., 2022). Even if there is no such requirement in the rules and regulations of the unit, knowledge owners are obligated to transfer knowledge (Su et al., 2022). Since knowledge sharing can make the information of individuals with different majors, backgrounds, experiences, knowledge, and skills in the organization gather together, and then break the barriers between knowledge owners and realize the free flow of knowledge within a certain range, knowledge sharing has a very significant positive effect on the organization (Wang et al., 2012; Bavik et al., 2018; Jiang and Chen, 2021). Knowledge sharing has a "double-edged sword" effect on individuals. On the one hand, in the process of knowledge sharing, individual knowledge is reorganized and integrated, and new ideas and ideas are generated in the process of sharing with others (Dong et al., 2017). Knowledge sharing plays the role of "individual gain." On the other hand, in the process of knowledge sharing, after others master the relevant knowledge, the individual's knowledge advantage will be lost, leading to the weakening of competitiveness (Su et al., 2018, 2021, 2022). Knowledge sharing plays the role of "individual loss." Therefore, how to motivate employees to share knowledge has become a problem that organizations must face (Wu and Lee, 2017; Wu, 2021).

Multiple studies have demonstrated that leadership can influence knowledge sharing. Empowering leadership promote knowledge sharing by letting subordinates take responsibility, participate in decision-making, and communicate with each other (Srivastava et al., 2006). Transformational leadership promote knowledge sharing by building common goals, reducing self-interest motives, and providing personalized

care (Shih et al., 2012; Liu and DeFrank, 2013; Dong et al., 2017). Self-sacrificial leadership promote knowledge sharing by emphasizing the mission and objectives of the organization and setting an example (Su et al., 2022). Benevolent leaders will not only give more attention and care to postgraduate supervisors in work, but also take care of many things outside of work or family members. According to the “reciprocity rule” in the social exchange theory (Blau, 1964), when one party receives favors and help from the other party, it will actively take actions to give the other party the same value in return (Gao and Liu, 2021). Benevolent leadership’s psychological and material support behavior will make the postgraduate supervisors feel grateful and return. This return is not only limited to the leader himself, but also spills over to the organizational level. For postgraduate supervisors, knowledge sharing is the most effective and convenient way for them to repay their leaders and organizations. Therefore, it is inferred that benevolent leadership positively predicts knowledge sharing behavior of postgraduate supervisors. Based on this, hypothesis 1 is proposed:

Hypothesis 1: Benevolent leadership can positively predict knowledge sharing of postgraduate supervisors.

## The mediating effect of creative self-efficacy on the relationship between benevolent leadership and knowledge sharing

Creative self-efficacy is an individual’s evaluation of whether a certain work he or she is engaged in has the ability and confidence to produce creative behavior, which reflects the individual’s self-belief or expectation for himself or herself in creative activities (Tierney and Farmer, 2002). Yang et al. (2011) further explained the creative self-efficacy as the special self-efficacy of individuals in their creative activities and the expression of their belief in the realization of their creativity. It can be understood from four aspects: the belief that you can generate new ideas, the confidence that you can solve problems creatively, the skill and impulse to help others complete new ideas, and the confidence that you can find solutions to new problems (Yang et al., 2011). Previous studies have shown that creative self-efficacy has a significant positive predictive effect on innovation behavior (Mielniczuk and Laguna, 2018; Newman et al., 2018), creative performance (Tierney and Farmer, 2011), and is an important factor to promote organizational development (Puente-Díaz, 2016). The influencing factors of creative self-efficacy can be roughly divided into organizational factors, leadership factors, job-related factors, individual factors, etc. (Yang and Cheng, 2009;

Yang et al., 2011). Among them, the positive influence of leadership factors on creative self-efficacy has been supported by many studies (Gong et al., 2009; Gu et al., 2015; Ye et al., 2018, 2019).

Benevolent leaders’ personalized care and compassion for subordinates and their families in work and life can improve the creative self-efficacy of postgraduate supervisors in the following two aspects. First, the encouragement and support of benevolent leaders to the work of their subordinates provides a safe psychological environment, stimulates the role obligation of postgraduate supervisors, increases work confidence, and enables postgraduate supervisors to dare to generate and try new ideas without worrying about the negative impact of failure (Emilia and Mariola, 2018). Secondly, benevolent leader’s concern for the personal life and family of subordinates can make the postgraduate supervisor concentrate more time and energy on the work, and avoid trifles to delay and affect the work (Chen et al., 2014). Therefore, the postgraduate supervisor can concentrate on creative work, and thus improve the personal sense of creative self-efficacy. The positive effect of benevolent leadership on creative self-efficacy has been proved by relevant studies (Xia et al., 2022).

Creative self-efficacy is the specific application of individual self-efficacy in creative activities, is the subjective evaluation of individual’s creative ability, and is the premise and basis of creative behavior. Postgraduate supervisors with high creative self-efficacy tend to be more willing to share knowledge. There are two main reasons. First, knowledge sharing helps postgraduate supervisors improve their expert power and organizational status (Wipawayangkool and Teng, 2016). Postgraduate supervisors with a high creative self-efficacy are more confident. They believe that they can generate new ideas in their study and work, like to think and explore work with new eyes and perspectives, and also believe that they can help others solve problems or promote the development of the organization through their own knowledge sharing (Yoon and Han, 2018; Wang et al., 2020). Therefore, they are more likely to be respected by others and valued by the organization. Second, knowledge sharing is conducive to the improvement of the quality of postgraduate supervisors. The knowledge sharing process of postgraduate supervisors is not only a process for others to understand and accept knowledge, but also a process in which individual knowledge becomes clearer, organized, systematic and scientific. In the process of sharing knowledge, individuals must first think, sort out, summarize their own knowledge before sharing it, so in the process of knowledge sharing, postgraduate supervisors will also have greater benefits (Tang et al., 2020; Tantawy et al., 2021).

According to the social exchange theory (Blau, 1964), caring, support, tolerance, and other behaviors of benevolent leadership have a positive influence on the creative self-efficacy (Yang et al., 2011). According to the content related to self-efficacy in

social cognitive theory (Bandura, 1977), it can be inferred that the creative self-efficacy has a positive influence on knowledge sharing (Xu et al., 2021). Therefore, it can be concluded that the benevolent leadership promotes the knowledge sharing of the postgraduate supervisors by improving the creative self-efficacy. Based on this, hypothesis 2 is proposed:

Hypothesis 2: Creative self-efficacy mediates the relationship between benevolent leadership and knowledge sharing.

## The moderating effect of professional identity on the relationship between benevolent leadership and creative self-efficacy

Professional identity is an individual's positive attitude and strong sense of investment in a certain occupation, which is reflected in the desire of the individual to maintain the occupation and the degree of love for the occupation (Lasky, 2005; Tripathi et al., 2020). Professional identity is based on the theory of social identity (Zhao et al., 2022), influenced by individual characteristics, the cultural atmosphere at that time and the evaluation of a certain career by social groups, and according to individual characteristics and social evaluation to determine their feelings and value significance of the occupation (Sheybani and Miri, 2019; Wei, 2021). Teachers' professional identity is the synthesis of teachers' positive cognition, experience, and behavioral tendency toward their profession and their internalized professional role (Mahmoudi-Gahruei et al., 2016; Sardabi et al., 2018). It is a multi-dimensional structure composed of four factors: professional value, role value, professional sense of belonging, and professional behavior tendency (Wei et al., 2013). Previous studies have shown that teachers' professional identity, as a protective factor, plays an enhanced role in job engagement, job satisfaction, career happiness, career commitment, professional development, job performance, mental health, and other factors (Ng and Feldman, 2008; Hong, 2010), while reducing occupational stress, job burnout, turnover intention, and other negative factors (Beijaard et al., 2000; Wei et al., 2013).

Professional identity can be divided into different levels such as high and low, strong and weak, so it is used as a moderating variable in this study. Individuals with high professional identity have a positive attitude toward work (Beijaard et al., 2004), pay attention to the accumulation of professional knowledge and the improvement of professional skills (Wang et al., 2011), are willing to pay time and energy for work, and aspire to achieve work achievements, and have a good career development prospect (Luo et al., 2014). Individuals with low professional identity have a negative attitude toward work,

are not willing to pay in the work, are prone to job burnout and negative emotions (Zhao et al., 2022), and are prone to turnover when encountering setbacks (Chen et al., 2020). In this study, professional identity as an individual variable moderates the relationship between benevolent leadership and creative self-efficacy. When postgraduate supervisors have a high level of professional identity, the relationship between benevolent leadership and creative self-efficacy is positively enhanced. Because when postgraduate supervisors have a positive attitude toward the work, the benevolent leadership's care, support, encouragement, and other behaviors strengthen the creative self-efficacy of postgraduate supervisors (Yang et al., 2011). When postgraduate supervisors have a low level of professional identity, the relationship between benevolent leadership and creative self-efficacy is negatively enhanced. The main reason for this situation is that when the individual's professional identity is low, he will have a negative attitude toward work, and his requirements for his work will continue to decrease (Ding et al., 2022). The kindness and support of benevolent leadership, and even the tolerance of "those who make mistakes," are regarded as "lax requirements," "acquiescence in deviant behavior," and "weak and incompetence," which leads to worse and worse results (Li et al., 2022). Therefore, hypothesis 3 is proposed:

Hypothesis 3: Professional identity plays a moderating role between benevolent leadership and creative self-efficacy. The higher the professional identity, the stronger the positive influence of benevolent leadership on creative self-efficacy. The lower the professional identity, the stronger the negative influence of benevolent leadership on creative self-efficacy.

## The moderating effect of research stress on the relationship between creative self-efficacy and knowledge sharing

Research stress refers to the stress generated in the process of completing scientific research tasks or carrying out scientific research activities. Stress has both positive and negative effects. Depending on the different effects, it can be divided into enstress and distress (Selye, 1982). According to the nature of work stress and its effects, the challenge-hindrance model of stress divides stress into challenge stressors and hindrance stressors (Cavanaugh et al., 2000). Challenge stressors is a kind of stress that can promote the growth and development of individuals (Rodell and Judge, 2009). It is mainly related to workload, time pressure, job complexity, and job responsibilities (Crawford et al., 2010). Hindrance stressors is a kind of stress that hinders the development of individual ability and work harvest (Boswell et al., 2004; LePine et al., 2005). It is mainly related to job insecurity, role conflict, and work distress (Podsakoff et al., 2007; Mazzola and Disselhorst, 2019). For postgraduate supervisors, the research stress should belong to the challenge

stress, because scientific research is one of the main work tasks of postgraduate supervisors, and many of the assessment indicators of postgraduate supervisors are related to scientific research. Research stress is something that every postgraduate supervisor will encounter in their work.

As an environmental variable, research stress plays a moderating role in the relationship between creative self-efficacy and knowledge sharing of postgraduate supervisors. First, under the condition of high research stress, it arouses the postgraduate supervisors' research needs and motives, and has an incentive effect on research behavior (Bunce and West, 1994). Postgraduate supervisors adopt a positive attitude and behavior to cope with the stress. Knowledge sharing is conducive to the integration and innovation of personal knowledge and the completion of scientific research tasks. Therefore, the higher the research stress, the closer the relationship between creative self-efficacy and knowledge sharing. Second, the affective events theory regard (Weiss and Cropanzano, 1996), affective reactions and work behaviors of different individuals are different for the same stressful event (Duan et al., 2011). The transactional theory of stress regard (Lazarus and Folkman, 1984), the influence of stress on individual psychology and behavior depends on individual evaluation and judgment of stress. According to the above two theories, under the condition of high research stress, postgraduate supervisors will regard research stress as challenges and opportunities, and they will take positive behaviors to cope with the stress, so they will have more knowledge sharing behaviors. While under the condition of low research stress, due to insufficient stress and other reasons, the enthusiasm of postgraduate supervisors to share knowledge is also low. Based on this, hypothesis 4 is proposed:

Hypothesis 4: Research stress plays a moderating role between creative self-efficacy and knowledge sharing. The greater the research stress, the closer the relationship between creative self-efficacy and knowledge sharing will be.

## A moderated mediating effect among the five variables

According to the above explanation, this study believes that benevolent leadership can be used as the independent variable, knowledge sharing as the dependent variable, creative self-efficacy as the mediating variable, and professional identity and research stress as the moderating variable to form a moderated mediating effect model. Due to the complexity of the situation, the mediating effect of benevolent leadership on knowledge sharing through creative self-efficacy is likely to be affected by more than one moderating variable. In this study, professional identity as an individual variable and research stress as an environmental variable jointly moderated the mediating effect

of benevolent leadership on knowledge sharing through creative self-efficacy. Professional identity moderated the first half of the mediating effect model, while research stress moderated the second half of the mediating effect model.

The “motivation-opportunity-ability framework” of individual behavior believe (Enno et al., 2008), a behavior is most likely to occur when the motivation, ability, and opportunity are combined (Blumberg and Pringle, 1982; Abiero and Bradfield, 2021). The effectiveness of this framework has been verified in many fields. In the field of knowledge management, it is mainly used to explain knowledge transmission, knowledge exchange, and knowledge sharing (Tobin and Wesley, 2015; Elbaz et al., 2018). This framework can also be used in this study to explain the influence of independent variables, mediating variables and moderating variables on knowledge sharing. Benevolent leadership as a “motivation factor” influence knowledge sharing, creative self-efficacy as a “ability factor” influence knowledge sharing, professional identity, and research stress together as a “opportunity factor” influence knowledge sharing. As the moderating effect is jointly acted by professional identity and research stress, it can be divided into four types: high professional identity and high research stress, high professional identity and low research stress, low professional identity and high research stress, low professional identity and low research stress. Since professional identity reflects an individual's attitude toward work and research stress reflects the challenge stress felt by an individual. We infer that when an individual's professional identity is high and research stress is high, both of them have a positive moderating effect on the mediating effect of creative self-efficacy; when an individual's professional identity is low and research stress is high, both of them have a negative moderating effect on the mediating effect of creative self-efficacy. Accordingly, hypothesis 5 is put forward as follows:

Hypothesis 5: Professional identity and research stress jointly moderate the mediating effect of benevolent leadership on knowledge sharing through creative self-efficacy. The higher the professional identity and research stress, the stronger the positive moderating effect is on the mediating effect of creative self-efficacy, while the lower the professional identity and the higher research stress, the stronger the negative moderating effect is on the mediating effect of creative self-efficacy.

## Materials and methods

### Procedure and participants

This study collects data through questionnaire survey. Using personal social network relationship and snowballing



method, the questionnaire was distributed to many universities in China. The online survey and on-site survey were used to collect the questionnaire. The online survey was carried out through professional platform what is named “Wenjuanxing,” the on-site survey was carried out by sending questionnaires to the participants and taking them back after answering them. The confidentiality of the results was emphasized before the survey, and the questionnaires were filled out voluntarily by the participants. A total of 1,211 questionnaires were distributed, after collecting the questionnaire, review the answers, delete linear and wavy answers, and 1,083 valid questionnaires were collected. **Table 1** presents the demographic characteristics of the sample. Of the 1,083 participants, included 709 (65.466%) males and 374 (34.534%) females. 30 (3.139%) participants were aged 30 years and below, 163 (15.051%) were aged 31–35 years, 355 (32.779%) were aged 36–40 years, 242 (22.345%) were aged 41–45 years, 149 (13.758%) were aged 46–50 years, 112 (10.342%) were aged 51–55 years, and 28 (2.586%) were aged 56 years and above. There were 177 (16.343%) participants with lecturer titles, 557 (51.431%) with associate professor titles, and 349 (32.226%) with professor titles. With regard to the years as a postgraduate supervisor, 421 (38.873%) participants were 3 years and below, 257 (23.730%) were 4–6 years, 165 (15.236%) were 7–9 years, and 240 (22.161%) were 10 years and above.

## Measurements

The measurement scales used in this study were derived from existing literature and have been used several times

TABLE 1 Demographic information of sample.

Characteristics	Item	n	%
Gender	Male	709	65.466
	Female	374	34.534
Age	30 years and below	34	3.139
	31–35	163	15.051
	36–40	355	32.779
	41–45	242	22.345
	46–50	149	13.758
	51–55	112	10.342
	56 years and above	28	2.586
Professional titles	Lecturer	177	16.343
	Associate professor	557	51.431
	Professor	349	32.226
Years as a postgraduate supervisor	3 years and below	421	38.873
	4–6	257	23.730
	7–9	165	15.236
	10 years and above	240	22.161

N = 1,083.

in published academic articles, showing good reliability and validity. All the scale items were rated on a five-point Likert scale, with 1 implying “completely disagree” and 5 implying “completely agree.”

### Benevolent leadership

Benevolent leadership was measured using the Benevolent Leadership Scale developed by [Fu et al. \(2012\)](#), this scale is adapted from the scale developed by [Cheng et al. \(2000\)](#), which consists of five items. Samples of these items are as follows: “The leader will care about my personal life” and “The leader’s care for me will extend to my family.” The Cronbach’s alpha for this scale was 0.939.

### Knowledge sharing

Knowledge sharing was measured using the Knowledge Sharing Intention Scale developed by [Wang and Zhu \(2012\)](#), which consists of five items. Samples of these items are as follows: “I am willing to share my knowledge and experience with others” and “When participating in the discussion, I will provide my own opinions as much as possible.” The Cronbach’s alpha for this scale was 0.881.

### Creative self-efficacy

Creative self-efficacy was measured using the Creative Self-Efficacy Scale developed by [Tierney and Farmer \(2002\)](#), which consists of four items. Samples of these items are as follows: “I think I’m good at putting forward new ideas” and “I have confidence in my ability to solve problems creatively.” The Cronbach’s alpha for this scale was 0.877.

### Professional identity

Professional identity was measured using the Chinese University Teachers Professional Identity Questionnaire developed by [Zhang et al. \(2013a\)](#), which consists of six items. Samples of these items are as follows: “As a postgraduate supervisors, I often feel respected” and “I am proud to be a postgraduate supervisors.” The Cronbach’s alpha for this scale was 0.848.

### Research stress

Research stress was measured using the Research Stress Questionnaire developed by [Zhang et al. \(2013c\)](#), which consists of three items. Samples of these items are as follows: “I am worried about how to complete the research task” and “I feel a lot of stress from my research work.” The Cronbach’s alpha for this scale was 0.828.

### Control variables

According to previous research, the gender, age, professional title, years as a postgraduate supervisor were used as control variables ([Chen et al., 2022](#); [Xia et al., 2022](#)).



## Data analyses

Data analyses were conducted using SPSS23.0 and AMOS23.0 (Wu, 2009, 2010), all comparisons were two-tailed, and  $p$ -values  $< 0.05$  were considered statistically significant. First, to establish the validity of the data. Confirmatory factor analysis is used in AMOS23.0 to evaluate the discriminant validity and common method bias between the five variables (Wu, 2009). Second, descriptive analyses were conducted. Descriptive the mean, standard deviation, and Pearson Correlation test was used to measure the correlation between the variables (Wu, 2010). Third, hypothesis test were conducted. Before testing the model, all variables were standardized. Explore the direct effect of the benevolent leadership on knowledge sharing by regression analysis; Model 4 of PROCESS was employed to test whether creative self-efficacy mediated the effect of the benevolent leadership on knowledge sharing; Model 1 of PROCESS was employed to test whether professional identity moderated the effect of the benevolent leadership on creative self-efficacy and research stress moderated the effect of creative self-efficacy on knowledge sharing; Model 21 of PROCESS was employed to test the moderated mediating effect model composed of 5 variables such as benevolent leadership, knowledge sharing, creative self-efficacy, professional identity, and research stress (Hayes, 2013, 2017). In addition, mediating effect and moderating effect analyses were tested using non-parametric bootstrapping methods, the 95% confidence interval produced by the bootstrapping procedure was examined and if zero was not included within the confidence interval, the effect was considered significant (Preacher and Hayes, 2004; Preacher et al., 2007; Hayes, 2009).

## Research results

### Common bias test and discriminant validity

In order to control the bias effect of common methods, the scales with good reliability and validity are used as the measuring tools. In the test process, the confidentiality of the results and the use of the results for academic research only were emphasized. The common method bias was evaluated by control unmeasured single method-factor approaches (Podsakoff et al., 2003; Zhou and Long, 2004). Adding the common method variance (CMV) in confirmatory factor analysis, Table 2 reveals that the fitting degree of the “Five-factor model + CMV” model was not significantly improved ( $\Delta RMSEA = 0.008 < 0.05$ ,  $\Delta SRMR = 0.007 < 0.05$ ,  $\Delta TLI = 0.016 < 0.1$ ,  $\Delta CFI = 0.019 < 0.1$ ). Thus, there is no serious common method bias in this data (Wen et al., 2018).

To test the discriminant validity between the five variables, the goodness of fit of each competing factor model was

compared by confirmatory factor analysis. The results in Table 2 show that the fitting indicators of the “Five-factor model” ( $\chi^2/df = 4.750$ ,  $RMSEA = 0.059$ ,  $SRMR = 0.043$ ,  $TLI = 0.936$ ,  $CFI = 0.944$ ) basically meet the standard and are significantly better than other factor models (Hair et al., 2019), which indicates that the research variables have good discriminant validity.

### Descriptive statistics and correlation analysis

Means, standard deviations, and correlations of the variables used in the analysis are presented in Table 3. The results reveal that the benevolent leadership is significantly positively correlated with knowledge sharing ( $r = 0.228$ ,  $p < 0.01$ ), creative self-efficacy ( $r = 0.197$ ,  $p < 0.01$ ), professional identity ( $r = 0.383$ ,  $p < 0.01$ ), and negatively correlated with research stress ( $r = -0.007$ ,  $p > 0.05$ ). Knowledge sharing is significantly positively correlated with creative self-efficacy ( $r = 0.351$ ,  $p < 0.01$ ), professional identity ( $r = 0.334$ ,  $p < 0.01$ ), and negatively correlated with research stress ( $r = -0.031$ ,  $p > 0.05$ ). Creative self-efficacy is significantly positively correlated with professional identity ( $r = 0.564$ ,  $p < 0.01$ ) and negatively correlated with research stress ( $r = -0.050$ ,  $p > 0.05$ ). Professional identity is positively correlated with research stress ( $r = 0.035$ ,  $p > 0.05$ ).

### Hypothesis testing

The input method was used for linear regression analysis in SPSS, and the results revealed that the benevolent leadership positively influences knowledge sharing (Model 1,  $B = 0.236$ ,  $SE = 0.032$ ,  $p < 0.001$ ). Therefore, Hypothesis 1 was verified.

In SPSS, Process Macro Model 4 (Hayes, 2013, 2017) was used for mediating effect analysis. Creative self-efficacy is a mediating variable, benevolent leadership is an independent variable, and knowledge sharing is a dependent variable. It can be seen from Table 4, benevolent leadership can positively influences creative self-efficacy (Model 2,  $B = 0.202$ ,  $SE = 0.027$ ,  $p < 0.001$ ), creative self-efficacy can positively influences knowledge sharing (Model 3,  $B = 0.323$ ,  $SE = 0.019$ ,  $p < 0.001$ ), benevolent leadership can positively influences knowledge sharing (Model 3,  $B = 0.170$ ,  $SE = 0.019$ ,  $p < 0.001$ ). The direct effect of the model is 0.174 ( $SE = 0.030$ ,  $CI [0.177, 0.294]$ ), and indirect effect is 0.065 ( $BootSE = 0.013$ ,  $BootCI [0.041, 0.093]$ ), the mediating effect accounts for 27.643% of the total effect. Because creative self-efficacy has a significant mediating effect between benevolent leadership and knowledge sharing, hypothesis 2 is verified.

Process Macro Model 1 (Hayes, 2013, 2017) was used for moderating effect analysis. It can be seen from Table 4, when

TABLE 2 Discriminant validity and common method bias test results.

Model	$\chi^2$	df	$\chi^2/df$	CFI	TLI	RMSEA	SRMR
Single-factor model	9187.715	230	39.947	0.394	0.333	0.190	0.159
Two-factor model a	7345.057	229	32.074	0.518	0.468	0.169	0.191
Two-factor model b	5297.192	229	23.132	0.657	0.621	0.143	0.120
Three-factor model a	4311.398	227	18.993	0.724	0.692	0.129	0.120
Three-factor model b	4900.563	227	21.588	0.684	0.648	0.138	0.149
Four-factor model a	2266.432	224	10.118	0.862	0.844	0.092	0.077
Four-factor model b	3096.804	224	13.825	0.806	0.780	0.109	0.102
Five-factor model	1044.978	220	4.750	0.944	0.936	0.059	0.043
Five-factor model + CMV	747.937	197	3.797	0.963	0.952	0.051	0.030

Single-factor model = BL + KS + CSE + PI + RS; Two-factor model a = BL + KS + CSE, PI + RS; Two-factor model b = BL, KS + CSE + PI + RS; Three-factor model a = BL, KS + CSE, PI + RS; Three-factor model b = BL + KS, CSE, PI + RS; Four-factor model a = BL, KS, CSE, PI + RS; Four-factor model b = BL, KS + CSE, PI, RS; Five-factor model = BL, KS, CSE, PI, RS; "+" represents factor combination; BL, benevolent leadership; KS, knowledge sharing; CSE, creative self-efficacy; PI, professional identity; RS, research stress; CMV represents homologous variance.

TABLE 3 Mean, standard deviation, and correlation analysis results of each variable.

Variable	1	2	3	4	5	6	7	8	9
1. Gender	1								
2. Age	−0.067*	1							
3. Title	−0.107**	0.613**	1						
4. SA	−0.060*	0.658**	0.628**	1					
5. BL	0.039	−0.135**	−0.094**	−0.134**	1				
6. KS	0.056	0.007	0.056	0.043	0.228**	1			
7. CSE	−0.095	−0.045	0.088**	0.036	0.197**	0.351**	1		
8. PI	0.046	−0.059	0.014	−0.011	0.383**	0.334**	0.564**	1	
9. RS	0.005	−0.026	−0.069*	−0.064*	−0.007	−0.031	−0.050	0.035	1
M	1.350	41.720	2.160	2.210	3.094	4.138	3.936	3.870	3.475
SD	0.476	6.966	0.679	1.177	0.934	0.470	0.591	0.605	0.882

\* $p < 0.05$ , \*\* $p < 0.01$ ; Gender: 1, male; 2, female; Title: 1, lecturer; 2, associate professor; 3, professor; SA, Supervisor age: 1, 3 years and below; 2, 4–6 years; 3, 10 years and above; BL, benevolent leadership; KS, knowledge sharing; CSE, creative self-efficacy; PI, professional identity; RS, research stress; M, mean; SD, standard deviation.

professional identity is a moderating variable, the interaction coefficient between the benevolent leadership and creative self-efficacy is significant (*Model 4*,  $B = 0.130$ ,  $SE = 0.023$ ,  $p < 0.001$ ), it shows that professional identity plays a moderating role. Therefore, hypothesis 3 has been verified. In order to better understand the moderating effect of professional identity between the benevolent leadership and creative self-efficacy, the professional identity is taken at three different levels according to the average value and the average value plus or minus a standard deviation ( $M - 1$  SD,  $M$ ,  $M + 1$  SD). When the level of professional identity is low ( $M - 1$  SD), creative self-efficacy will increase by  $-0.164$  standard deviations for every 1 standard deviation increase in benevolent leadership. When the level of professional identity is high ( $M + 1$  SD), creative self-efficacy will increase by  $0.095$  standard deviation for every 1 standard deviation increase in benevolent leadership (*Table 5*). This suggests that the lower the professional identity, the stronger the negative influence of benevolent leadership on creative self-efficacy and the higher the professional identity, the stronger the positive influence of benevolent leadership

on creative self-efficacy. The simple slope analysis diagram of benevolent leadership and creative self-efficacy drawn with professional identity as the moderating variable reflects the same rule (*Figure 2*). It can be seen from *Table 4*, when research stress is a moderating variable, the interaction coefficient between the creative self-efficacy and research stress is significant (*Model 5*,  $B = 0.062$ ,  $SE = 0.014$ ,  $p < 0.01$ ), it shows that research stress plays a moderating role. Therefore, hypothesis 4 has been verified. In order to better understand the moderating effect of research stress between the creative self-efficacy and knowledge sharing, the research stress is taken at three different levels according to the average value and the average value plus or minus a standard deviation ( $M - 1$  SD,  $M$ ,  $M + 1$  SD). When the level of research stress is low ( $M - 1$  SD), knowledge sharing will increase by  $0.302$  standard deviations for every 1 standard deviation increase in creative self-efficacy. When the level of research stress is high ( $M + 1$  SD), knowledge sharing will increase by  $0.427$  standard deviation for every 1 standard deviation increase in creative self-efficacy (*Table 5*). This suggests that when the research stress level is high, the

**TABLE 4** Regression analysis results of mediating and moderating effects.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
	KS	CSE	KS	CSE	KS
Constant	−0.250	0.624	−0.452	0.488	−0.387
Gender	0.116	−0.196**	0.179**	−0.227***	0.203**
Age	−0.006	−0.024***	0.002	−0.016**	0.001
Title	0.104	0.229***	0.031	0.174***	0.026
SA	0.051	0.057	0.032	0.024	0.017
BL	0.236***	0.202***	0.170***	−0.035	
CSE			0.323***		0.364***
PI				0.590***	
BL × PI				0.130***	
RS					−0.029
CSE × RS					0.062**
R	0.251	0.268	0.400	0.607	0.372
R <sup>2</sup>	0.063	0.072	0.160	0.368	0.138
F	14.514***	16.714***	34.081***	89.604***	24.643***

\*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; SA, supervisor age; BL, benevolent leadership; KS, knowledge sharing; CSE, creative self-efficacy; PI, professional identity; RS, research stress.

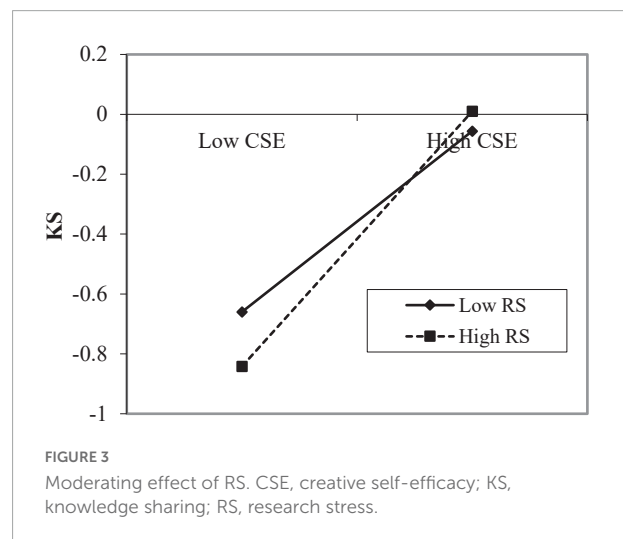
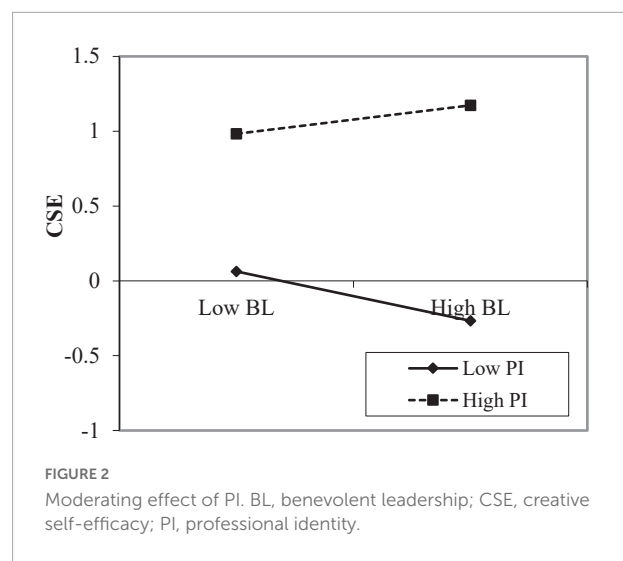
**TABLE 5** Moderating effect on different moderated levels of PI and RS.

	Effect	SE	<i>t</i>	<i>P</i>	LLCI	ULCI
PI (M - 1 SD)	−0.164	0.035	−4.665	0.000	−0.233	−0.095
PI (M)	−0.035	0.027	−1.300	0.194	−0.087	0.018
PI (M + 1 SD)	0.095	0.032	2.995	0.003	0.033	0.157
RS (M - 1 SD)	0.302	0.035	8.522	0.000	0.232	0.372
RS (M)	0.364	0.029	12.589	0.000	0.308	0.421
RS (M + 1 SD)	0.427	0.039	10.944	0.000	0.350	0.503

PI, professional identity; RS, research stress; M, mean; SD, standard deviation.

correlation between creative self-efficacy and knowledge sharing is closer. The simple slope analysis diagram of creative self-efficacy and knowledge sharing drawn with research stress as the moderating variable reflects the same rule (Figure 3).

In order to better explore the relationship between the five variables, in SPSS, Process Macro Model 21 (Hayes, 2013, 2017) was used for moderated mediating effect analysis, the results are shown in Figure 4. According to Table 6, both professional identity and research stress moderated the mediating effect of creative self-efficacy, but the direction and magnitude of the moderating effect were different. When professional identity and research stress were positive one standard deviation ( $M + 1$  SD), the indirect effect value was 0.036. When professional identity was negative one standard deviation ( $M - 1$  SD) and research stress was positive one standard deviation ( $M + 1$  SD), the indirect effect value was  $-0.062$ . This suggests that when the professional identity level was high and the research stress level was high, the indirect effect was the positive stronger; when the



professional identity level was low and the research stress level was high, the indirect effect was negative stronger.

## Discussion

This study took 1,083 postgraduate supervisors as participants to explore the relationships among benevolent leadership, knowledge sharing, creative self-efficacy, professional identity and research stress, and built a moderated mediating effect model. This study explores the mechanism and boundary conditions of benevolent leadership's influence on knowledge sharing, and answers not only "how" benevolent leadership influences knowledge sharing, but also "when" the influence is stronger or weaker. The results of this study enrich the literature and theory of benevolent leadership and knowledge sharing, and also have some implications for management practice.

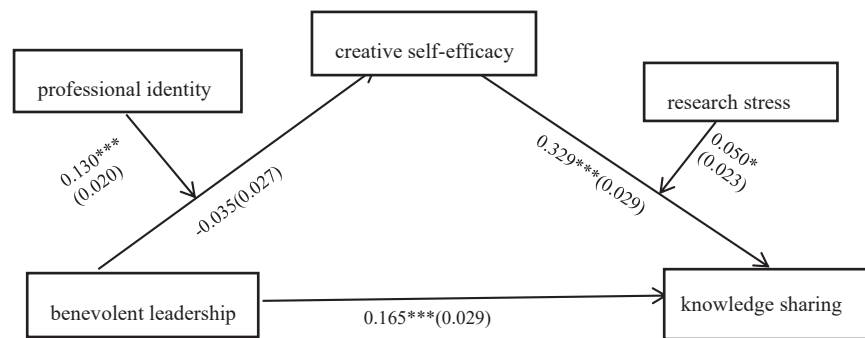


FIGURE 4

A moderated mediating effect model results. \* $P < 0.05$ , \*\*\* $P < 0.001$ ; the coefficients in the model are unstandardized, with standard errors in parentheses.

## Theoretical implications

First, deepen the understanding of knowledge sharing of postgraduate supervisors and enrich relevant research. In China, postgraduate supervisors are mainly responsible for two tasks: cultivate postgraduates and conducting scientific research (Lu, 2017). Although the post of postgraduate supervisor belongs to academic position, the practitioners of academic position who do not have the qualification of postgraduate supervisor cannot cultivate postgraduates (Yin et al., 2021). Postgraduate supervisors have a closer relationship with knowledge sharing than those in other academic positions. (1) Cultivating postgraduates requires postgraduate supervisors to impart and share their knowledge with postgraduate (Cheng and Cao, 2021). (2) Postgraduate supervisors have accumulated certain knowledge during scientific research, and they have the ability and quality to share knowledge (Sun et al., 2019). (3) Knowledge sharing can help postgraduate supervisors obtain more information and resources, which benefits both individuals and organizations. Therefore, they play an important role in the academic development of an organization and it is particularly necessary to study the knowledge sharing of postgraduate supervisors. In the previous empirical studies, there are few studies that take postgraduate supervisor as participants, and even fewer studies that explore how leadership style influences the psychology and behavior of postgraduate supervisor. This study proves that benevolent leadership can positively promote the creative self-efficacy and knowledge sharing of postgraduate supervisor, and explores the influence of professional identity and research stress, which deepens the understanding of knowledge sharing and enriches the relevant research on postgraduate supervisor.

Second, enriches the theoretical research of benevolent leadership. Different cultural backgrounds give birth to different leadership theories. Benevolent leadership is rooted in the thought of “benevolence” in traditional Chinese culture (Farh and Cheng, 2000). “Benevolence” emphasizes friendship, help,

understanding, sympathy, and tolerance among people. In terms of leadership behavior, leaders should not only be responsible for the development of the organization and the completion of work tasks, but also care for the personal well-being and living conditions of their subordinates (Cheng et al., 2004). This kind of care will not only extend to the subordinates’ families and matters outside their work, but also show their understanding of difficulties encountered in subordinates’ work and tolerance of mistakes made by subordinates. Benevolent leadership emphasizes that the leaders’ personalized, comprehensive and persistent care for the well-being of their subordinates is highly consistent with Chinese values, behavior patterns, and interpersonal communication models. It has been widely welcomed by Chinese and widely exists in Chinese organizations around the world (Lin et al., 2018), which has promoted the development and performance improvement of the organizations (Wang et al., 2018). However, compared with other types of leadership styles, there is still less research on benevolent leadership. This study constructs a moderated mediating effect model with benevolent leadership as the independent variable, knowledge sharing as

TABLE 6 Mediating effects of CSE on different moderated levels of PI and AS.

PI	RS	Effect	BootSE	BootLLCI	BootULCI
M-1 SD	M-1 SD	−0.046	0.013	−0.074	−0.024
M-1 SD	M	−0.054	0.014	−0.083	−0.028
M-1 SD	M + 1 SD	−0.062	0.017	−0.098	−0.031
M	M-1 SD	−0.010	0.008	−0.026	0.006
M	M	−0.011	0.009	−0.030	0.006
M	M + 1 SD	−0.013	0.011	−0.036	0.007
M + 1 SD	M-1 SD	0.026	0.010	0.010	0.049
M + 1 SD	M	0.031	0.010	0.012	0.054
M + 1 SD	M + 1 SD	0.036	0.012	0.014	0.062

CSE, creative self-efficacy; PI, professional identity; RS, research stress; M, mean; SD, standard deviation.

the dependent variable, creative self-efficacy as the mediating variable, and professional identity and research stress as the moderating variables. It has accumulated the relevant literature of benevolent leadership research and enriched the theoretical research related to benevolent leadership.

Third, discusses the influence of benevolent leadership on knowledge sharing. From the social exchange theory, it can be seen that individuals always tend to follow the principle of reciprocity for equal value social exchange (Blau, 1964). Although individuals always tend to hide knowledge rather than share it in order to win respect and prestige (Park et al., 2017; Wang et al., 2020), caring and supportive behaviors of benevolent leaders inspire gratitude among subordinates. When leaders show sympathy and concern for subordinates, postgraduate supervisor will also give rewards with corresponding positive behaviors (Li et al., 2016). This study confirms the positive effect of benevolent leadership on knowledge sharing, highlights the important effect of benevolent leadership on knowledge sharing, and deepens the understanding of the relationship between benevolent leadership and knowledge sharing.

Fourth, explored the mediating effect of creative self-efficacy. After confirming the positive influence of benevolent leadership on knowledge sharing, it is particularly necessary to explore the internal mechanism of this influence. This study proves that creative self-efficacy has a partial mediating effect between benevolent leadership and knowledge sharing, that is, benevolent leadership can not only directly affect knowledge sharing, but also indirectly affect knowledge sharing through creative self-efficacy. Since the improvement of the creative self-efficacy of postgraduate supervisor is what benevolent leaders hope to see, social exchange theory can explain the positive role of benevolent leaders in creative self-efficacy (Yang et al., 2011). Social cognitive theory can also explain the positive effect of benevolent leadership on creative self-efficacy. Since social cognitive theory holds that social persuasion is beneficial to improve individual self-efficacy, trust, encouragement, and praise from leaders, as an important kind of social persuasion, are conducive to improving postgraduate supervisors' creative self-efficacy (Zhang et al., 2018). Social cognitive theory emphasizes that self-efficacy is the key factor leading to individual behavior (Bandura, 1977). Therefore, the higher the creative self-efficacy of postgraduate supervisors, the more confidence in themselves, the more likely to appear knowledge sharing (Bandura, 1982). From the above discussion, it can be seen that the creative self-efficacy plays a mediating role, which not only reflects the relationship between benevolent leadership and creative self-efficacy but also reflects the relationship between creative self-efficacy and knowledge sharing. In a word, benevolent leadership increases knowledge sharing by improving the creative self-efficacy of postgraduate supervisors.

Fifth, tested the moderating effect of professional identity and research stress. Previous studies mainly used professional

identity as an independent variable, dependent variable and mediator variable, and rarely used it as a moderator variable. This study believes that professional identity reflects an individual's attitude toward his occupation, and different attitudes will bring different effects on the relationship between variables (Zhao et al., 2022). Therefore, professional identity can also be used as a moderating variable in the study. The results show that the relationship between benevolent leadership and creative self-efficacy is different under different levels of professional identity. When the level of professional identity is high ( $M + 1\text{ SD}$ ), the moderating effect of professional identity is significant. With the increase of benevolent leadership, the level of creative self-efficacy is also increasing. When the level of professional identity is general ( $M$ ), the moderating effect of professional identity is not significant. When the level of professional identity is low ( $M - 1\text{ SD}$ ), the moderating effect of professional identity is significant. With the increase of benevolent leadership, the creative self-efficacy decreases. The emergence of this situation, on the one hand, makes us deepen our understanding of the importance of professional identity, and on the other hand, illustrates once again that the effectiveness of leadership behavior is different under different conditions (Zhang et al., 2018). When subordinates do not agree with their profession, the caring and tolerance to mistakes of benevolent leadership may make subordinates lower their requirements on themselves, and thus make them more mediocrity and muddle along in work, and even produce work withdrawal behavior or workplace deviant behavior (Ding et al., 2022).

The research stress is an important environmental variable affecting the work and life of postgraduate supervisor. According to the challenge-hindrance stressors model, research stress belongs to challenge stressor, which brings more gains and growth to employees (Cavanaugh et al., 2000). Under different research stress conditions, the relationship between creative self-efficacy and knowledge sharing is different. The higher the research stress, the closer the relationship between creative self-efficacy and knowledge sharing will be. According to the theory of emotional arousal, higher research stress will stimulate the passion and vitality of postgraduate supervisor with high creative self-efficacy (Bunce and West, 1994), they will be more confident, have more positive behaviors, and therefore have more knowledge sharing behaviors. The results of this study not only prove the moderating effect of research stress on creative self-efficacy and knowledge sharing, but also prove the positive effect of challenge stress on work.

Sixth, deepen the understanding of the effectiveness of leadership behavior. Whether a certain leadership behavior is effective or how the effect is, there are differences in different influence mechanisms and different situations (Farh and Cheng, 2000). Many studies have shown that the same leadership behavior is effective in one situation and may not be effective in another situation (Li et al., 2014; Zhang et al., 2018). This



study fully considers the difference and complexity of the situation, takes professional identity and research stress as moderating variables, comprehensively considers the influence of the two moderating variables on the mediating effect. When the postgraduate supervisor has a high level of professional identity and high research stress, he has the will to pay for his own work from the individual perspective, and an atmosphere to promote work harder from the environmental perspective. Therefore, benevolent leadership has a positive influence on knowledge sharing through creative self-efficacy. When postgraduate supervisors have low professional identity and high research stress, they will not recognize their own work from the perspective of individuals and are even less willing to pay for their work. From the perspective of the environment, research stress has become a burden. Therefore, benevolent leadership has a negative influence on knowledge sharing through creative self-efficacy. The moderated mediating effect model constructed in this study comprehensively explains the influence of multiple moderating variables on the relationship between benevolent leadership and knowledge sharing, deepening the understanding of the effectiveness of leadership behavior.

## Practical implications

First, show benevolent leadership behavior and promote knowledge sharing. Postgraduate supervisors are typical knowledge workers, who have strong autonomy and creative in their work. The leadership style of caring, support and tolerance shown by benevolent leaders highly conforms to the characteristics of postgraduate supervisors' work. In practical work, leaders can encourage postgraduate supervisors to share more knowledge and make contributions to the development of the organization with their own knowledge by caring about their work and life, solving their difficulties, creating a relaxed working environment, and other benevolent leadership behaviors (Li et al., 2022). Second, increase job opportunities and improve creative self-efficacy. According to the social cognitive theory, the improvement of self-efficacy is influenced by previous successful experience, verbal persuasion, and other factors (Bandura, 1982). Organizations can provide employees with more job opportunities and personal development opportunities through job enrichment, job expansion, participation in decision-making and encouraging voice behavior. By letting employees improve their personal quality and accumulate successful experience in their work, we can create conditions for improving their creative self-efficacy (Xia et al., 2022). On this basis, leaders can improve subordinates' creative self-efficacy by creating a relaxed working environment and encouraging subordinates to make bold innovations in their work. Third, cultivate the spirit of respecting work and enhance professional identity. In the recruitment process, the organization should pay attention to the selection of employees

who like to engage in the work, and let the employees with high compatibility of ability, temperament, personality, and occupation join the organization (Horvath et al., 2018). In work, it is necessary to increase the training of employees, so that employees fully realize the significance of their work. In the process of managing the career of employees, the development prospect of employees in the organization should be planned (Wang et al., 2017), so that employees can see the future and hope, so as to improve their professional identity. Fourth, according to the actual situation of the organization, appropriately increase research stress. Organizations can create certain stress scenarios according to their industries and their own development stages to increase the motivation and enthusiasm of employees (Zhang et al., 2018). When the organization carries out stress management, it must pay attention to the actual situation. If the stress is too small, it will not motivate the employees. If the pressure is too large, the employees will lose confidence and motivation (Tang et al., 2022). Fifth, considering different situational factors and take appropriate leadership behavior. Situational factors are important factors affecting the effectiveness of leadership behavior (Li et al., 2015). Due to the complexity of the situation, there may be a variety of situational factors affecting leadership behavior (Li et al., 2022). It is necessary to fully consider the influence of different situational combinations on the effectiveness of leadership behavior and adopt different leadership behaviors according to different situations.

## Limitations and future directions

There are still some shortcomings in this study, which need to be further improved in subsequent studies. First, this manuscript is a cross-sectional study at a single time point, and all the data are from the participants themselves. Although there is no serious common method bias problem, it is not conducive to infer the causal relationship of variables. In future studies, data collection from multiple sources, longitudinal tracking surveys, and experimental methods should be attempted to further verify the relationship between variables. Second, due to the limitation of conditions, this manuscript adopts the snowball method to collect data by using the individual's social relationship network, so the generalizability and representativeness of the research results deserve further analysis. In the future, the sampling range should be enlarged to make the results more robust. Third, this manuscript only discusses the linear relationship between variables, but does not consider the non-linear relationship between variables. Pierce and Aguinis (2013) once proposed the "Too much of a good thing" effect in the field of management, that is, there may be a non-linear inverted "U-shaped" relationship

between variables. Future researches can explore the curvilinear relationships between variables. Fourth, although this paper discusses the mechanism and boundary conditions of benevolent leadership's influence on knowledge sharing, the process of leadership's influence on behavior is very complex, and there are still some other variables that can mediate or moderate the relationship between them (Wang and Cheng, 2010). In the future, we should try to explore other mediating variables (e.g., organizational commitment, job satisfaction, psychological contract, perceived insider status) and moderating variables (e.g., gender, education, traditionality, perceived climate of team Cha-xu) to enrich the relevant research on benevolent leadership.

## Conclusion

This study constructs a moderated mediating effect model with benevolent leadership as the independent variable, knowledge sharing as the dependent variable, creative self-efficacy as the mediating variable, and professional identity and research stress as the moderating variables. The results showed that benevolent leadership positively influence knowledge sharing, creative self-efficacy partially mediated the relationship between benevolent leadership and knowledge sharing, professional identity moderated the relationship between benevolent leadership and creative self-efficacy, and research stress moderated the relationship between creative self-efficacy and knowledge sharing. Professional identity and research stress jointly moderate the mediating effect of creative self-efficacy between benevolent leadership and knowledge sharing.

## Data availability statement

The original contributions presented in this study are included in this article/supplementary material, further inquiries can be directed to the corresponding author.

## References

- Abiero, A. R., and Bradfield, L. A. (2021). The contextual regulation of goal-directed actions. *Curr. Opin. Behav. Sci.* 41, 57–62. doi: 10.1016/j.cobeha.2021.03.022
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* 84, 191–215. doi: 10.1037/0033-295X.84.2.191
- Bandura, A. (1982). Self-efficacy mechanisms in human behavior. *Am. Psychol.* 37, 122–147.
- Bavik, Y. L., Tang, P. M., Shao, R., and Lam, L. W. (2018). Ethical leadership and employee knowledge sharing: Exploring dual-mediation paths. *Leadersh. Q.* 29, 322–332. doi: 10.1016/j.leaqua.2017.05.006
- Beijaard, D., Meijer, P. C., and Verloop, N. (2004). Reconsidering research on teachers' professional identity. *Teach. Teach. Educ.* 20, 107–128.
- Beijaard, D., Verloop, N., and Vermunt, J. D. (2000). Teachers' perceptions of professional identity: An exploratory study from a personal knowledge perspective. *Teach. Teach. Educ.* 16, 749–764. doi: 10.1016/S0742-051X(00)00023-8
- Blau, P. M. (1964). *Exchange and power in social life*. New York, NY: John Wiley and Sons.
- Blumberg, M., and Pringle, C. D. (1982). The missing opportunity in organizational research: Some implications for a theory of work performance. *Acad. Manag. Rev.* 7, 560–569. doi: 10.5465/amr.1982.4285240
- Boswell, W. R., Olson-Buchanan, J. B., and LePine, M. A. (2004). Relations between stress and work outcomes: The role of felt challenge, job control, and psychological strain. *J. Vocat. Behav.* 64, 165–181. doi: 10.1016/S0001-8791(03)00049-6

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Institute of Psychology and Behavior of Henan University. All participants agreed to participate in the study. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

Both authors were involved in developing, editing, reviewing, and providing feedback for this manuscript and approved the final version to be published.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Bunce, D., and West, M. (1994). Changing work environments: Innovative coping responses to occupational stress. *Work Stress* 8, 319–331. doi: 10.1080/02678379408256539
- Cavanaugh, M. A., Boswell, W. R., Roehling, M. V., and Boudreau, J. W. (2000). An empirical examination of self-reported work stress among US managers. *J. Appl. Psychol.* 85, 65–74. doi: 10.1037/0021-9010.85.1.65
- Chan, S. (2017). Benevolent leadership, perceived supervisory support, and subordinates' performance: The moderating role of psychological empowerment. *Leadersh. Organ. Dev. J.* 38, 897–911. doi: 10.1108/LODJ-09-2015-0196
- Chen, M. Z., Zada, M., Khan, J., and Saba, N. U. (2022). How does servant leadership influences creativity? enhancing employee creativity via creative process engagement and knowledge sharing. *Front. Psychol.* 13:947092. doi: 10.3389/fpsyg.2022.947092
- Chen, X. P., Eberly, M. B., Chiang, T. J., Farh, J. L., and Cheng, B. S. (2014). Affective trust in Chinese leaders: Linking paternalistic leadership to employee performance. *J. Manag.* 40, 796–819. doi: 10.1177/0149206311410604
- Chen, X., Zhong, J., Luo, M., and Lu, M. (2020). Academic self-efficacy, social support, and professional identity among preservice special education teachers in China. *Front. Psychol.* 11:374. doi: 10.3389/fpsyg.2020.00374
- Cheng, B. S., Chou, L. F., Wu, T. Y., Huang, M. P., and Farh, J. L. (2004). Paternalistic leadership and subordinate responses: Establishing a leadership model in Chinese organizations. *Asian J. Soc. Psychol.* 7, 89–117. doi: 10.1111/j.1467-839X.2004.00137.x
- Cheng, B. S., Huang, M., and Chou, L. (2002). Paternalistic leadership and its effectiveness: Evidence from Chinese organizational teams. *J. Psychol. Chin. Soc.* 3, 85–112.
- Cheng, B. S., Zhou, L. F., and Farh, J. L. (2000). A triad model of paternalistic leadership: Construction and measurement. *Indig. Psychol. Res. Chin. Soc.* 14, 3–64. doi: 10.6254/IPRCS
- Cheng, H., and Cao, Y. (2021). On construction of the responsibility implementation mechanism of postgraduate supervisors in moral education from the perspective of field domain. *J. Grad. Educ.* 4, 10–16. doi: 10.19834/j.cnki.jsjy2011.2021.04.02
- Crawford, E. R., LePine, J. A., and Rich, B. L. (2010). Linking job demands and resources to employee engagement and burnout: A theoretical extension and meta-analytic test. *J. Appl. Psychol.* 95, 834–848. doi: 10.1037/a0019364
- Ding, F., Liu, X., Amin, A. A., Latif, K. M., and Akram, F. (2022). The link between English foreign language teacher's professional identity and their critical thinking that leads to teacher's success in the Chinese context: Leaders motivational language as a moderator. *Front. Psychol.* 13:983215. doi: 10.3389/fpsyg.2022.983215
- Dong, Y. T., Bartol, K. M., Zhang, Z. X., and Li, C. W. (2017). Enhancing employee creativity via identity skill development and team knowledge sharing: Influences of dual-focused transformational leadership. *J. Organ. Behav.* 38, 439–458. doi: 10.1002/job.2134
- Duan, J., Fu, Q., Tian, X., and Kong, Y. (2011). Affective events theory: Contents, application and future directions. *Adv. Psychol. Sci.* 19, 599–607. doi: 10.3724/SP.J.1042.2011.00599
- Elbaz, A., Agag, G., and Alkathiri, N. (2018). How ability, motivation and opportunity influence travel agents performance: The moderating role of absorptive capacity. *J. Knowl. Manag.* 22, 119–141. doi: 10.1108/JKM-07-2017-0308
- Emilia, M., and Mariola, L. (2018). Positive affect mediates the relationship between self-efficacy and innovative behavior in entrepreneurs. *J. Creat. Behav.* 54, 267–278.
- Enno, S., Aleda, V. R., and Sridhar, B. (2008). How motivation, opportunity, and ability drive knowledge sharing: The constraining-factor model. *J. Oper. Manag.* 26, 426–445. doi: 10.1016/j.jom.2007.09.001
- Erkutlu, H., and Chafra, J. (2016). Benevolent leadership and psychological well-being: The moderating effects of psychological safety and psychological contract breach. *Leadersh. Organ. Dev. J.* 37, 369–386. doi: 10.1108/LODJ-07-2014-0129
- Farh, J. L., and Cheng, B. S. (2000). "A cultural analysis of paternalistic leadership in Chinese organizations," in *Management and organizations in the Chinese context*, eds J. T. Li, A. S. Tsui, and E. Weldon (London: Palgrave Macmillan), 84–127.
- Farh, J. L., Cheng, B. S., Chou, L. F., and Chu, X. P. (2006). "Authority and benevolence: Employees' responses to paternalistic leadership in China," in *China's domestic private firms: Multidisciplinary perspectives on management and performance*, eds A. S. Tsui, Y. Bian, and L. Cheng (New York, NY: Sharpe), 230–260.
- Fu, X., Li, Y., and Si, Y. (2012). The impact of paternalistic leadership on innovation: An integrated model. *Nankai Bus. Rev.* 15, 121–127.
- Gao, Y., and Liu, H. Y. (2021). How supervisor-subordinate guanxi influence employee innovative behavior: A moderated mediation model. *Psychol. Res. Behav. Manag.* 14, 2001–2014. doi: 10.2147/PRBM.S342875
- Gong, Y. P., Huang, J. C., and Farh, J. L. (2009). Employee learning orientation, transformational leadership, and employee creativity, the mediating role of employee creative self-efficacy. *Acad. Manag. J.* 52, 765–778.
- Gu, J., He, C., and Liu, H. (2015). Supervisory styles and graduate student creativity: The mediating roles of creative self-efficacy and intrinsic motivation. *Stud. High. Educ.* 42, 721–742. doi: 10.1080/03075079.2015.1072149
- Gumusluoglu, L., Karakitapogluaygun, Z., and Hu, C. (2019). Angels and devils? how do benevolent and authoritarian leaders differ in shaping ethical climate via justice perceptions across cultures? *Bus. Ethics Eur. Rev.* 29, 388–402. doi: 10.1111/beer.12260
- Hair, J. P., Black, J. P., Babin, J. P., and Anderson, R. E. (2019). *Multivariate data analysis*, 8th Edn. Harlow: Cengage Learning.
- Hayes, A. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Commun. Monogr.* 76, 408–420. doi: 10.1080/03637750903310360
- Hayes, A. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.
- Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford publications.
- Hong, J. Y. (2010). Pre-service and beginning teachers' professional identity and its relation to dropping out of the profession. *Teach. Teach. Educ.* 26, 1530–1543. doi: 10.1016/j.tate.2010.06.003
- Horvath, M., Goodell, J. E., and Kosteas, V. D. (2018). Decisions to enter and continue in the teaching profession: Evidence from a sample of U.S. secondary stem teacher candidates. *Teach. Teach. Educ.* 71, 57–65. doi: 10.1016/j.tate.2017.12.007
- Ipe, M. (2003). Knowledge sharing in organizations: A conceptual framework. *Hum. Resour. Dev. Rev.* 2, 337–359. doi: 10.1177/1534484303257985
- Jiang, D., and Chen, Z. (2021). Innovative enterprises development and employees' knowledge sharing behavior in China: The role of leadership style. *Front. Psychol.* 12:747873. doi: 10.3389/fpsyg.2021.747873
- Jin, L., Chen, Y., and Xi, J. (2016). A multi-level research on the effect of paternalistic leadership on scientific research team's innovation performance. *Sci. Res. Manag.* 37, 107–116. doi: 10.19571/j.cnki.1000-2995.2016.07.013
- Lasky, S. (2005). A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform. *Teach. Teach. Educ.* 21, 899–916. doi: 10.1016/j.tate.2005.06.003
- Lazarus, R. S., and Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York, NY: Springer Publishing Company, 150–153.
- Le, B. P., and Than, T. S. (2020). The link between transformational leadership and knowledge sharing: Mediating role of distributive, procedural and interactional justice. *J. Inform. Knowl. Manag.* 19:203. doi: 10.1142/S0219649220500203
- Le, P. B., and Lei, H. (2018). The mediating role of trust in stimulating the relationship between transformational leadership and knowledge sharing processes. *J. Knowl. Manag.* 22, 521–537. doi: 10.1108/JKM-10-2016-0463
- LePine, J. A., Podsakoff, N. P., and LePine, M. A. (2005). A meta-analytic test of the challenge stressor–hindrance stressor framework: An explanation for inconsistent relationships among stressors and performance. *Acad. Manag. J.* 48, 764–775. doi: 10.5465/amj.2005.18803921
- Li, G., Rubenstein, A. L., Lin, W., Wang, M., and Chen, X. (2018). The curvilinear effect of benevolent leadership on team performance: The mediating role of team action processes and the moderating role of team commitment. *Pers. Psychol.* 71, 369–397. doi: 10.1111/peps.12264
- Li, H., Sun, S., Wang, P., and Yang, Y. (2022). Examining the inverted U-shaped relationship between benevolent leadership and employees' work initiative: The role of work engagement and growth need strength. *Front. Psychol.* 13:699366. doi: 10.3389/fpsyg.2022.699366
- Li, R., Tian, X., and Liu, S. (2015). Does benevolent leadership increase employee pro-social rule breaking? *Acta Psychol. Sin.* 47, 637–652. doi: 10.3724/SP.J.1041.2015.00637
- Li, R., Tian, X., and Sun, J. (2014). The mechanisms of how self-sacrificial leadership impacts on employee knowledge sharing. *Nankai Bus. Rev.* 17, 24–32. doi: 10.3969/j.jssn.1008-3448.2014.05.004
- Li, X., Gao, D., and Zhao, S. (2016). How benevolent leadership influence township civil servants' job performance: Effect of voice behavior and perceived organizational support. *Psychol. Res.* 9, 52–59.

- Lin, W., Ma, J., Zhang, Q., Li, J., and Jiang, F. (2018). How is benevolent leadership linked to employee creativity? the mediating role of leader-member exchange and the moderating role of power distance orientation. *J. Bus. Ethics* 152, 1099–1115. doi: 10.1007/s10551-016-3314-4
- Liu, N. C., and Liu, M. S. (2011). Human resource practice sand individual knowledge-sharing behavior-an empirical study for Taiwanese R&D professionals. *Int. J. Hum. Resour. Manag.* 22, 981–997. doi: 10.1080/09585192.2011.555138
- Liu, Y. W., and DeFrank, R. S. (2013). Self-interest and knowledge-sharing intentions: The impacts of transformational leadership climate and HR practices. *Int. J. Hum. Resour. Manag.* 24, 1151–1164. doi: 10.1080/09585192.2012.709186
- Lu, D. (2017). On professional improvement of postgraduate supervisors: Definition, dimension and path. *J. Grad. Educ.* 2, 62–68.
- Luo, J., Zhou, Y., Wei, P., and Zhao, S. (2014). Teachers' professional identity and affective commitment: Mediating role of job satisfaction. *Psychol. Dev. Educ.* 30, 322–328.
- Mahmoudi-Gahrouei, V., Tavakoli, M., and Hamman, D. (2016). Understanding what is possible across a career: Professional identity development beyond transition to teaching. *Asia Pac. Educ. Rev.* 17, 581–597. doi: 10.1007/s12564-016-9457-2
- Mazzola, J. J., and Disselhorst, R. (2019). Should we be “challenging” employees? a critical review and meta-analysis of the challenge-hindrance model of stress. *J. Organ. Behav.* 40, 949–961. doi: 10.1002/job.2412
- Mielniczuk, E., and Laguna, M. (2018). Positive affect mediates the relationship between self-efficacy and innovative behavior in entrepreneurs. *J. Creat. Behav.* 54, 267–278.
- Newman, A., Herman, H. M., Schwarz, G., and Nielsen, I. (2018). The effects of employees' creative self-efficacy on innovative behavior: The role of entrepreneurial leadership. *J. Bus. Res.* 89, 1–9. doi: 10.1016/j.jbusres.2018.04.001
- Ng, T. W., and Feldman, D. C. (2008). Long work hours: A social identity perspective on meta-analysis data. *J. Organ. Behav.* 29, 853–880. doi: 10.1002/job.536
- Park, J., Chae, H., and Jin, N. C. (2017). The need for status as a hidden motive of knowledge-sharing behavior: An application of costly signaling theory. *Hum. Perf.* 30, 21–37. doi: 10.1080/08959285.2016.1263636
- Pierce, J., and Aguinis, H. (2013). The too-much-of-a-good-thing effect in management. *J. Manag.* 39, 313–338. doi: 10.1177/0149206311410060
- Podsakoff, N. P., LePine, J. A., and LePine, M. A. (2007). Differential challenge stressor-hindrance stressor relationships with job attitudes, turnover intentions, turnover, and withdrawal behavior: A meta-analysis. *J. Appl. Psychol.* 92, 438–454. doi: 10.1037/0021-9010.92.2.438
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Preacher, K., and Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav. Res. Meth. Ins. Comput.* 36, 717–731. doi: 10.3758/BF03206553
- Preacher, K., Rucker, D., and Hayes, A. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivar. Behav. Res.* 42, 185–227. doi: 10.1080/00273170701341316
- Puente-Diaz, R. (2016). Creative self-efficacy: An exploration of its antecedents, consequences, and applied implications. *J. Psychol.* 150, 175–195. doi: 10.1080/00223980.2015.1051498
- Rodell, J. B., and Judge, T. A. (2009). Can “good” stressors spark “bad” behaviors? The mediating role of emotions in links of challenge and hindrance stressors with citizenship and counterproductive behaviors. *J. Appl. Psychol.* 94, 1438–1451. doi: 10.1037/a0016752
- Saeed, I., Khan, J., Zada, M., Zada, S., Vega-Muñoz, A., and Contreras-Barraza, N. (2022). Linking ethical leadership to followers' knowledge sharing: Mediating role of psychological ownership and moderating role of professional commitment. *Front. Psychol.* 13:841590. doi: 10.3389/fpsyg.2022.841590
- Sardabi, N., Biri, R., and Golestan, A. A. (2018). Reshaping teacher professional identity through critical pedagogy-informed teacher education. *Int. J. Instruct.* 11, 617–634. doi: 10.12973/iji.2018.11342a
- Sedighi, M., van Splunter, S., Brazier, F., van Beers, C., and Lukosch, S. (2016). Exploration of multi-layered knowledge sharing participation: The roles of perceived benefits and costs. *J. Knowl. Manag.* 20, 1247–1267. doi: 10.1108/JKM-01-2016-0044
- Selye, H. (1982). “History and present status of the stress concept,” in *Handbook of stress*, eds L. Goldberger and S. Breznitz (New York, NY: Free Press), 7–17.
- Sheybani, M., and Miri, F. (2019). The relationship between EFL teachers' professional identity and their critical thinking: A structural equation modeling approach. *Cogent Psychol.* 6:1592796. doi: 10.1080/23311908.2019.1592796
- Shih, H. A., Chiang, Y. H., and Chen, T. J. (2012). Transformational leadership, trusting climate, and knowledge exchange behaviors in Taiwan. *Int. J. Hum. Resour. Manag.* 23, 1057–1073. doi: 10.1080/09585192.2011.639546
- Srivastava, A., Bartol, K. M., and Locke, E. A. (2006). Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *Acad. Manag. J.* 49, 1239–1251.
- Su, X., Jiang, X., Xie, G., Huang, M., and Xu, A. (2022). How does self-sacrificial leadership foster knowledge sharing behavior in employees? moral ownership, felt obligation and supervisor-subordinate guanxi. *Front. Psychol.* 13:910707. doi: 10.3389/fpsyg.2022.910707
- Su, X., Lin, W., Wu, J., Zheng, Q., Chen, X., and Jiang, X. (2021). Ethical leadership and knowledge sharing: The effects of positive reciprocity and moral efficacy. *SAGE Open* 11:215824402110218. doi: 10.1177/21582440211021823
- Su, X., Xu, W., Zheng, M., and Zheng, Q. (2018). Ethical leadership and knowledge sharing: A dual-mediating path exploration. *J. Harbin Univ. Commerce* 6, 54–62.
- Sun, J., Dai, Y., and Hu, J. (2019). Influence of supervisors' tacit knowledge on research interest of postgraduates: Based on the moderating effect of interactive modes by different dominant entities. *J. Grad. Educ.* 5, 38–44.
- Tang, T., Vezzani, V., and Eriksson, V. (2020). Developing critical thinking, collective creativity skills and problem solving through playful design jams. *Think. Skills Creat.* 37:100696. doi: 10.1016/j.tsc.2020.100696
- Tang, Y., Zhang, Z., Wu, S., and Zhou, J. (2022). The impact of challenge and hindrance stressors on newcomers' organizational socialization: A moderated-mediation model. *Front. Psychol.* 13:968852. doi: 10.3389/fpsyg.2022.968852
- Tantawy, M., Herbert, K., McNally, J. J., Mengel, T., Piperopoulos, P., and Foord, D. (2021). Bringing creativity back to entrepreneurship education: Creative self-efficacy, creative process engagement, and entrepreneurial intentions. *J. Bus. Ventur. Insights* 15:e00239. doi: 10.1016/j.jbvi.2021.e00239
- Than, T. S., Le, B. P., and Bui, T. T. L. (2020). Transformational leadership and knowledge sharing: Determinants of firm's operational and financial performance. *SAGE Open* 10, 1–14. doi: 10.1177/2158244020927426
- Tierney, P., and Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Acad. Manage. J.* 45, 1137–1148. doi: 10.5465/3069429
- Tierney, P., and Farmer, S. M. (2011). Creative self-efficacy development and creative performance over time. *J. Appl. Psychol.* 96, 277–293. doi: 10.1037/a0020952
- Tobin, T., and Wesley, W. P. (2015). Organizational networks and the process of corporate entrepreneurship how the motivation, opportunity, and ability to act affect firm knowledge, learning, and innovation. *Small Bus. Econ.* 45, 447–463. doi: 10.1007/s11187-015-9638-0
- Tripathi, N., Zhu, J., Jacob, G. H., Frese, M., and Gielnik, M. M. (2020). Intraindividual variability in identity centrality: Examining the dynamics of perceived role progress and state identity centrality. *J. Appl. Psychol.* 105:889. doi: 10.1037/apl0000465
- Wang, A. C., and Cheng, B. S. (2010). When does benevolent leadership lead to creativity? The moderating role of creative role identity and job autonomy. *J. Organ. Behav.* 31, 106–121. doi: 10.1002/job.634
- Wang, A. C., Tsai, C. Y., Dionne, S. D., Yammarino, F. J., Spain, S. M., Ling, H. C., et al. (2018). Benevolence-dominant, authoritarianism-dominant, and classical paternalistic leadership: Testing their relationships with subordinate performance. *Leadersh. Q.* 29, 686–697. doi: 10.1016/j.leaqua.2018.06.002
- Wang, H., Tseng, J., and Yen, Y. (2012). Examining the mechanisms linking guanxi, norms and knowledge sharing: The mediating roles of trust in Taiwan's high-tech firms. *Int. J. Hum. Resour. Manag.* 23, 4048–4068. doi: 10.1080/09585192.2011.654234
- Wang, S., and Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Hum. Resour. Manag. Rev.* 20, 115–131. doi: 10.1016/j.hrmr.2009.10.001
- Wang, X. Q., Zhang, D. J., and Zeng, L. H. (2011). Professional value and professional efficacy: The dual core factor model of professional identity in normal students. *Psychol. Dev. Educ.* 27, 662–669.
- Wang, X., Zhu, J., Liu, L., and Chen, X. (2017). Cognitive-processing bias in Chinese student teachers with strong and weak professional identity. *Front. Psychol.* 8:784. doi: 10.3389/fpsyg.2017.00784
- Wang, Y., and Zhu, Y. (2012). Organizational socialization, trust, knowledge sharing and innovation behavior: Research on mechanism and path. *Res. Dev. Manag.* 24, 34–46.



- Wang, Z., Zhao, S., and Yang, J. (2020). The causes and consequences of multi-level knowledge hiding behavior: A perspective from status competition. *Adv. Psychol. Sci.* 28, 893–903. doi: 10.3724/SP.J.1042.2020.00893
- Wei, G. (2021). Imagined professional identity: A narrative inquiry into a Chinese teacher's perezhivaniya in life. *Teach. Teach. Educ.* 102:103337. doi: 10.1016/j.tate.2021.103337
- Wei, S., Song, G., and Zhang, D. (2013). The social cognition processing characteristics on occupational events in teachers with different levels of professional identity. *Psychol. Dev. Educ.* 33, 45–55. doi: 10.16187/j.cnki.issn1001-4918.2017.01.06
- Weiss, H. M., and Cropanzano, R. (1996). Affective events theory: A theoretical discussion of the structure, causes and consequences of affective experiences at work. *Res. Organ. Behav.* 18, 1–74.
- Wen, Z., Huang, B., and Tang, D. (2018). Preliminary work for modeling questionnaire data. *J. Psychol. Sci.* 41, 204–210.
- Wipawayangkool, K., and Teng, J. T. C. (2016). Paths to tacit knowledge sharing: Knowledge internalization and individual task-technology fit. *Knowl. Manag. Res. Pract.* 14, 309–318. doi: 10.1057/kmrp.2014.33
- Wu, M. (2009). *Structural equation modeling: Operation and application of AMOS*. Chongqing: Chongqing University Press.
- Wu, M. (2010). *Practice of questionnaire statistical analysis: SPSS operation and application*. Chongqing: Chongqing University Press.
- Wu, M., Huang, X., and Chan, S. C. H. (2012). The influencing mechanisms of paternalistic leadership in mainland China. *Asia Pac. Bus. Rev.* 18, 631–648. doi: 10.1080/13602381.2012.690940
- Wu, W. (2021). How ethical leadership promotes knowledge sharing: A social identity approach. *Front. Psychol.* 12:727903. doi: 10.3389/fpsyg.2021.727903
- Wu, W. L., and Lee, Y. C. (2017). Empowering group leaders encourages knowledge sharing: Integrating the social exchange theory and positive organizational behavior perspective. *J. Knowl. Manag.* 21, 474–491. doi: 10.1108/JKM-08-2016-0318
- Xia, Z., Yu, H., and Yang, F. (2022). Benevolent leadership and team creative performance: Creative self-efficacy and openness to experience. *Front. Psychol.* 12:745991. doi: 10.3389/fpsyg.2021.745991
- Xu, G., Huang, Y., and Tan, L. (2020). International justice and employee sharing hiding behavior: The mediating role of organizational identification and the moderating role of justice sensitivity. *Chin. Soft Sci. Oz.* 125–132.
- Xu, H., Guo, P., and Bao, L. (2021). Influence of organizational innovation support on innovative behavior of researchers: Chain intermediary effect of creative self-efficacy and knowledge sharing. *Sci. Tech. Manag. Res.* 8, 124–131. doi: 10.3969/j.issn.1000-7695.2021.08.017
- Xu, Q., Zhao, Y., Xi, M., and Zhao, S. (2018). Impact of benevolent leadership on follower taking charge: Roles of work engagement and role-breadth self-efficacy. *Chin. Manag. Stud.* 12, 741–755. doi: 10.1108/CMS-03-2018-0448
- Yang, H. L., and Cheng, H. H. (2009). Creative self-efficacy and its factors: An empirical study of information system analysts and programmers. *Comput. Hum. Behav.* 25, 429–438. doi: 10.1016/j.chb.2008.10.005
- Yang, J. Z., Yang, D. T., Zhao, S. D., and Jing, L. D. (2011). The motivation of employee creativity: Employee creative self-efficacy. *Adv. Psychol. Sci.* 19, 1363–1370.
- Ye, Q., Wang, D., and Li, X. (2018). Promoting employees' learning from errors by inclusive leadership: Do positive mood and gender matter? *Baltic J. Manage.* 13, 125–142. doi: 10.1108/BJM-05-2017-0160
- Ye, Q., Wang, D., and Li, X. (2019). Inclusive leadership and employees' learning from errors: A moderated mediation model. *Austr. J. Manage.* 44, 462–481. doi: 10.1177/0312896218805796
- Yin, D., Huang, J., and Qu, Y. (2021). Reflections on the reform of the system for selecting doctoral supervisors—a case study of peking university. *Acad. D. Grad. Educ.* 5, 16–20. doi: 10.16750/j.adge.2021.05.004
- Yoon, D. Y., and Han, S. H. (2018). Global leadership competencies and knowledge transfer in Korean multinational corporations: Self-efficacy as a moderator. *Soc. Behav. Pers. Int. J.* 46, 1143–1156. doi: 10.2224/sbp.6753
- Zhang, R., Yang, S., and Li, T. (2013b). A review of benevolent leadership. *Adv. Psychol. Sci.* 21, 1307–1316. doi: 10.3724/SP.J.1042.2013.01307
- Zhang, N., Zhu, F., and Zhang, B. (2013a). *Professional identification and organizational identification of Chinese university teachers: An theoretical and empirical study*. ChengDu: Southwestern University of Finance and Economics Press.
- Zhang, Y., Liao, J., and Zhao, J. (2013c). The impact of research stress on the academic misconduct of PhD candidates. *Sci. Res. Manag.* 34, 99–107.
- Zhang, Y., Liu, H., Wang, M., and Qing, P. (2018). The impact of challenge stress and hindrance stress on employee creativity: The mediating role of self-efficacy and the moderating role of justice. *Acta Psychol. Sin.* 50, 450–461. doi: 10.3724/SP.J.1041.2018.00450
- Zhao, S., Dong, Y., and Luo, J. (2022). Profiles of teacher professional identity among student teachers and its association with mental health. *Front. Public Health* 10:735811. doi: 10.3389/fpubh.2022.735811
- Zhou, H., and Long, L. (2004). Statistical remedies for common method biases. *Adv. Psychol. Sci.* 12, 942–950. doi: 10.3969/j.issn.1671-3710.2004.06.018



## Appendix

### Benevolent leadership

The leader usually give me his (her) assiduous and thoughtful attention.  
The leader will care about my personal life.  
The leader's care for me will extend to my family.  
The leader will give careful and considerate care to the subordinates who have been together for a long time.  
When I meet with difficulties, the leader will give me help in time.

### Knowledge sharing

I am willing to share my knowledge and experience with others.  
When participating in the discussion, I will provide my own opinions as much as possible.  
I will try my best to answer questions raised by my colleagues.  
When my colleague needs help, I will try my best to provide him with the information and documents he needs.  
I think sharing knowledge and experience with others is a very fulfilling thing.

### Creative self-efficacy

I think I'm good at putting forward new ideas.  
I have confidence in my ability to solve problems creatively.  
I have tips to further supplement and improve others' views.  
I am good at finding new ways to solve problems.

### Professional identity

As a postgraduate supervisors, I often feel respected.  
I am proud to be a postgraduate supervisors.  
I feel insulted when someone makes groundless accusations against the postgraduate supervisor group.  
As a postgraduate supervisor, I can realize my value.  
I will be very happy when I see or hear the words praising the postgraduate supervisor.  
I would like to mention that I am a postgraduate supervisor.

### Research stress

I am worried about how to complete the research task.  
I feel a lot of stress from my research work.  
I feel depressed and unhappy because of my research work.



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# Relationship between occupational noise exposure and hypertension: Cross-sectional evidence from real-world

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**Background:** Occupational noise is one of the most common and prevalent occupational hazards worldwide and may induce adverse auditory and/or non-auditory health effects. However, the relationship between occupational noise exposure and hypertension is controversial and has long been debated.

**Methods:** Based on large sample cross-sectional data from all registered occupational health examination units from 2021 to 2022 ( $N = 101,605$ ), this study aimed to analyze the prevalence of hearing loss and hypertension and to explore the influencing factors of hypertension of workers in Wuhan. Descriptive statistics, univariate analyses and multivariate analyses were used. Forest plot and nomograms were constructed for the visualization of predictive results. The ROC curve, AUC, C-index and calibration curves were used to assess the predictive accuracy and validity. DCA was performed to evaluate the net benefit that workers could receive.

**Results:** Higher rate of high-frequency hearing loss (25.3%), speech frequency hearing loss (8.8%), ECG abnormalities (31.9%) and hypertension (21.0%) were found in workers exposed to occupational noise in Wuhan. Occupational noise exposure (OR = 1.09, 95% CI: 1.01–1.18,  $p = 0.04$ ), growth of age (OR: 1.07, 95% CI: 1.07–1.07,  $p < 0.001$ ), overweight (OR: 1.82, 95% CI: 1.73–1.92,  $p < 0.001$ ), obesity (OR: 3.62, 95% CI: 3.42–3.83,  $p < 0.001$ ), hyperglycemia (OR: 1.84, 95% CI: 1.73–1.96,  $p < 0.001$ ), hypercholesterolemia (OR = 1.34; 95% CI 1.22–1.48;  $p < 0.001$ ), ECG abnormalities (OR = 1.11; 95% CI 1.07–1.15;  $p < 0.001$ ) and family history of hypertension (OR = 1.69; 95% CI 1.58–1.81;  $p < 0.001$ ) were risk factors of hypertension for workers. Male workers had a relatively higher hypertension risk than female workers (OR = 1.61; 95% CI 1.54–1.69;  $p < 0.001$ ). Ear protective measures could not reduce the risk of hypertension in workers. Our nomogram has good predictive accuracy and validity. A dynamic nomogram to predict the workers' risk of hypertension was established publicly available online.

**Conclusion:** Occupational noise exposure may elevate workers' hypertension risk. More effective and relevant prevention measures should be taken. Our nomogram may help identify high-risk workers and facilitate timely interventions.

#### KEYWORDS

occupational health, occupational noise, hearing loss, hypertension, nomogram

## Introduction

Hypertension (ICD10 I10-I15) is a common chronic non-communicable disease and the main risk factor of cardiovascular and cerebrovascular diseases (1, 2). Besides high disability and high mortality, it may also cause a heavy burden to the patient, family and society (3). According to Global Burden of Disease Study 2019 (GBD 2019), there were about 10.85 million deaths caused by hypertension worldwide in 2019, accounting for 31% of all causes of death (4). From 1990 to 2019, the deaths induced by hypertension among Chinese residents increased from 1.2 to 2.6 million (5). Apart from socioeconomic and personal factors (such as dietary and exercise habits) (6–8), incidence of hypertension might be influenced by environmental risks such as air pollution and noise (9–13).

Occupational noise is one of the most common and prevalent occupational hazards of the modern world and health effects of noise were first recognized in occupational settings (14). With the development of modern industrialization, occupational noise exposure related to occupational injury has gradually attracted public attention. It has long been established that occupational noise exposure may induce adverse auditory health effects (14–16) and non-auditory health effects (17–20), while the effect of occupational noise exposure on hypertension has been controversial. Existing studies report conflicting results on it (21–23). A prospective cohort study shows that workers exposed to noise levels between 82 and 106 dB for 3–17 years may increase the

risk of hypertension with a non-linear exposure-response pattern (22). A landmark finding from animal studies was the demonstration that a chronic exposure to noise with average sound pressure level (SPL) of 85 dB may elicit sustained elevations in monkeys' blood pressure by 30 mmHg without a return to baseline values after the noise ended (24). Some systematic review studies support the association between occupational noise exposure and hypertension (23, 25, 26), while a systematic review with meta-analysis from the WHO/ILO Joint suggests that there is insufficient evidence on the burden of cardiovascular disease (CVD) attributable to occupational exposure to noise appears (21). Yet this research was quickly criticized and questioned by peers (27). Although the authors have responded to the doubts (28), it may not be that much convincing. There is still uncertainty about whether hypertension is associated with occupational noise exposure to date.

As data beyond traditional clinical trials, real-world data (RWD) come from the real medical environment and may reflect the health status of the population under real conditions. According to the latest definition from US Food and Drug Administration (FDA) (29), RWD are data relating to patient health status and/or the delivery of healthcare routinely collected from a variety of sources. RWD play an increasing important role in healthcare decisions (30) while many of them are not sufficiently used, such as physical data from physical examination organizations, leading to data waste and the efficiency of physical examination. Medical records of regular occupational health examinations is such RWD. To prevent occupational diseases, Chinese government require enterprises engage third-party organizations to identify and detect occupational hazards to which workers may be exposed. Workers identified with occupational hazards exposure would attend regular occupational health examinations.

Using occupational health examination data from all registered occupational health examination units (37 units) in Wuhan from 2021 to 2022, the objectives of this study were: (1) estimate the current prevalence of hearing loss and hypertension in workers with occupational risk exposure in Wuhan; (2) examine whether there is potential association between hypertension and occupational noise exposure.

Abbreviations: ALAT, Alanine aminotransferase; AUC, area under the ROC curve; BHFTA, binaural high frequency threshold average; BMI, mean body mass index; CI, confidence intervals; C-index, concordance indexes; CVD, cardiovascular disease; dB, decibels; DBP, diastolic blood pressure; DCA, decision curve analysis; ECG, electrocardiogram; FBG, fasting blood glucose; FDA, US Food and Drug Administration; GBD 2019, Global Burden of Disease Study 2019; HR, Hazard ratio; MTMV, monaural threshold of weighted value; MTMVL, monaural threshold of weighted value of the left ear; MTMVR, Monaural threshold of weighted value of the right ear; NIHL, noise-induced hearing loss; OR, odds ratio; ROC, receiver operating characteristic; RWD, real-world data; SBP, systolic blood pressure; SD, Standard deviation; SPL, sound pressure level; TBIL, total bilirubin; TC, total cholesterol.

## Materials and methods

### Study population and data source

Our study population were workers with occupational hazards exposure in Wuhan. Data used in this study were medical records of regular occupational health examinations from all registered occupational health examination units (37 units) in Wuhan from January 2021 to May 2022. One lakh six thousand nine hundred thirty-one workers aged 18–60 years exposed to different occupational hazards from 1,264 enterprises in Wuhan, Hubei were enrolled.

Data used in this study comprised of two parts: questionnaire survey and physical examination data. Questionnaire survey contained the workers' demographic information, sociological information and medical history. The demographic information module included workers' sex, age, conscious symptoms and their occupational history (e.g., unit, occupational hazard factors exposed and the duration of exposure). The sociological information module mainly investigated the disease history of the respondents' immediate relatives (parents, grandparents). The medical history module included the type of disease, time, treatment process, disease outcome and so on. Based on the technical specifications for occupational health monitoring GBZ188-2014 (31), physical examination data included height, weight, blood pressure, pulse, blood routine, urine routine, blood lipids, blood glucose, electrocardiogram (ECG), liver function and audiologic testing. All physical examinations were performed by occupational health physicians from 37 registered occupational health examination units in Wuhan. Each worker had the right to refuse participation in health examinations or questionnaire survey partially or completely.

### Definition and assessment of variables

Blood pressure was measured after 5 min of rest in a quiet area. Hypertension was defined as systolic blood pressure (SBP)  $\geq 140$  mm Hg and/or diastolic blood pressure (DBP)  $\geq 90$  mm Hg, or antihypertensive medication use (3).

The mean body mass index (BMI) was computed by the ratio of body weight (kg) to height squared ( $m^2$ ). Overweight (including obesity) was defined as  $BMI \geq 24$ , normal as  $18.5 \leq BMI < 24$  and underweight as  $BMI < 18.5$  using the Working Group on Obesity in China criteria (32). Obesity as defined as  $BMI \geq 27$  in this study.

The normal level range of Chinese fasting blood glucose (FBG) is 3.9–6.0 mmol/L (33). Hyperglycemia was defined as  $FBG > 6.0$  mmol/L and hypoglycemia was defined as  $FBG < 3.9$  mmol/L. Hypercholesterolemia was defined as total cholesterol (TC)  $\geq 6.2$  mmol/L (34). The blood samples were collected in the morning on an empty stomach.

Pure-tone audiometry was used to measure the workers' thresholds of hearing at 0.5, 1, 2, 3, 4 and 6 kHz on the basis of diagnostic criteria GBZ 49-2014 (35). Only workers at positions exposed to noise would participate in audiometric examinations. The symbols  $HL_{500Hz}$ ,  $HL_{1000Hz}$ ,  $HL_{2000Hz}$ ,  $HL_{3000Hz}$ ,  $HL_{4000Hz}$ ,  $HL_{6000Hz}$  represented the listener's hearing level threshold at a particular pure-tone frequency, in decibels (dB). The subscript L stood for the left ear and R for the right. The binaural high frequency threshold average (BHFTA) and monaural threshold of weighted value (MTMV) were calculated using formula (1) and formula (2), the units were dB. It was defined as high-frequency hearing loss when BHFTA exceeded 25 dB, and normal high-frequency hearing function when BHFTA was  $< 25$  dB. The lower MTMV value of two ears was labeled as  $MTMV_{better}$ . It was defined as speech frequency hearing loss when  $MTMV_{better}$  exceeded 25 dB.

$$BHFTA = \frac{HL_{L3000Hz} + HL_{L4000Hz} + HL_{L6000Hz} + HL_{R3000Hz} + HL_{R4000Hz} + HL_{R6000Hz}}{6} \quad (1)$$

$$MTMV = \frac{HL_{500Hz} + HL_{1000Hz} + HL_{2000Hz}}{3} \times 0.9 + HL_{4000Hz} \times 0.1 \quad (2)$$

### Ethical considerations

Ethical approval was granted by the ethics committee of Wuhan Prevention and Treatment Center for Occupational Diseases (approval number 2022-WZF03).

### Statistical analyses

Data analysis and visualization were performed using R statistical software (version 4.2.1). Group differences of continuous data were analyzed by Student's *t*-test and categorical data by chi-square test ( $\alpha = 0.05$ ). Multivariate analysis was performed using binary logistic regression. Forest plot (36) and nomograms (37) were constructed for the visualization of statistical predictive models based on binary logistic regression model. The receiver operating characteristic (ROC) curve, area under the ROC curve (AUC), concordance indexes (C-index) and calibration curves were used to assess the predictive accuracy, the discrimination and calibration of the nomogram and internally validated. Decision curve analysis (DCA) was performed to evaluate the net benefit that workers could receive. Internal validation and external validation were carried out, respectively. The bilateral  $P < 0.05$  was considered to be statistically significant.

## Results

### Descriptive characteristics of workers

After elimination of respondents who had absence of blood pressure records ( $n = 2,690$ ), occupational history ( $n = 421$ ), or had hypertension before work ( $n = 2,215$ ), 101,605 respondents were finally included in our analysis. The mean age of the respondents was  $37.2 \pm 9.4$  years and 79.5% were male. 57.6% respondents were exposed to occupational noise while only 56.9% of them took ear protection measures. The mean BMI value of the respondents was  $24.0 \pm 3.7$  and 69.3% was overweight (BMI  $\geq 24$ ). Sixty-three thousand one hundred sixty-one respondents (99.6% of self-reported occupational noise exposed) participated in the pure tone audiometry tests and the mean BHFTA value of them was  $22.5 \pm 10.8$  with 25.7% had high-frequency hearing loss (BHFTA  $> 25$ dB). The mean MTMV value of better ear was  $18.8 \pm 6.4$  with 8.6% had impairment on speech frequency hearing functions (MTMV<sub>better</sub> $>25$ dB). Thirty-one thousand one hundred eighty-four respondents had ECG abnormalities and 20.6% had hypertension. Detailed descriptive characteristics of the respondents are listed in Table 1.

There were more male in workers exposed to occupational noise (83.6%) than other risk factors (74.1%) ( $p < 0.001$ ). Compared to workers exposed to other risk factors, workers exposed to occupational noise were younger ( $37.1 \pm 9.5$ ) ( $p < 0.001$ ), yet had a higher mean BMI ( $24.1 \pm 3.7$ ) ( $p < 0.001$ ) and 30.4% were overweight or obese (48.4% in those had BMI records). Only 56.9% workers would use hearing protective equipment though they were exposed to occupational noise. Higher rate of high-frequency hearing loss (25.3%), speech frequency hearing loss (8.8%), ECG abnormalities (31.9%) and hypertension (21.0%) were found in workers exposed to occupational noise than others (3.3% high-frequency hearing loss, 0.7% speech frequency hearing loss, 30.2% ECG abnormalities and 20.0% hypertension, respectively, all  $ps < 0.001$ ). Results of comparisons of the characteristics between workers exposed to different risk factors are listed in Table 2.

### Results of univariate and multivariable analyses

Univariate analyses were used to identify risk factors of speech frequency hearing loss, ECG abnormalities and hypertension. According to our analysis, workers exposed to occupational noise had a statistically significant ( $p < 0.001$ ) higher prevalence of high-frequency hearing loss (25.3%), speech frequency hearing loss (8.8%), ECG

TABLE 1 Descriptive characteristics of workers.

Characteristics	Category/Range	<i>n</i>	%	Mean	SD
Age	18–60	101,605		37.2	9.4
Height (meter)	1.40–2.00	59,085		1.7	0.1
Weight (kg)	35.0–162.0	59,096		69.0	12.8
Exposure time (year)	0–44	101,605		9.6	9.3
BMI	12.2–45.0	59,075		24.0	3.7
	<18.5	2,876	2.8		
	18.5–23.9	28,338	27.9		
	$\geq 24$	16,726	69.3		
SBP (mmHg)	38–247	101,605		124.8	15.9
DBP (mmHg)	41–176	101,605		78.8	11.3
MTMVL	–6–116	63,163		20.3	7.4
MTMVR	–6–112	63,160		20.0	7.4
BHFTA	–15–112	63,161		22.6	10.8
Sex	Male	80,825	79.5		
	Female	20,780	20.5		
Occupational noise exposure	No	43,033	42.4		
	Yes	58,572	57.6		
Ear protection	No	64,680	63.7		
	Yes	36,925	36.3		
ECG	Normal	68,678	68.8		
	Abnormal	31,163	31.2		
Hypertension	No	80,699	79.4		
	Yes	20,906	20.6		

SD, Standard deviation; BMI, Body mass index; SDP, Systolic blood pressure; DBP, Diastolic blood pressure; BHFTA, Binaural high frequency threshold average; MTMVL, Monaural threshold of weighted value of the left ear; MTMVR, Monaural threshold of weighted value of the right ear; ECG, Electrocardiogram.

abnormalities (31.6%) and hypertension (21.0%) than those not (0.7, 29.5 and 20.0%, respectively). The prevalence of hearing loss and hypertension increased with the time of exposure to occupational hazards ( $p < 0.001$ ). For workers exposed to occupational hazards for over 20 years, the prevalence rates of high-frequency hearing loss, speech frequency hearing loss and hypertension reached 29.0, 13.1, and 36.9%, respectively. Besides, workers who bore abnormal BHFTA or MTMV had higher rate of ECG abnormalities and hypertension. More details are shown in Table 3.

Binary logistic regressions were performed to calculate odds ratios (ORs) for the risk of hypertension (Figure 1). Occupational noise exposure (OR = 1.09, 95% CI: 1.01–1.18,  $p = 0.04$ ), growth of age (OR: 1.07, 95% CI: 1.07–1.07,  $p < 0.001$ ) and BMI, hyperglycemia (OR: 1.84, 95% CI: 1.73–1.96,  $p < 0.001$ ), hypercholesterolemia (OR = 1.34; 95% CI 1.22–1.48;  $p < 0.001$ ), ECG abnormalities (OR = 1.11; 95% CI 1.07–1.15;  $p < 0.001$ ) and family history of hypertension (OR = 1.69; 95% CI 1.58–1.81;



TABLE 2 Comparisons of the characteristics between workers exposed to different risk factors.

	Other risk factors ( <i>n</i> = 43,033)		Occupational noise ( <i>n</i> = 58,572)		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	
Sex					<0.001
Male	31,866	74.1	48,959	83.6	
Female	11,167	25.9	9,613	16.4	
Ear protection					<0.001
No	39,440	91.7	25,240	43.1	
Yes	3,593	8.3	33,332	56.9	
BHFTA					<0.001
≤25	3,405	7.9	43,552	74.4	
>25	1,403	3.3	14,801	25.3	
Not examined	38,225	88.8	219	0.4	
MTMV <sub>better</sub>					<0.001
≤25	4,523	10.5	53,175	90.8	
>25	285	0.7	5,177	8.8	
Not examined	38,225	88.8	220	0.4	
ECG					<0.001
Normal	29,246	68.0	39,432	67.3	
Abnormal	12,682	29.5	18,481	31.6	
Not examined	1,105	2.6	659	1.1	
Hypertensive					<0.001
No	34,408	80.0	46,291	79.0	
Yes	8,625	20.0	12,281	21.0	
Family history of hypertension					<0.001
No	41,938	97.5	54,702	93.4	
Yes	1,095	2.5	3,870	6.6	
TC					<0.001
Normal	16,882	39.2	23,383	39.9	
Abnormal	956	2.2	1,498	2.6	
Not examined	25,195	58.6	33,691	57.5	
TBIL					<0.001
Normal	20,834	48.4	27,344	46.7	
Abnormal	3,709	8.6	5,012	8.6	
Not examined	18,490	43.0	26,216	44.8	
Age	37.3 ± 9.3		37.1 ± 9.5		<0.001
BMI	23.8 ± 3.6		24.1 ± 3.7		<0.001
<18.5	1,091	2.5	1,785	3.0	<0.001
18.5–23.9	11,062	25.7	17,276	29.5	
24.0–26.9	6,155	14.3	10,571	18.0	
≥27	3,856	9.0	7,279	12.4	
Not examined	20,869	48.5	21,661	37.0	
Exposure time	9.4 ± 9.2		9.7 ± 9.4		<0.001
≤3 years	14,674	34.1	17,176	31.0	<0.001
4–10 years	14,154	32.9	20,775	35.5	
11–20 years	8,228	19.1	10,795	18.4	
≥21 years	5,977	13.9	8,826	15.1	
Fasting glucose	5.3 ± 1.3		5.3 ± 1.4		0.080

(Continued)

TABLE 2 (Continued)

	Other risk factors ( <i>n</i> = 43,033)		Occupational noise ( <i>n</i> = 58,572)		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	
Normal	21,965	51.0	31,134	53.2	<0.001
Hyperglycemia	2,310	5.4	3,550	6.1	
Hypoglycaemia	392	0.9	699	1.2	
Not examined	18,366	42.7	23,189	39.6	
ALAT	24.9 ± 23.3		27.1 ± 24.5		<0.001
SBP	124.2 ± 16.2		125.2 ± 15.7		<0.001
DBP	78.2 ± 11.5		79.2 ± 11.2		<0.001

TC, Total cholesterol; TBIL, Total bilirubin; ALAT, Alanine aminotransferase.

$p < 0.001$ ) were risk factors of hypertension for workers. Male workers had a relatively higher hypertension risk than female workers (OR = 1.61; 95% CI 1.54–1.69;  $p < 0.001$ ).

## Nomogram construction and validation

Nomograms were the visualization of statistical predictive models specifically developed to enable individualized prognosis prediction and may convey the results of a various statistical models. In our study, the intention was to predict a binary outcome of workers' hypertension (yes/no) based on the above results. After listwise deletion of participants with missing values, 37,406 workers were included in the analysis. For internal validation, the workers were randomly assigned into two groups with a ratio of 7:3 following a randomization sequence: training set ( $n = 26,004$ ) and internal validation set ( $n = 11,402$ ). For external validation, we used data from a survey conducted in a cigarette factory in Wuhan from July 2020 to August 2020. Eight hundred seventy-nine workers were included in this study for external validation. With the results in Figure 1, we incorporated sex, age, BMI, noise exposure, BHFTA, ECG results, TC results, family history of hypertension and blood glucose results into the nomogram to predict incidence risk of hypertension [ $R^2 = 0.225$ , C-index = 0.760 (95% CI 0.754–0.767)] (Figure 2). The characteristics of participants in training set, internal validation set and external validation set are shown in Table 4.

The nomogram had good accuracy in training set (AUC, 0.760; 95% CI 0.754–0.767) (Figure 3A), internal validation set (AUC, 0.760; 95% CI 0.750–0.770) (Figure 3B) and external validation set (AUC, 0.766; 95% CI 0.715–0.817) (Figure 3C). The calibration curves were close to the ideal diagonal line and showed good calibration in training set (Figure 4A), internal validation set (Figure 4B) and external validation set (Figure 4C). Moreover, the DCA showed significant net benefit of the predictive model (Figure 5A), as well as that in the

validation cohorts (Figures 5B,C). These data demonstrated that our nomogram had a high potential for clinical utility.

## Website of nomogram

To facilitate use of our prediction model, a dynamic nomogram was established publicly available online ([https://hbpdynnomo.shinyapps.io/DynNom\\_HBP\\_workers/](https://hbpdynnomo.shinyapps.io/DynNom_HBP_workers/)) using the DynNom package of R. It may dynamically predict the hypertension risk of workers on the website in a user-friendly way.

## Discussion

Based on occupational health examination data, this study analyzed the current prevalence of hearing loss, ECG abnormalities and hypertension among workers with different occupational risks exposure in Wuhan. We further explored the risk factors of workers' hypertension. According to our study, occupational noise was the most exposed occupational hazard factor for workers in Wuhan and 57.6% respondents were exposed to it. 31.2% workers showed ECG abnormalities and 20.6% had hypertension. Such a high frequency of occupational noise exposure suggests that importance should be placed on monitoring the hazards of occupational noise and targeted occupational protection measures should be taken as early as possible. Among respondents participated in pure tone audiometry tests, 25.7% had high-frequency hearing loss and 8.6% had speech frequency hearing loss. Workers exposed to occupational noise had higher rate of high-frequency hearing loss (25.3%), speech frequency hearing loss (8.8%), ECG abnormalities (31.6%) and hypertension (21.0%), reconfirming the negative effect of occupational noise on auditory system and cardiovascular system (1, 14, 38).

TABLE 3 Univariate analysis for the possible predictive factors of speech frequency hearing loss, ECG abnormalities and hypertension.

Variable	MTMV <sub>better</sub>			<i>p</i>	ECG			<i>p</i>	Hypertensive		<i>p</i>
	Normal	Abnormal	Not examined		Normal	Abnormal	Not examined		No	Yes	
Sex				<0.001				<0.001			<0.001
Male	60.0%	5.8%	34.2%		67.7%	31.0%	1.4%		77.5%	22.5%	
Female	44.4%	3.8%	51.9%		67.3%	29.5%	3.1%		86.8%	13.2%	
Occupational noise exposure				<0.001				<0.001			<0.001
No	10.5%	0.7%	88.8%		68.0%	29.5%	2.6%		80.0%	20.0%	
Yes	90.8%	8.8%	0.4%		67.3%	31.6%	1.1%		79.0%	21.0%	
BHFTA				<0.001				<0.001			<0.001
Normal	98.3%	1.7%	0.0%		67.6%	31.3%	1.1%		81.3%	18.7%	
Abnormal	71.1%	28.9%	0.0%		67.1%	32.2%	0.7%		72.8%	27.2%	
Not examined	0.0%	0.0%	100.0%		67.8%	29.3%	2.9%		80.0%	20.0%	
MTMV <sub>better</sub>			—					<0.001			<0.001
Normal		67.6%	31.3%	1.1%		80.0%	20.0%				
Abnormal		66.2%	33.4%	0.3%		70.0%	30.0%				
Not examined		67.8%	29.3%	2.9%		80.0%	20.0%				
ECG				<0.001			—				<0.001
Normal	56.8%	5.3%	38.0%			79.4%	20.6%				
Abnormal	58.0%	5.9%	36.1%			79.0%	21.0%				
Not examined	35.6%	1.1%	63.3%			88.8%	11.2%				
Fasting glucose				<0.001				<0.001			<0.001
Normal	58.9%	5.5%	35.6%		67.3%	32.3%	0.4%		81.1%	18.9%	
Hyperglycemia	53.6%	13.1%	33.3%		67.9%	31.7%	0.4%		54.6%	45.4%	
Hypoglycaemia	61.2%	4.1%	34.6%		56.7%	43.0%	0.3%		85.7%	14.3%	
Not examined	54.4%	4.2%	41.4%		68.2%	28.1%	3.7%		80.7%	19.3%	
TC				<0.001				<0.001			<0.001
Normal	57.6%	7.2%	35.2%		67.4%	32.6%	0.0%		78.2%	21.8%	
Abnormal	58.0%	10.0%	32.0%		70.7%	29.2%	0.1%		62.5%	37.5%	
Not examined	56.2%	4.0%	39.9%		67.6%	29.4%	3.0%		81.0%	19.0%	
TBIL				<0.001				<0.001			0.004
Normal	56.8%	5.6%	37.6%		72.9%	26.6%	0.5%		79.5%	20.5%	
Abnormal	56.1%	7.3%	36.6%		71.3%	28.5%	0.2%		78.1%	21.9%	
Not examined	56.9%	4.7%	38.4%		61.1%	35.5%	3.3%		79.6%	20.4%	

(Continued)

TABLE 3 (Continued)

Variable	MTMV <sub>better</sub>			<i>p</i>	ECG			<i>p</i>	Hypertensive		<i>p</i>
	Normal	Abnormal	Not examined		Normal	Abnormal	Not examined		No	Yes	
Family history of hypertension				<0.001				<0.001			<0.001
No	56.7%	4.6%	38.7%		67.3%	30.9%	1.8%		80.5%	19.5%	
Yes	57.8%	20.2%	22.0%		72.9%	27.1%	0.0%		58.9%	41.1%	
Family history of cardiac disease				<0.001				0.8%			<0.001
No	56.8%	5.3%	37.9%		67.6%	30.7%	1.7%		79.5%	20.5%	
Yes	55.8%	20.4%	23.8%		75.1%	24.9%	0.0%		61.5%	38.5%	
Age	36.5 ± 9.3	44.4 ± 8.5	37.2 ± 9.3	<0.001	37.4 ± 9.3	36.9 ± 9.8	34.0 ± 7.9	<0.001	35.9 ± 9.0	42.1 ± 9.4	<0.001
BMI	24.1 ± 3.7	24.4 ± 3.5	23.8 ± 3.6	<0.001	24.3 ± 3.6	23.5 ± 3.7	22.2 ± 3.5	<0.001	23.4 ± 3.4	26.0 ± 3.8	<0.001
<18.5	63.1%	4.3%	32.6%	<0.001	49.0%	48.4%	2.6%	<0.001	94.5%	5.5%	<0.001
18.5–23.9	60.3%	6.6%	33.1%		60.8%	37.9%	1.3%		86.7%	13.3%	
24.0–26.9	61.7%	8.1%	30.2%		67.7%	31.6%	0.7%		74.0%	26.0%	
≥27	64.3%	8.0%	27.8%		69.6%	29.9%	0.5%		59.3%	40.7%	
Not examined	50.1%	2.9%	47.0%		72.8%	24.5%	2.7%		80.9%	19.1%	
Exposure time	9.3 ± 9.0	15.0 ± 11.6	9.3 ± 9.1	<0.001	10.0 ± 9.4	9.1 ± 9.2	5.2 ± 5.6	<0.001	8.7 ± 8.6	13.3 ± 10.9	<0.001
≤3 years	56.0%	3.5%	40.5%	<0.001	64.1%	33.2%	2.7%	<0.001	86.7%	13.3%	<0.001
4–10 years	60.2%	3.9%	36.0%		67.8%	30.4%	1.8%		81.6%	18.4%	
11–20 years	55.5%	5.4%	39.1%		70.1%	28.8%	1.1%		75.6%	24.4%	
≥21 years	52.1%	13.1%	34.8%		71.6%	28.1%	0.3%		63.1%	36.9%	
SBP	124.9 ± 15.5	128.2 ± 17.3	124.1 ± 16.3	<0.001	124.8 ± 15.5	125.0 ± 16.8	120.0 ± 15.8	<0.001	119.3 ± 11.2	145.9 ± 13.9	<0.001
DBP	79 ± 11.2	80.7 ± 11.8	78.1 ± 11.5	<0.001	78.7 ± 11.1	78.9 ± 11.8	77.5 ± 10.8	<0.001	75.0 ± 8.3	93.2 ± 9.6	<0.001

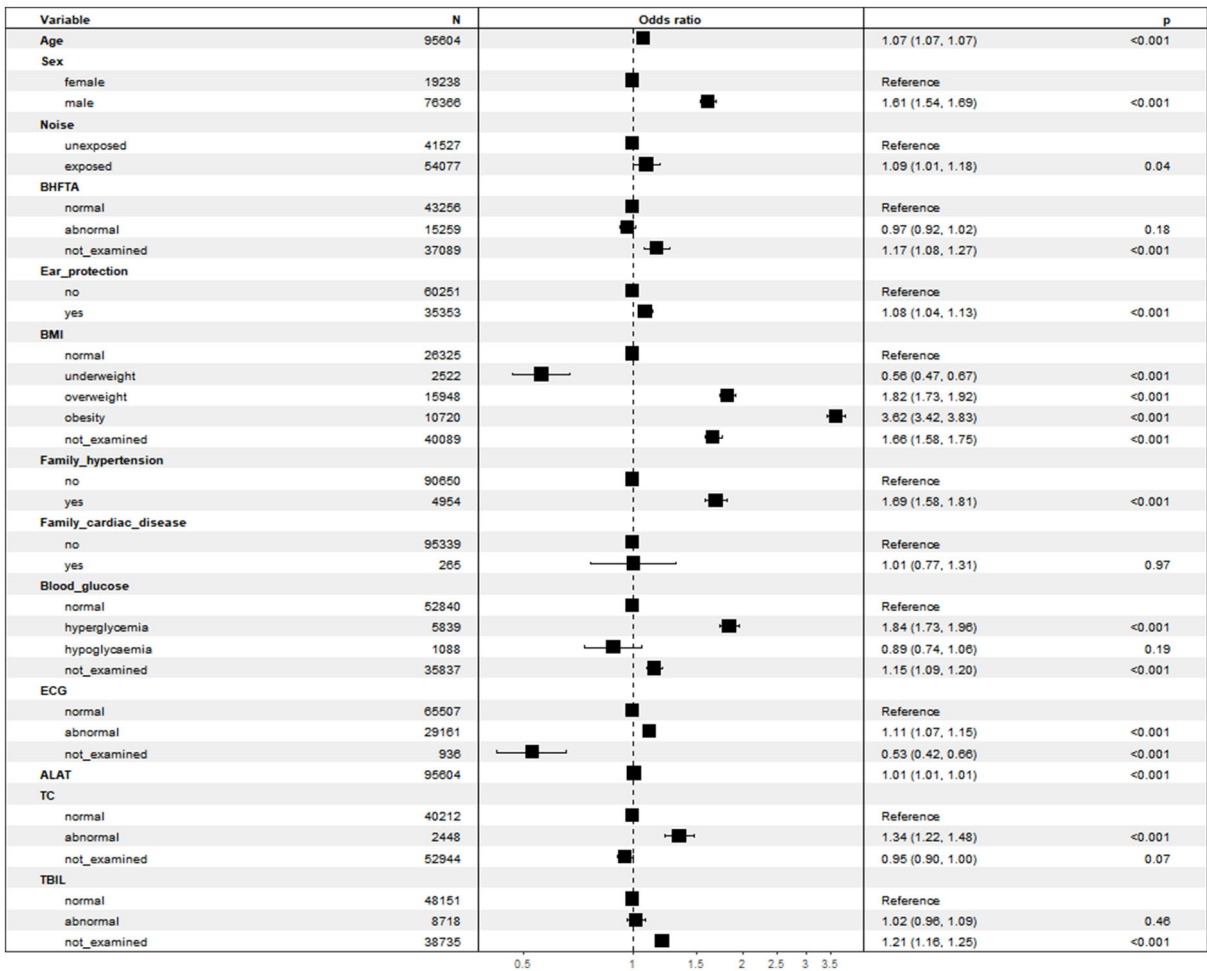
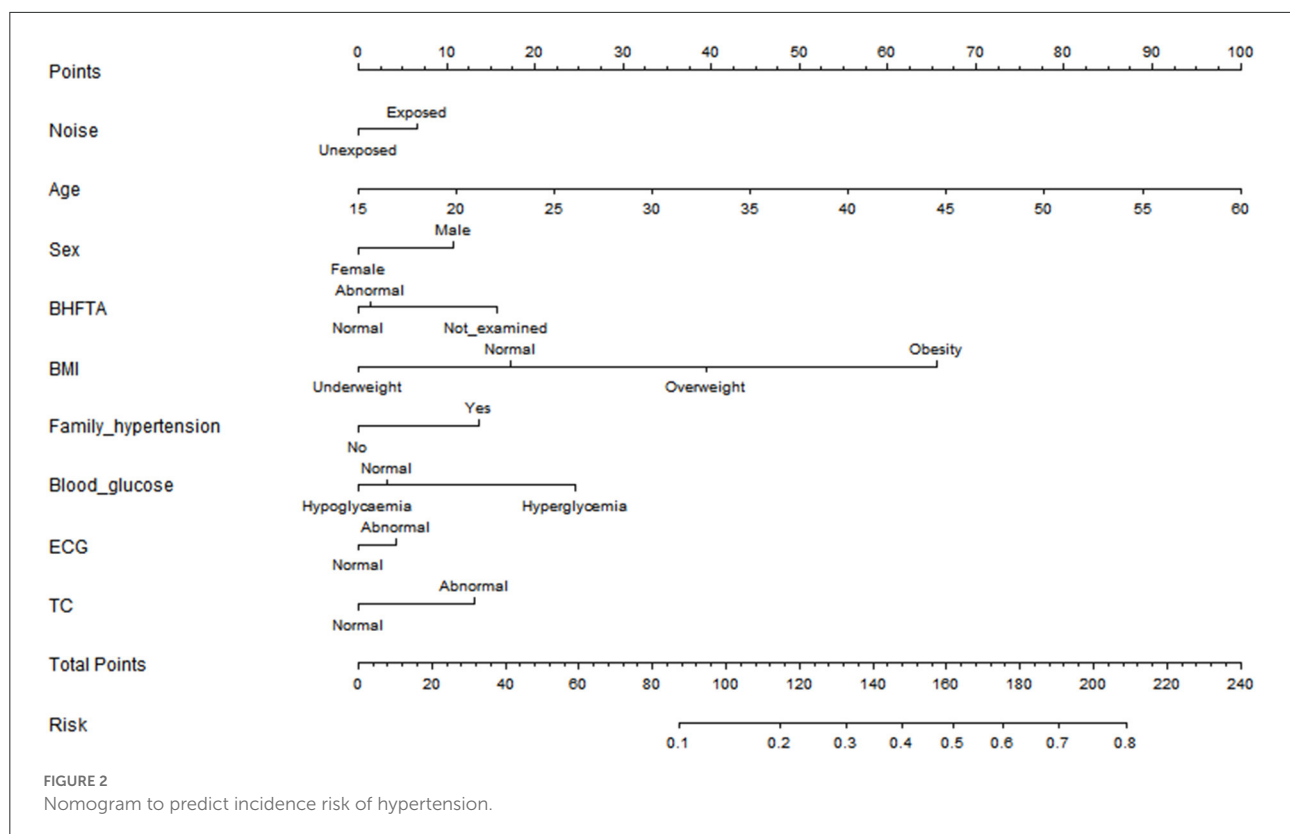


FIGURE 1  
Forest plot of multivariable logistic regression.

Studies have suggested that acoustic overstimulation may contribute to the pathogenesis and biochemical changes that result in hearing loss (39, 40). The continued and evolving research involving noise-induced hearing loss (NIHL) has determined that there is a close relationship between the occurrence of NIHL and changes in some genes, cell metabolism, cell apoptosis and so forth (41). Thus, workers exposed to occupational noise may have heightened risk for hearing loss. Damaging effects of occupational noise on cardiovascular system have been presented in previous studies (17, 19, 20) as well. Several mechanisms through which noise contribute to cardiovascular system impairment are proposed: changes to gene net-works, epigenetic pathways, the gut microbiota, circadian rhythm, neuronal excitability and signal transduction, oxidative stress, inflammation and metabolism (13). Experimental evidence shows that noise may cause an increase in stress hormone release and in circulating angiotensin II (Ang II) levels with significant stress-induced

increase in blood pressure (38). The effects of noise exposure on cognitive function (18), mental health (42) and spiritual wellbeing (43) may also play an important role in the process of occupational noise exposure affecting cardiovascular health. Surprisingly, we found that protective measures such as wearing ear muffs and earplugs could not reduce the risk of hypertension in workers. One possibility is that protective measures of the workers are not in place. Workers do not wear or do not wear ear protection equipment correctly, or the protective effect of ear protection equipment is limited. Common occupational ear protection articles are more used to protect workers against high-frequency noise, while protection against low-frequency noise is limited. Alternatively, the influence of occupational noise on hypertension has nothing to do with ear protection and more valid and relevant measures should be taken. Effects of wearing protective equipment and impacts of occupational noise at different frequencies and intensities on the cardiovascular system of workers deserve further exploration. Besides, we





found a sex-dependent effect of noise on hypertension, which is consistent with the previous study (44). It may be related with the fact that the risk pattern for hypertension (45) and nature of the work (46) are different for male and female.

Although univariate analysis showed that workers with hearing loss had greater prevalence of hypertension, multivariate analysis showed that the relationships between the two were not significant. In our study, workers exposed to occupational noise ( $OR = 1.09$ ; 95% CI 1.01–1.18;  $p = 0.04$ ) faced higher risk of hypertension than those not and the association between hypertension and occupational noise exposure was confirmed existed regardless whether the worker had hearing loss. A systematic review suggested that exposure to noise at work was consistently positively associated with hypertension [Hazard ratio (HR) = 1.68; 95% CI 1.10–2.57] (26). Previous research suggests that noise could raise blood pressure without impairing auditory sensitivity (24). However, the healthy worker survivor effect (47) should not be ignored as well. Aside from the muting effects of hearing loss, the healthy worker survivor effect would also conceal the impacts of occupational noise on blood pressure. In addition, the muting correlation between hearing loss and hypertension may also be related to their positive correlations with age. Hyperglycemia ( $OR = 1.84$ ; 95% CI 1.73–1.96;  $p < 0.001$ ), hypercholesterolemia ( $OR = 1.34$ ; 95% CI 1.22–1.48;  $p < 0.001$ ) and ECG abnormalities ( $OR = 1.11$ ; 95% CI 1.07–1.15;  $p < 0.001$ ) were significant predictors as well. It should

be noted that hypertension, dyslipidemia and dysglycemia are risk factors of CVD (48) and hypertension combined with dysglycemia may greatly exacerbate the risk of CVD (49).

We provided a visualization of workers' hypertension prediction using nomogram based on binary logistic regression analysis. Available sociodemographic characteristics and clinical parameters were used in the nomograms, which was convenient and quick for screening the high-risk individuals. Previous nomogram suggests that age, sex, early life factors, family history of the disease, and lifestyle factors may predict the risk of hypertension (44, 50). Given the research subjects of this study are workers exposed to occupational hazards and data limit, this study finally included age, sex, occupational noise exposure status and physical examination results. Results revealed that sex, age, BMI, occupational noise exposure status, ECG results, TC results, family history of hypertension and blood glucose results were predictors of hypertension in workers with different occupational hazards in Wuhan. Our nomogram showed good predictive accuracy and validity. It may help identify high-risk workers and facilitate timely, effective and targeted prevention interventions so as to improve occupational health.

There are several limitations in our study as follows. First, occupational health examination data are by their nature observational studies, where data tend to be collected by clinicians rather than investigators. Data used for this study were cross-sectional and we can only demonstrate

TABLE 4 Characteristics of participants in training set and validation sets.

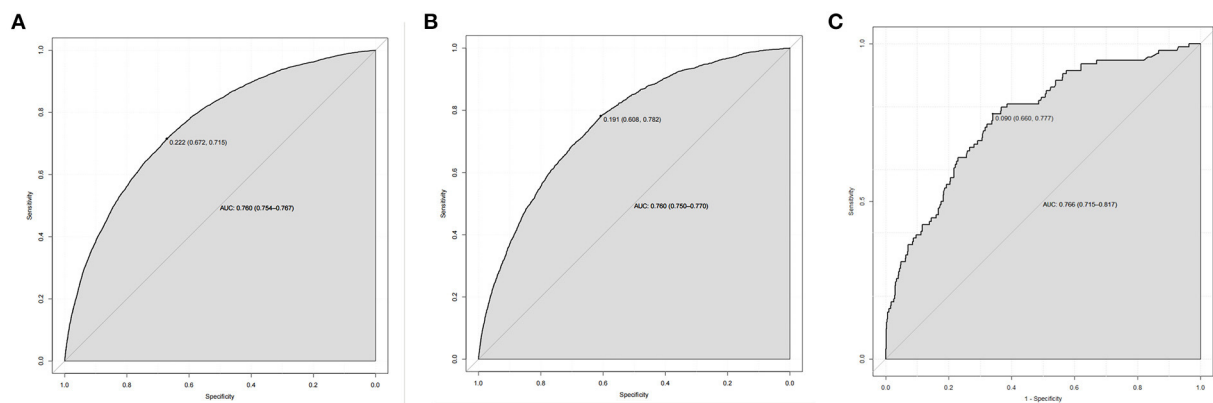
Characteristic	Training set ( <i>n</i> = 26,004)		Internal validation set ( <i>n</i> = 11,402)		<i>p</i>	External validation set ( <i>n</i> = 879)		<i>p</i>
	<i>n</i>	%	<i>n</i>	%		<i>n</i>	%	
Sex								
Female	5,430	20.4	2,353	20.6	0.616	199	22.6	0.107
Male	21,174	79.6	9,049	79.4		680	77.4	
Age	38.7±9.5	38.6±9.5	0.231	37.8±10.7	0.021			
Occupational noise exposure								
No	10,576	39.8	4,558	40	0.685	236	26.8	<0.001
Yes	16,028	60.2	6,844	60		643	73.2	
BMI								
<18.5	1,096	4.1	468	4.1	0.855	49	5.6	<0.001
18.5–23.9	12,344	46.4	5,288	46.4		524	59.6	
24.0–26.9	7,828	29.4	3,396	29.8		181	20.6	
≥27	5,336	20.1	2,250	19.7		125	14.2	
BHFTA								
Normal	12,306	46.3	5,247	46	0.754	593	67.5	<0.001
Abnormal	5,378	20.2	2,287	20.1		149	16.9	
Not examined	8,920	33.5	3,868	33.9		137	15.6	
Exposure time								
≤3 years	5,289	19.9	2,267	19.9	0.706	184	24.3	<0.001
4–10 years	8,279	31.1	3,582	31.4		200	26.4	
11–20 years	6,345	23.8	2,748	24.1		139	18.4	
≥21 years	6,691	25.2	2,805	24.6		234	30.9	
Family history of hypertension								
No	23,475	88.2	10,095	88.5	0.406	568	64.6	<0.001
Yes	3,129	11.8	1,307	11.5		311	35.4	
ECG								
Normal	17,707	66.6	7,597	66.6	0.893	667	75.9	<0.001
Abnormal	8,897	33.4	3,805	33.4		212	24.1	
Total cholesterol (TC)								
Normal	25,047	94.1	10,734	94.1	0.981	845	96.1	0.013
Abnormal	1,557	5.9	668	5.9		34	3.9	
Fasting glucose								
Normal	23,159	87.1	9,891	86.7	0.624	800	91	<0.001
Hyperglycemia	2,858	10.7	1,263	11.1		78	8.9	
Hypoglycaemia	587	2.2	248	2.2		1	0.1	
Hypertensive								
No	20,376	76.6	8,725	76.5	0.885	785	89.3	<0.001
Yes	6,228	23.4	2,677	23.5		94	10.7	

associations rather than prove causality, nor did we verify the mechanism. Secondly, we only studied whether exposure to occupational noise had an impact on the risk of hypertension, but did not specifically estimate the impact of noise at different frequencies and intensities on health. Last but not least, despite adjusting some factors in the present study, there are still some confounders that may influence

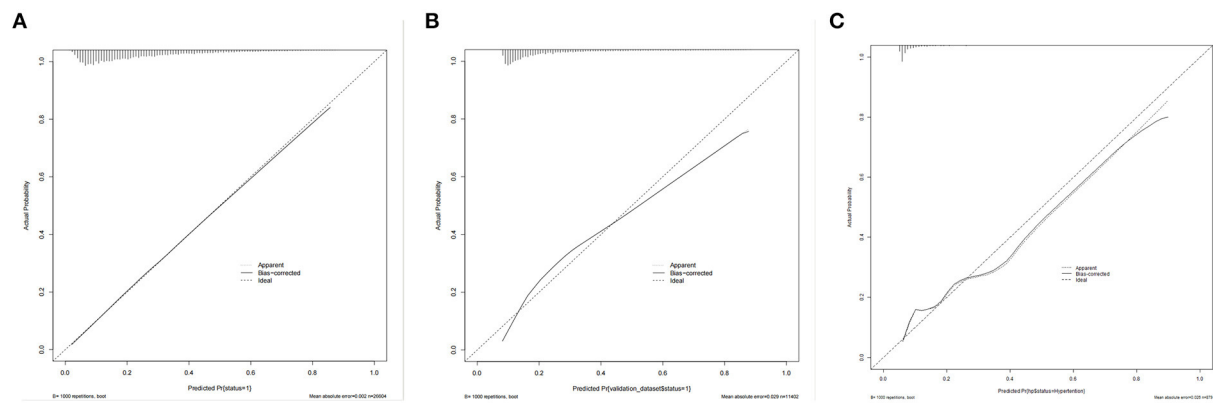
the results not included, which should be considered in subsequent studies.

## Conclusion

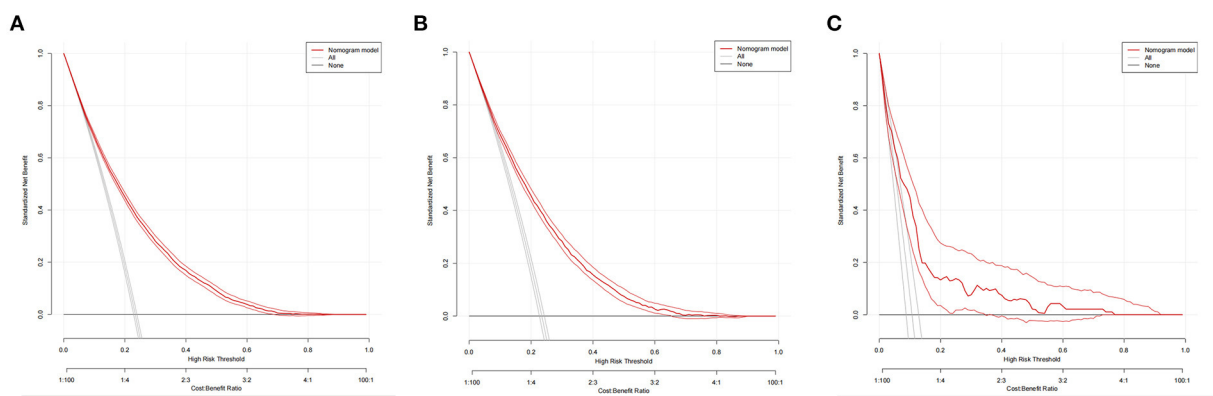
Occupational noise exposure of workers may elevate their hypertension risk. Standard ear protection



**FIGURE 3**  
ROC curves. (A) Training set. (B) Internal validation set. (C) External validation set. ROC, receiver operating characteristic; AUC, area under the ROC curve.



**FIGURE 4**  
Calibration curve for predicting probability of hypertension. (A) Training set. (B) Internal validation set. (C) External validation set.



**FIGURE 5**  
Decision curve analysis in prediction of hypertension. (A) Training set. (B) Internal validation set. (C) External validation set.

measures should be strengthened and more effective and relevant hypertension prevention measures should be taken. Our nomogram may help identify high-risk workers and facilitate timely interventions so as to improve occupational health.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

LZ and XT designed the study. LZ, ZC, WY, WF, FH, ZP, and GY collected the data. LZ performed statistical analysis. LZ, SC, and ZC drafted this manuscript. LZ, XT, and GY revised the manuscript. XT and GY had primary responsibility for final content. All authors were involved in the revisions and approved the final version of the manuscript.

## References

1. Zhou B, Perel P, Mensah GA, Ezzati M. Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension. *Nat Rev Cardiol.* (2021) 18:785–802. doi: 10.1038/s41569-021-00559-8
2. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol.* (2020) 16:223–37. doi: 10.1038/s41581-019-0244-2
3. Poulter NR, Prabhakaran D, Caulfield M. Hypertension. *Lancet.* (2015) 386:801–12. doi: 10.1016/S0140-6736(14)61468-9
4. Murray CJ, Aravkin AY, Zheng P, Abbafati C, Abbas KM, Abbasi-Kangevari M, et al. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet.* (2020) 396:1223–49.
5. Xu T, Zhou M, Liu J, Wang L, Dong W. Death burden attributable to hypertension in 1990 and 2019 in China. *Chin J Prev Contr Chron Dis.* (2022) 30:327–31. doi: 10.16386/j.cjpcd.issn.1004-6194.2022.05.002
6. Falaschetti E, Mindell J, Knott C, Poulter N. Hypertension management in England: a serial cross-sectional study from 1994 to 2011. *Lancet.* (2014) 383:1912–9. doi: 10.1016/S0140-6736(14)60688-7
7. Lawes CM, Vander Hoorn S, Law MR, Elliott P, MacMahon S, Rodgers A. Blood pressure and the global burden of disease 2000. Part 1: estimates of blood pressure levels. *J Hypertens.* (2006) 24:413–22. doi: 10.1097/01.hjh.0000199801.72563.6f
8. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet.* (2005) 365:217–23. doi: 10.1016/S0140-6736(05)17741-1
9. Mannuccio MP, Carla A. Noise and air pollution as triggers of hypertension. *Eur Heart J.* (2021) 42:2085–7. doi: 10.1093/eurheartj/ehab104
10. Münzel T, Schmidt FP, Steven S, Herzog J, Daiber A, Sørensen M. Environmental noise and the cardiovascular system. *J Am Coll Cardiol.* (2018) 71:688–97. doi: 10.1016/j.jacc.2017.12.015
11. Jarup L, Babisch W, Houthuijs D, Pershagen G, Katsouyanni K, Cadum E, et al. Hypertension and exposure to noise near airports: the HYENA study. *Environ Health Perspect.* (2008) 116:329–33. doi: 10.1289/ehp.10775
12. De Kluizenaar Y, Gansevoort RT, Miedema HM, de Jong PE. Hypertension and road traffic noise exposure. *J Occup Environ Med.* (2007) 49:484–92. doi: 10.1097/JOM.0b013e318058a9ff
13. Münzel T, Sørensen M, Daiber A. Transportation noise pollution and cardiovascular disease. *Nat Rev Cardiol.* (2021) 18:619–36. doi: 10.1038/s41569-021-00532-5
14. Basner M, Babisch W, Davis A, Brink M, Clark C, Janssen S, et al. Auditory and non-auditory effects of noise on health. *Lancet.* (2014) 383:1325–32. doi: 10.1016/S0140-6736(13)61613-X
15. Tikka C, Verbeek JH, Kateman E, Morata TC, Dreschler WA, Ferrite S, et al. Interventions to prevent occupational noise-induced hearing loss. *Cochrane Database Syst Rev.* (2017) 7:CD006396. doi: 10.1002/14651858.CD006396.pub4
16. Li X, Dong Q, Wang B, Song H, Wang S, Zhu B. The influence of occupational noise exposure on cardiovascular and hearing conditions among industrial workers. *Sci Rep.* (2019) 9:11524. doi: 10.1038/s41598-019-47901-2

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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17. Wang D, Xiao Y, Feng X, Wang B, Li W, He M, et al. Association of occupational noise exposure, bilateral hearing loss with atherosclerotic cardiovascular disease risk in Chinese adults. *Int J Hyg Environ Health*. (2021) 235:113776. doi: 10.1016/j.ijheh.2021.113776
18. Deal JA, Gross AL, Sharrett AR, Abraham AG, Coresh J, Carlson M, et al. Hearing impairment and missing cognitive test scores in a population-based study of older adults: the atherosclerosis risk in communities neurocognitive study. *Alzheimers Dement*. (2021) 17:1725–34. doi: 10.1002/alz.12339
19. Yang Y, Zhang E, Zhang J, Chen S, Yu G, Liu X, et al. Relationship between occupational noise exposure and the risk factors of cardiovascular disease in China. *Medicine*. (2018) 97:e11720. doi: 10.1097/MD.00000000000011720
20. Yang L, Dai X, Wu L, Xu T, Chen Z, Min Z, et al. Stress hormone biosynthesis-based genes and lifestyle moderated the association of noise exposure with blood pressure in a cohort of Chinese tobacco factory workers: a cross-sectional analysis. *Int J Hyg Environ Health*. (2022) 239:113868. doi: 10.1016/j.ijheh.2021.113868
21. Teixeira LR, Pega F, Dzhambov AM, Bortkiewicz A, Correa da Silva DT, de Andrade CAF, et al. The effect of occupational exposure to noise on ischaemic heart disease, stroke and hypertension: A systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-Related Burden of Disease and Injury. *Environ Int*. (2021) 154:106387.
22. Lin YT, Chen TW, Chang YC, Chen ML, Hwang BF. Relationship between time-varying exposure to occupational noise and incident hypertension: a prospective cohort study. *Int J Hyg Environ Health*. (2020) 226:113487. doi: 10.1016/j.ijheh.2020.113487
23. Bolm-Audorff U, Hegewald J, Pretzsch A, Freiberg A, Nienhaus A, Seidler A. Occupational noise and hypertension risk: a systematic review and meta-analysis. *Int J Environ Res Public Health*. (2020) 17:6281. doi: 10.3390/ijerph17176281
24. Peterson EA, Augenstein JS, Tanis DC, Augenstein DG. Noise raises blood pressure without impairing auditory sensitivity. *Science*. (1981) 211:1450–2. doi: 10.1126/science.7466404
25. Tomei G, Fioravanti M, Cerratti D, Sancini A, Tomao E, Rosati MV, et al. Occupational exposure to noise and the cardiovascular system: a meta-analysis. *Sci Total Environ*. (2010) 408:681–9. doi: 10.1016/j.scitotenv.2009.10.071
26. Skogstad M, Johannessen HA, Tynes T, Mehlum IS, Nordby KC, Lie A. Systematic review of the cardiovascular effects of occupational noise. *Occup Med*. (2016) 66:10–6. doi: 10.1093/occmed/kqv148
27. Bolm-Audorff U, Hegewald J, Pretzsch A, Freiberg A, Nienhaus A, Seidler A. Letter to the editor regarding, “The effect of occupational exposure to noise on ischaemic heart disease, stroke and hypertension: A systematic review and meta-analysis from the WHO/ILO joint estimates of the work-related burden of disease and injury”. *Environ Int*. (2022) 161:107104. doi: 10.1016/j.envint.2022.107104
28. Teixeira L, Dzhambov AM, Gagliardi D; WHO/ILO Working Group of Individual Experts on Occupational Exposure to Noise on Ischaemic Heart Disease, Stroke, and Hypertension. Response to Letter to the Editor Regarding “The effect of occupational exposure to noise on ischaemic heart disease, stroke and hypertension: A systematic review and meta-analysis from the WHO/ILO joint estimates of the work-related Burden of disease and injury”. *Environ Int*. (2022) 161:107105. doi: 10.1016/j.envint.2022.107105
29. FDA. *Framework for FDA's Real-World Evidence Program*. (2018). Available online at: <https://www.fda.gov/media/120060/download>
30. McMahon AW, Quinto K, Abernethy A, Corrigan-Curay J. Summary of literature on pediatric real-world evidence and effectiveness. *JAMA Pediatr*. (2021) 175:1077–9. doi: 10.1001/jamapediatrics.2021.2149
31. Ruan Y, Zhang X, Xie L, Chen W, Sun D. GBZ 188-2014 Revision of technical specifications for occupational health monitoring. *Chin J Indust Hygiene Occup Dis*. (2016) 34:146–7. doi: 10.3760/cma.j.issn.1001-9391.2016.02.020
32. Zhou BF. Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults—study on optimal cut-off points of body mass index and waist circumference in Chinese adults. *Biomed Environ Sci*. (2002) 15:83–96. doi: 10.1046/j.1440-6047.11.s8.9.x
33. CDS. CDS Guideline for the prevention and treatment of type 2 diabetes mellitus in China (2020 edition). *Chin J Diabetes Mellitus*. (2021) 13:315–409. doi: 10.3760/cma.j.cn115791-20210221-00095
34. Gao RL, Zhao SP. 2016 Chinese guideline for the management of dyslipidemia in adults. *Chin J Cardiol*. (2016) 44:833–53.
35. P. National Health Commission P. National Health Commission. *National Health Commission of Peoples Republic of China: People's Republic of China*. (2014).
36. Kim J, Kaufman JS, Bang H. Graphing ratio measures on forest plot. *J Am Coll Cardiol*. (2018) 71:585–6. doi: 10.1016/j.jacc.2017.10.098
37. Iasonos A, Schrag D, Raj GV, Panageas KS. How to build and interpret a nomogram for cancer prognosis. *J Clin Oncol*. (2008) 26:1364–70. doi: 10.1200/JCO.2007.12.9791
38. Münzel T, Daiber A, Steven S, Tran LP, Ullmann E, Kossmann S, et al. Effects of noise on vascular function, oxidative stress, and inflammation: mechanistic insight from studies in mice. *Eur Heart J*. (2017) 38:2838–49. doi: 10.1093/eurheartj/ehx081
39. de Iriarte Rodríguez R, Magarinos M, Pfeiffer V, Rapp UR, Varela-Nieto I. C-Raf deficiency leads to hearing loss and increased noise susceptibility. *Cell Mol Life Sci*. (2015) 72:3983. doi: 10.1007/s00018-015-1919-x
40. Finneran JJ. Noise-induced hearing loss in marine mammals: a review of temporary threshold shift studies from 1996 to 2015. *J Acoust Soc Am*. (2015) 138:1702–26. doi: 10.1121/1.4927418
41. Carlsson PI, Van Laer L, Borg E, Bondeson ML, Thys M, Fransen E, et al. The influence of genetic variation in oxidative stress genes on human noise susceptibility. *Hear Res*. (2005) 202:87–96. doi: 10.1016/j.heares.2004.09.005
42. Ma J, Li C, Kwan MP, Kou L, Chai Y. Assessing personal noise exposure and its relationship with mental health in Beijing based on individuals' space-time behavior. *Environ Int*. (2020) 139:105737. doi: 10.1016/j.envint.2020.105737
43. McLean EK, Tarnopolsky A. Noise, discomfort and mental health a review of the socio-medical implications of disturbance by noise. *Psychol Med*. (1977) 7:19–62. doi: 10.1017/S0033291700023138
44. Liang JH, Zhao Y, Chen YC, Huang S, Zhang SX, Jiang N, et al. Development and validation of a nomogram-based prognostic model to predict high blood pressure in children and adolescents—findings from 342,736 individuals in China. *Front Cardiovasc Med*. (2022) 9:884508. doi: 10.3389/fcvm.2022.884508
45. Stockholm ZA, Bonde JP, Christensen KL, Hansen ÅM, Kolstad HA. Occupational noise exposure and the risk of hypertension. *Epidemiology*. (2013) 24:135–42. doi: 10.1097/EDE.0b013e31826b7f76
46. Wang D. *The relationship of occupational noise, smoking and shift work with hearing loss and hypertension (Doctoral dissertation)* Huazhong University of Science and Technology, Wuhan, China. (2018). p. 130.
47. Brown DM, Picciotto S, Costello S, Neophytou AM, Izano MA, Ferguson JM, et al. The healthy worker survivor effect: target parameters and target populations. *Curr Environ Health Rep*. (2017) 4:364–72. doi: 10.1007/s40572-017-0156-x
48. Isomaa BO, Almgren P, Tuomi T, Forsen B, Lahti K, Nissen M, et al. Cardiovascular morbidity and mortality associated with the metabolic syndrome. *Diabetes Care*. (2001) 24:683–9. doi: 10.2337/diacare.24.4.683
49. Tian J, Sheng CS, Sun W, Song X, Wang H, Li Q et al. Effects of high blood pressure on cardiovascular disease events among chinese adults with different glucose metabolism. *Diabetes Care*. (2018) 41:1895–900. doi: 10.2337/dc18-0918
50. Deng X, Hou H, Wang X, Li Q, Li X, Yang Z, et al. Development and validation of a nomogram to better predict hypertension based on a 10-year retrospective cohort study in China. *Elife*. (2021) 10:e66419. doi: 10.7554/eLife.66419





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# Bringing our best selves to work: Proactive vitality management and strengths use predicting daily engagement in interaction

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The present research focused on bottom-up, proactive employee behaviors and personal resources that can contribute to more engagement and optimal functioning at work. Based on the Job Demands-Resources (JD-R) and Conservation of Resources (COR) theories, we tested direct and interactive relationships between strengths use (SU), daily proactive vitality management (PVM), and daily work engagement (WE). Eighty-seven ( $N=87$ ) employees from a multinational company completed self-reported questionnaires at the beginning of the study and throughout five consecutive workdays ( $N=358$ ), yielding a multilevel dataset. We have found a significant daily positive relationship between PVM and WE, which showed significant inter-individual variation and was significantly enhanced by SU at the individual level. This study showed that PVM as employee-initiated proactive behavior and SU as a proactive personal resource facilitate engagement independently but yield the strongest results when used together, suggesting an interactive mechanism between bottom-up effects postulated in the JD-R theory.

## KEYWORDS

proactive vitality management, strength use, work engagement, diary study, JD-R theory

## 1. Introduction

Predicting employee engagement has had tremendous success in the past, mostly driven by the Job Demands-Resources (JD-R) theory (Bakker and Demerouti, 2017). Work engagement (WE) entails experiencing the work as an activity that individuals want to “devote time and effort to” (vigor), perceive as being “significant and meaningful” (dedication), and carry out “fully concentrated and engrossed in it” (absorption; Bakker, 2014, p. 2). Research guided by the JD-R theory showed that organizations need to enrich the resources employees rely on in order to be fully engaged (Bakker and Demerouti, 2017). However, technological developments (i.e., virtual work) and changes in the nature of work (i.e., remote work) have raised the issue that employees need to take more responsibility for their work outcomes and progress (Op den Kamp et al., 2018). This has put the employee center stage, creating a need for research that highlights how employees are active and

proactive in changing their work and themselves each day to perform their job (Bakker, 2015; Bakker and Demerouti, 2018).

In line with recent developments in the JD-R theory (Demerouti et al., 2019), this study investigates employee-initiated behavioral strategies in the form of proactive vitality management (PVM; Op den Kamp et al., 2018) as antecedents of daily WE. PVM is defined as “goal-oriented behavior aimed at managing physical and mental energy to promote optimal functioning at work” (Op den Kamp et al., 2018, p. 10). PVM includes self-initiated and goal-oriented behaviors that involve generating energy resources proactively instead of reacting to already depleted energy after periods of work (Op den Kamp et al., 2018). In this sense, it is a distinct concept from related ones, such as recovery experiences (e.g., relaxing and recovering through leisure activities; Sonnentag and Fritz, 2007) and micro-breaks (e.g., surfing the internet, discussing with colleagues; Fritz et al., 2011) which are meant to restore energy and attention that has been already depleted. Recent research has generated enthusiasm toward PVM since initial investigations linked it to higher creativity (Op den Kamp et al., 2020), entrepreneurial performance (Tisu and Virgă, 2022), and task performance (Bakker, 2017). Based on Bakker et al. (2020) work, we argue that employees who proactively build energy, inspiration, and motivation at work, consciously managing their own energetic, affective, and cognitive resources during the day, can facilitate their daily WE.

Research has also highlighted significant person-level moderators that can shape the efficiency of such proactive energy management strategies (e.g., goal orientation, Bakker et al., 2020; self-insight, Op den Kamp et al., 2020). Inspired by this literature, we propose that strengths use (SU) could constitute a person-level moderator of the daily relationship between PVM and WE. SU represents employees' initiative to use their strengths more often to complete work (van Woerkom et al., 2016). Strengths are trait-like characteristics (Wood et al., 2011), and SU can be conceptualized as a personal resource, representing a dispositional or habitual behavior (Kira et al., 2010) to use one's strengths to perform at work. From the perspective of the Conservation of Resources theory (COR; Hobfoll, 2011), SU as a personal resource can help employees create and/or attract other resources into a resource caravan (Chu et al., 2022; Ding and Lin, 2020). Empirical work has supported this assertion, showing that SU is connected to higher self-efficacy (Meyers and van Woerkom, 2017), person-job fit (Kooij et al., 2017), and positive affect (Meyers and van Woerkom, 2017). SU could represent a possible facilitator of the positive effects of PVM (Op den Kamp et al., 2018) due to its' potential to create resourceful conditions for “can do” (through feelings of efficacy), “reason to” (through alignment of the job with one's values and skills), and “energized to” (through positive affect) motivational states that prompt, proactive goal generation and aid self-regulation in striving to achieve those goals (Parker et al., 2010). This conceptualization of SU as a personal resource being dispositional and habitual implies stability in the construct, representing a person-level characteristic that varies across employees. PVM, on the other hand, is strongly tied to the responsibilities and workflow of any specific day, making it a variable that we can expect to show significant daily variability within

employees (Bakker et al., 2020). Adopting a diary design and building a multilevel model whereby intra-individual variation in PVM represents the first level of analysis (Level 1) and inter-individual differences in SU represent the second level (Level 2) of analysis allows us to gauge a complex interaction between more stable and more fluctuating proactive initiatives.

The proposed model (Figure 1) has its' main contribution to the literature by testing interactions between bottom-up effects in the JD-R theory (Bakker and Demerouti, 2017). We argue that these bottom-up effects most likely do not operate independently from one another but having personal resources that ensure better alignment between the employee and the work, could enhance the efficiency of short-term, concrete behavioral strategies that contribute to maintaining a positive state of mind for work on a daily basis. Both the JD-R theory and the model of proactive motivation (Parker et al., 2010) have theorized that the efficiency of proactive initiatives can be enhanced or hindered by contextual variables, such as job resources and demands (i.e., job control, leader behavior), or individual-level factors such as goal orientation (Bakker et al., 2020) or self-insight (Op den Kamp et al., 2020). However, although personal resources could also manifest this effect from a theoretical perspective, there is no empirical work currently in the literature that would directly test this possibility.

Second, we highlight the relevance of proximal, hands-on strategies that employees themselves can implement daily to take personal initiative in improving their well-being. This moves forward from existing research which has for a long time focused on proactive actions aimed at changing aspects of the environment or the task (i.e., job crafting, Bakker, 2015) and much less on changing oneself (Parker et al., 2010). PVM is focused on the self (Op den Kamp et al., 2018), which makes it more accessible for employees daily, and less dependent on the work itself than enacting other forms of proactive behavior (i.e., renegotiating task boundaries).

Third, we assessed PVM and WE as time-varying constructs using a daily diary method. This approach minimizes retrospective bias by asking participants to refer to states and actions that have just occurred during their day (Bakker, 2014). Empirical evidence showed daily variations not only in WE (Sonnentag et al., 2010) but also in its' antecedents, uncovering a dynamic and state-like experience of being engaged as a function of dynamic and state-like antecedents (Bakker, 2014). Bakker et al. (2020) were the first to link PVM to WE in a weekly design. However, while the authors have raised the issue that PVM is likely fluctuating also on shorter timeframes than a week, the research on this topic is relatively new and scarce. Therefore, this relationship has not yet been established at a day level.

## 1.1. Day-level relationship between daily proactive vitality management and daily work engagement

One main objective of the present study is to analyze the week-level positive relationship between PVM and WE (Bakker

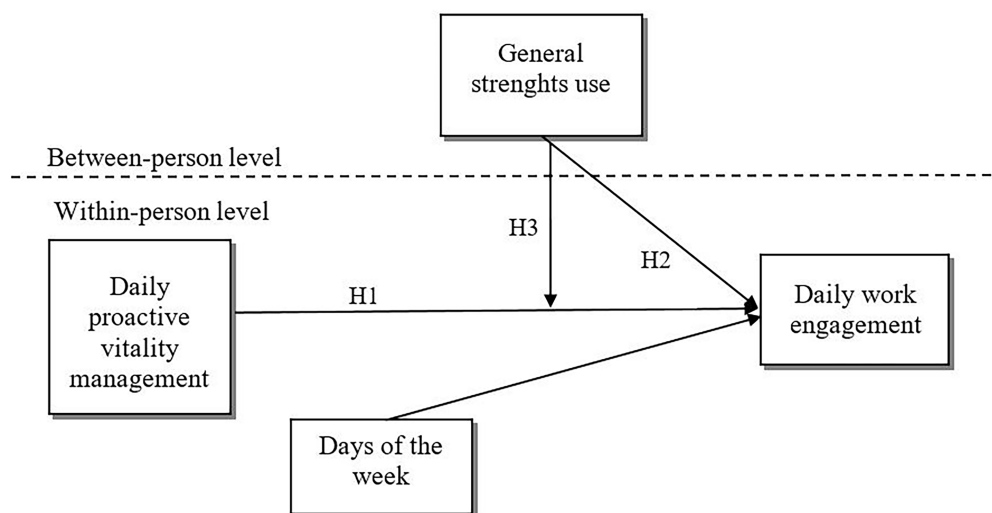


FIGURE 1  
A multi-level model of work engagement, proactive vitality management, and strengths use.

et al., 2020) at the day level. We argue that employees improve their daily engagement when they proactively manage their energetic, volatile, affective, and cognitive resources (Op den Kamp et al., 2018). Individuals can achieve this completely tailored to their personal, idiosyncratic needs and preferences, such as choosing to jog or walk to work to feel more physically energized and awake upon arrival or choosing to get comfortable in the car and play some inspiring or relaxing music to stay mindful and calm for an anticipated rushed workday (Op den Kamp et al., 2018). These strategies are not restricted to morning activities but can serve employees throughout the day. For example, if an employee has an important presentation in the middle of the day, engaging in PVM to optimize energy for that presentation could mean arranging other tasks earlier to gain a half-hour window to step outside and think through the presentation with a cup of coffee, or meditating before the presentation to get focused and present. The affective, energetic, and cognitive resources (i.e., task focus, optimism, positive affect) that are mobilized through PVM enable the employee to act and achieve objectives during the day (Sonnentag et al., 2010) and feel more vitality and engagement while working (Bakker, 2017). According to JD-R theory, such daily resource gain generated by PVM could significantly increase daily WE (Bakker, 2015; Bakker et al., 2020).

Empirical support for this assertion comes from related literature highlighting daily antecedents of WE in the form of positive affect, re-attachment to work, anticipated task focus (Sonnentag et al., 2020), and daily optimism (Tims et al., 2011). Bakker et al. (2020) empirically demonstrated a direct weekly relationship between PVM and WE. However, engagement is a state that also fluctuates in a shorter time frame of days (Bakker, 2014). PVM could represent a specific behavior through which an

employee could achieve this state daily (Bakker and Demerouti, 2018). Based on this literature, we anticipate the following:

H1: Daily PVM is positively related to daily WE.

## 1.2. The cross-level effects of strengths use

Identifying key strengths is essential, but beyond the possession of certain strengths, the active use of these seems to be the key toward the most benefits in terms of reduced stress, more efficient work, increased self-esteem, vitality, and positive affect (Wood et al., 2011; van Woerkom et al., 2016). From the perspective of COR theory, this renders SU the role of a key personal resource (Ding and Lin, 2020; Chu et al., 2022), which can contribute to engagement by generating a resource caravan (Hobfoll, 2011). Research has shown that SU can facilitate engagement by employing personal strengths that match the job, increasing other resources such as person-job fit (Kooij et al., 2017), and self-efficacy and optimism (Meyers and van Woerkom, 2017; van Woerkom and Meyers, 2019). These, in turn, attract job resources in the form of developmental opportunities, positive feedback, or autonomy (Stander and Mostert, 2013). Employees' initial investment of their strengths has the potential to draw a series of other resources that can also be invested further, creating a positive gain cycle (Hobfoll, 2011).

In a recent intervention study, Bakker and van Wingerden (2021) found that employees who learned to employ their strengths increased their WE. Following this empirical evidence, as well as other previous studies (van Woerkom et al., 2016; Bakker and van Woerkom, 2018), we propose that employees who

generally use their strengths to complete their work will report increased daily engagement:

*H2: SU at the individual level is positively related to daily WE.*

Further, we argue that SU and PVM do not have only independent bottom-up relationships to WE, but rather, there could be a constant interaction between them. Within the JD-R theory, general personal dispositions can moderate the daily gain cycle between resources, WE, and proactive crafting behaviors (Bakker, 2015). Hence, individual differences, such as the propensity to engage in SU, might influence whether specific PVM strategies generate the desired effects or not (Bakker et al., 2020). Both JD-R and COR theories postulate that personal resources can have a significant role in the motivational gain cycle (Hobfoll, 2011) through their power to attract and gain other resources that maintain engagement. The enrichment of resources generated by SU as a personal resource (Chu et al., 2022) forms a resource caravan (Hobfoll, 2011) with the potential to create motivational states that sustain proactive action (Parker et al., 2010). Proactively engaging in vitality management can be easiest for an individual in activities that satisfy the conditions for proactive behavior to take place (Op den Kamp et al., 2018). Drawing on the proactivity model of Parker et al. (2010), we can expect that employees would engage in PVM with greater probability when they believe that they can have success in achieving their goal of getting into an energized state (“can-do motivation”), have some motivation to engage vigorously in the activity (“reason to motivation”), and when positive feelings activate them (“energized to”). The three states are fundamental in proactive goal generation and self-regulation to strive toward a self-initiated goal (Parker et al., 2010) and can be actively created by a personal resource such as SU. Empirical evidence supports this, showing that SU is linked to higher performance and proactivity (Miglianico et al., 2020; Tisu et al., 2022), as well as higher self-efficacy (van Woerkom et al., 2016). This suggests that employees who actively use their strengths build up performance coupled with beliefs in their success in work assignments where strengths have led to success. Other research shows that employees who achieve a better alignment between their strengths and their jobs can increase person-job fit, making the job more congruent with themselves and more personally motivating (Kooij et al., 2017). Other studies have provided results on the beneficial effects of SU in terms of positive affect and optimism (Meyers and van Woerkom, 2017).

While our study is the first to test the specific moderating effect of SU, recent research has provided empirical support for person-level moderators of the associations PVM has to well-being and performance. Op den Kamp et al. (2020) have found that PVM is more strongly related to creativity at the week level in the case of employees with higher self-insight (i.e., being more aware of ones’ states and feelings). In another study, Bakker et al. (2020) have shown that employees’ learning goal orientation moderates the weekly association between PVM and WE. Thus, we have formulated the following hypothesis:

*H3: SU at the individual level enhances the daily positive relationship between PVM and WE.*

## 2. Materials and methods

### 2.1. Participants and procedure

All 200 employees from a Romanian site of a multinational company were invited to participate in a study about well-being at the workplace voluntarily. This site functioned as a call center to offer support to clients in multiple languages across Europe. To our invitation, 104 employees enrolled in the study (52% response rate). We discarded data from 17 employees because they provided less than three daily responses, which has been suggested as a minimum number of observations needed to make inferences about daily relationships (Singer et al., 2003), leaving a total of 358 daily observations from 87 employees (44% response rate). The questionnaires were administered in web-based and paper-and-pencil forms, depending on employees’ access to online forms during work hours. In the first week of the study, participants completed a general questionnaire (demographic variables and SU). In the following week, they filled in the daily repeated measures. Employees received the daily questionnaire in the afternoon and had the rest of the entire working day to respond. None of the employees worked in shifts or weekends. Participants were offered an incentive to encourage daily participation. Participants who completed all measures were eligible to participate in the prize draw for an electric scooter offered up by the research team.

### 2.2. Sample characteristics

Participants (78.2% women) had a mean age of 30 years ( $SD = 4.76$ ). The sample included employees in operational roles (69%), support functions (e.g., human resources, financial departments, 20%), and managers (11%). All participants worked full-time and had a permanent work contract. 17% of the participants were employed at the company for less than 1 year, 40% for over a year, and 43% for more than 2 years. 52% of the participants had a Bachelor’s degree, and 38% had a Master’s degree.

### 2.3. Measures

*Strengths use* was assessed by six items from the Strengths Use and Deficit Correction Questionnaire (van Woerkom et al., 2016), which has been previously translated and used in Romanian (Tisu et al., 2022). Participants rated their SU behavior (e.g., “I organize my job to suit my strong points”) on a 7-point Likert scale



(0 = *almost never*, 6 = *almost always*). The scale had high internal consistency ( $\alpha = 0.95$ ).

*Daily proactive vitality management* was measured with eight items from the PVM scale (Op den Kamp et al., 2018), adapted to the Romanian context by Bălăceanu et al. (2022). Participants rated their PVM behaviors (e.g., “Today, I made sure that I could focus well on my work”) on a 7-point Likert-type scale (1 = *totally disagree*, 7 = *totally agree*). Cronbach’s alpha values were excellent across all measurements (0.87, 0.94, 0.92, 0.95, 0.94, with a mean of 0.92).

*Daily work engagement* was measured with six items from the Utrecht Work Engagement Scale (UWES-9; Schaufeli et al., 2006), adapted to the Romanian context by Virgă et al. (2009). Following Bakker and Xanthopoulou (2009), we considered two items for each of the three dimensions: vigor (“Today, I was bursting with energy while working”), dedication (“Today, I was enthusiastic about my job”), and absorption (“Today, I got carried away when I was working”). Responses were given on a 7-point scale (0 = *completely disagree*, 6 = *completely agree*). The scale had good reliability across the five days (0.77, 0.89, 0.87, 0.87, and 0.86, with a mean of 0.85).

## 2.4. Construct validity

To establish multilevel construct validity, we conducted multilevel confirmatory factor analyses (MCFA) using MPlus 8 (Muthén and Muthén, 1998). Goodness-of-fit was evaluated using the  $\chi^2$  likelihood ratio statistic alongside the comparative fit index (CFI), the Tucker–Lewis Index (TLI), the root mean square error of approximation (RMSEA), and the standardized root means square residual (SRMR). Values of 0.90 or higher for CFI and TLI, and 0.08 or lower for RMSEA and SRMR indicate an acceptable model fit to the data (Hu and Bentler, 1999). Models were compared using the Satorra–Bentler scaled chi-squared difference (Satorra and Bentler, 2010) and the difference in CFI, with  $\Delta\text{CFI} > 0.01$ , indicating a significant change in model fit (Cheung and Rensvold, 2002).

Table 1 contains the results of the MCFA. The hypothesized 3-factor model (M1) placed SU at Level 2 (L2) and defined PVM and WE as distinct but correlated Level 1 (L1) factors. This model had a good fit to the data [ $\chi^2(106) = 3131.83$ ,  $p < 0.001$ ; CFI = 0.92; TLI = 0.9; RMSEA = 0.08; SRMR<sub>within</sub> = 0.07; SRMR<sub>between</sub> = 0.03]. To verify if PVM and WE are indeed best conceptualized as within-person factors, we compared this model with a 5-factor model (M2) in which we defined latent factors for PVM and WE on both levels. This model fared significantly worse [ $\chi^2(281) = 3537.15$ ,  $p < 0.001$ ; CFI = 0.71; TLI = 0.68; RMSEA = 0.09; SRMR<sub>within</sub> = 0.18; SRMR<sub>between</sub> = 0.23;  $\Delta\chi^2(15) = 86.16$ ,  $p < 0.001$ ;  $\Delta\text{CFI} = 0.21$ ]. This comparison assured that PVM and WE are better conceptualized and modeled only at L1. To further test the discriminant validity of the L1 measures, we also compared the hypothesized model to a 2-factor solution (M3), which merged PVM and WE in one

factor at L1. M3 also performed significantly worse compared to M1 [ $\chi^2(106) = 3131.83$ ,  $p < 0.001$ ; CFI = 0.81; TLI = 0.76; RMSEA = 0.16; SRMR<sub>within</sub> = 0.07; SRMR<sub>between</sub> = 0.03;  $\Delta\chi^2(3) = 187.58$ ,  $p < 0.001$ ;  $\Delta\text{CFI} = 0.11$ ]. This comparison provides support for the conceptual distinctiveness of PVM and WE. Lastly, to test for the risk of common method bias, we made the last comparison to a model which defined only one latent factor at L2 for all items (M4). M4 performed unacceptably on all indices [ $\chi^2(281) = 3537.15$ ,  $p < 0.001$ , CFI = 0.22; TLI = 0.20; RMSEA = 0.15; SRMR<sub>within</sub> = 0.38; SRMR<sub>between</sub> = 0.31].

## 2.5. Hypotheses testing

We applied Hierarchical Linear Modeling using Maximum Likelihood estimation with robust standard errors in MPlus 8 to test the proposed model (Muthén and Muthén, 1998). This approach entails separating the variability at the within-person and between-person levels to test both intra-individual variations and inter-individual differences (Singer et al., 2003). In the first step, we assessed intercept variability in WE. In the next step, we regressed WE on time in the form of days of the week (centered around the first measurement point) and on PVM (centered around the person-mean). In the third step, we allowed the slopes of the relationship between WE and PVM to vary across employees. In the last step, we tested the cross-level effects of SU by regressing the intercept and the PVM – WE slope on SU, centered around the grand mean. We performed simple slope tests using Preacher’s online tool for a detailed analysis of the cross-level interaction (Preacher et al., 2006). After each step, we calculated pseudo- $R^2$  on the total-, within-, and between-variance, tested the improvement in model fit using the Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and calculated a difference test using the Satorra–Bentler scaled chi-square, based on the log-likelihoods (Satorra and Bentler, 2010).

## 3. Results

Zero-order correlations, means, standard deviations, and scale reliabilities are summarized in Table 2. Attrition varied between 10.3% (on day 1) and 28.7% (on day 5). Additionally, we calculated a multilevel correlation among the daily measures, which showed a significant within-person association between PVM and WE (Estimate = 0.59,  $p < 0.001$ ).

Table 3 reports the main analysis results in each model-building step. A significant chi-squared difference between models, alongside a progressive decrease in AIC and BIC values, indicated substantial improvement in model fit after each step in the analysis. WE showed an intra-class correlation (ICC) of 0.622, and PVM showed an ICC of 0.577, suggesting that 62%, respectively, 57% of the variance in these constructs can be explained by inter-individual differences. Conversely, 38% of



TABLE 1 Fit indices from the multilevel confirmatory factor analysis.

Model	$\chi^2$ (df)	$\Delta\chi^2$ ( $\Delta$ df)	CFI	$\Delta$ CFI	TLI	RMSEA	SRMR <sub>Within</sub>	SRMR <sub>Between</sub>
M1–3 factors	3131.83 (106)***		0.92		0.90	0.08	0.07	0.03
M2–5 factors	3537.15 (281)***	86.16 (15)***	0.71	0.21	0.68	0.09	0.18	0.23
M3–2 factors (common latent factor at L1)	3131.83 (106)***	187.58 (3)***	0.81	0.11	0.76	0.16	0.07	0.03
M4–1 common latent factor at L2	3537.15 (281)***	194.51 (3)***	0.22	0.7	0.20	0.15	0.38	0.31

$N=421$ ;  $\Delta\chi^2$ , Satorra-Bentler scaled chi-squared difference based on the log-likelihoods; df, degrees of freedom; CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual. Each alternative model was compared to M1 (hypothesized 3-factor model with WE and PVM as L1 factors, and SU as L2 factor). \*\*\* $p < 0.001$ .

TABLE 2 Descriptive statistics, scale reliabilities, and bivariate correlations among daily PVM, WE, and general SU.

M (SD)		α	Day 1 PVM	Day 2 PVM	Day 3 PVM	Day 4 PVM	Day 5 PVM	Day 1 WE	Day 2 WE	Day 3 WE	Day 4 WE	Day 5 WE
SU	5.31 (1.28)	0.95	0.37**	0.28*	0.19	0.27*	0.28*	0.30*	0.28*	0.15	0.11	0.28*
Day 1 PVM	3.88 (0.49)		0.87	0.67***	0.55***	0.53***	0.53***	0.67***	0.51***	0.44***	0.50***	0.35**
Day 2 PVM	3.77 (0.70)			0.94	0.81***	0.65***	0.45**	0.56***	0.76***	0.64***	0.48***	0.41**
Day 3 PVM	3.75 (0.62)				0.92	0.64***	0.54***	0.53***	0.68***	0.79***	0.58***	0.49***
Day 4 PVM	3.71 (0.76)					0.95	0.69***	0.46***	0.66***	0.58***	0.75***	0.64***
Day 5 PVM	3.79 (0.62)						0.94	0.44**	0.49***	0.53***	0.59***	0.81***
Day 1 WE	3.08 (0.60)							0.77	0.69***	0.63***	0.60***	0.40**
Day 2 WE	3.13 (0.78)								0.89	0.80***	0.74***	0.60***
Day 3 WE	3.19 (0.75)									0.87	0.66***	0.64***
Day 4 WE	3.16 (0.75)										0.86	0.71***
Day 5 WE	3.19 (0.72)											0.85

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , Cronbach's  $\alpha$  coefficients are displayed on the main diagonal.  $N_{\text{day1}}=78$ ,  $N_{\text{day2}}=75$ ,  $N_{\text{day3}}=76$ ,  $N_{\text{day4}}=67$ ,  $N_{\text{day5}}=62$ .

the variance in WE and 43% in PVM is intra-individual and can be explained by within-person changes over the week.

The results showed that the weekday variation significantly and positively predicted WE ( $\gamma_{10}=0.04$ ,  $SE=0.02$ ,  $p=0.02$ ), indicating that employees became slightly more engaged as the week progressed. In line with the first hypothesis (H1), PVM positively predicted WE ( $\gamma_{20}=0.64$ ,  $SE=0.06$ ,  $p < 0.001$ ), showing that employees were more engaged during the days when they

more proactively managed their vitality. Variability in the workdays and PVM explained 11.3% of the total variance of WE. There was also a significant intercept-slope covariance ( $\sigma_{\mu 01}=0.08$ ,  $SE=0.03$ ,  $p=0.02$ ), indicating that individuals who started the week at a higher level of WE experienced a stronger daily relationship between PVM and WE. Furthermore, the PVM-WE slope showed significant inter-individual variability ( $\mu_{ij}=0.08$ ,  $SE=0.03$ ,  $p=0.005$ ), suggesting that the positive relationship

TABLE 3 Model results.

Level and variable	Null model	Fixed L1 predictors	Random slopes	Cross-level effects
<i>Level 1</i>				
Intercept	3.16*** (0.06)	3.08*** (0.08)	3.01*** (0.07)	3.01*** (0.07)
Day ( $\gamma_{10}$ )		0.04** (0.02)	0.03* (0.02)	0.04* (0.02)
PVM ( $\gamma_{20}$ )		0.64*** (0.07)	0.68*** (0.06)	0.67*** (0.06)
<i>Level 2</i>				
SU ( $\gamma_{01}$ )				0.12*(0.05)
SU*PVM ( $\gamma_{11}$ )				0.14** (0.05)
<i>Variance components</i>				
L1 variance	0.19*** (0.03)	0.12*** (0.02)	0.11*** (0.02)	0.10*** (0.02)
L2 variance	0.31** (0.06)	0.32*** (0.06)	0.33*** (0.06)	0.30*** (0.05)
Slope variance ( $\mu_{ij}$ )			0.08** (0.03)	0.05 (0.03)
Intercept-slope covariance ( $\sigma_{\mu 01}$ )			0.08* (0.03)	0.06 (0.03)
ICC	0.62			
<i>Model fit information</i>				
$\Delta$ AIC		−122.96	−9.39	−7.04
$\Delta$ BIC		−121.55	−7.97	−5.62
-2LL (df)		96.63 (2)***	33.89 (2)***	10.33 (2)**
Number of free parameters	3	5	7	9
Pseudo R <sup>2</sup> total		0.11 (11.3%)	0.02 (2.3%)	0.06 (5.8%)
Pseudo R <sup>2</sup> within		0.38 (37.6%)	0.11 (11%)	–
Pseudo R <sup>2</sup> between		–	–	0.08 (7.7%)

L1, inter-individual level 1; L2, intra-individual level 2; SU, strengths use; PVM, proactive vitality management; WE, work engagement; Robust standard errors of estimates are in parentheses. \*\*\*Significant at  $p \leq 0.001$ ; \*\*Significant at  $p \leq 0.01$ ; \*Significant at  $p \leq 0.05$ ; italicized estimates are non-significant.

between PVM and WE varies across individuals, and inter-individual differences might explain its' variation. Allowing random slopes explained an additional 2.3% of the total variance in WE.

The second hypothesis (H2) postulated a significant direct cross-level effect of SU on the WE intercept. The data showed that higher levels of general SU reported in the first week of the study predicted a higher average of daily WE in the following week ( $\gamma_{01} = 0.12$ ,  $SE = 0.05$ ,  $p = 0.012$ ). Furthermore, SU significantly predicted the PVM – WE slope ( $\gamma_{11} = 0.14$ ,  $p = 0.006$ ), which supports our third hypothesis (H3), postulating a cross-level moderating effect of SU. Adding SU to the model explained an additional 6.5% of the total variance and 8.3% of the between-person variability in WE. The simple slope analysis showed that at lower levels of SU (1 SD below the mean), PVM predicted WE positively ( $\beta = 0.49$ ,  $SE = 0.09$ ,  $p < 0.001$ ), but this relationship became significantly stronger ( $t = 2.9$ ,  $df = 712$ ,  $p = 0.003$ ) at higher levels of SU (+1 SD above the mean;  $\beta = 0.85$ ,  $SE = 0.08$ ,  $p < 0.001$ ). This means that the strongest benefits of daily PVM in terms of increased engagement could be observed in the case of those employees who also generally relied more on their strengths to organize and complete their tasks (Figure 2).

## 4. Discussion

This research adopted a diary method to investigate the daily relationship between PVM and WE throughout a workweek. Based on previous research (Op den Kamp et al., 2018; Bakker et al., 2020), we expected to find a dynamic daily relationship between PVM and WE that inter-individual differences in SU can moderate.

The data showed significant variability and a slight increase in WE from the beginning to the end of the workweek, replicating previous findings regarding daily changes in employee engagement (Sonnentag et al., 2010, 2020; Bakker, 2014). As predicted by H1, on days when employees actively managed their cognitive, emotional, and energetic resources, they also reported feeling more engaged in their work. These results are aligned with previous research demonstrating relationships between PVM and WE (Op den Kamp et al., 2018; Bakker et al., 2020; Bălăceanu et al., 2022; Tisu et al., 2021). From the perspective of the JD-R theory (Bakker and Demerouti, 2017), PVM represents a specific type of self-regulatory behavior, which, similar to job crafting (Tims and Bakker, 2010), can contribute to the motivational process through the resource gains that are generated by engaging in the behavior. While PVM differentiates from job crafting

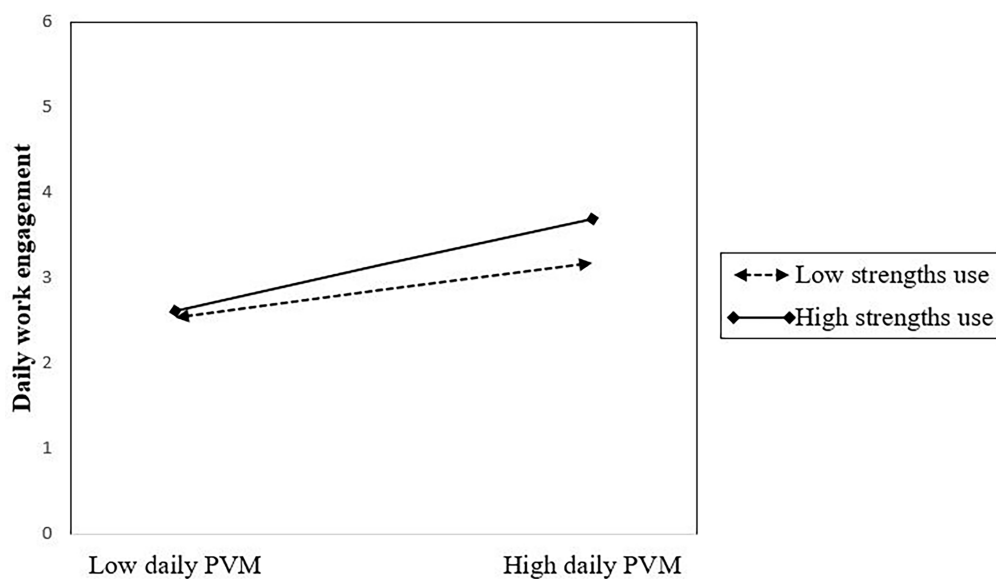


FIGURE 2  
The cross-level interaction between general SU and daily PVM in predicting daily WE.

through the distinct focus on the self instead of aspects of the work, it can work through a similar process, actively impacting the resources (especially energetic and affective resources) that employees then draw from to stay engaged in work tasks (Op den Kamp et al., 2018). For example, an employee can decide to take the bike to work in the morning, with the proactive goal of arriving in a more energized state for a morning task. Another employee might meditate shortly before starting a difficult task to create a more absorbed state in the activity.

The most important findings of the present research reside in the significant cross-level direct (H2) and moderating (H3) effects of SU. These results are aligned with previous cross-sectional and longitudinal research (van Woerkom et al., 2016; Bakker and van Woerkom, 2018). Existing studies focusing on the outcomes of SU have shown that relying more on strengths to complete work increases person-job fit (Kooij et al., 2017), boosts personal resources, and positive affect (Meyers and van Woerkom, 2017; van Woerkom and Meyers, 2019), attributing SU the role of a personal resource, which attracts and generates other resources that an individual needs to invest to achieve high levels of well-being (Hobfoll, 2011). JD-R theory's perspective conveys that SU has an essential moderating role in the motivational gain cycle (Bakker, 2015). Aligned with these theoretical frames, the proactivity literature (Parker et al., 2010) and previous studies investigating SU as a personal resource (Ding and Lin, 2020; Chu et al., 2022), the data confirmed our expectations that PVM would predict the highest engagement in the case of employees who direct their energy and effort toward activities they use their key strengths in. This could be because the resources and states associated with SU facilitate the motivational states necessary for mobilizing and sustaining proactive action (Parker et al., 2010). By creating the conditions in which proactive goal generation and

behavior thrive, SU seems to be an essential person-level catalyst for the benefits of PVM. For example, suppose an employee is highly creative and uses this strength frequently to perform his/her work over time. In this case, tasks that can imply creativity can be associated with feelings of competence, self-efficacy, and anticipated positive affect. These can prompt and maintain proactive initiatives toward activities that energize the employee (e.g., taking a walk outside to get fresh air) or facilitate a focused state (e.g., meditating, researching other creative works that are connected) whenever the employee anticipates that using his/her creativity in the task will be possible and beneficial.

## 4.1. Theoretical implications

In this research, we adopted a bottom-up, employee-focused perspective, highlighting proactive behaviors and resources that employees bring into the well-being dynamics in organizations. Concretely, we found that daily engagement can be achieved by employees' active and proactive generation of positive psychological states and their efforts to make the most of psychological resources. This focus complements top-down approaches that scholars and employers generally take to promote WE in organizations (Bakker, 2014; Op den Kamp et al., 2018) by highlighting that employees have a proactive influence over their well-being and are not only passive receivers of traditionally researched top-down effects (Bakker and Demerouti, 2018). Moreover, following previous studies proposing that the efficiency of PVM can be moderated by stable person-level and environment-level factors (Bakker et al., 2020; Op den Kamp et al., 2020), we showed that personal resources that also imply a propensity toward proactive action (such as SU), could improve

the daily positive effects of PVM. This means that the bottom-up effects enlisted within the JD-R theory (Bakker, 2017) do not exist and operate only independently. Rather, our theoretical understanding of them can be expanded if we also consider that short-term, concrete behaviors work in interaction with stable proactive personal resources.

## 4.2. Practical implications

In terms of practical insights, this research suggests that creating awareness around such proactive strategies and allowing employees the freedom and opportunity to engage in them could return high levels of daily engagement. Beyond encouraging employees to use their strengths and manage their vitality, organizations also can take action through training interventions facilitating PVM and SU. Organizations that wish to promote such behaviors through training can build on valuable recent findings. The results of a recent intervention study showed that training based on energy management techniques led to increases in PVM (Bălăceanu and Virgă, 2022). Helping employees develop PVM strategies and allowing them time and space to implement these consistently across the week could greatly benefit maintaining high energy levels throughout the week. In the after-COVID context, with work from home isolated from the resources that the presence of colleagues and managers offer during the day (van Zoonen and Sivunen, 2021) and different plans of returning to work that heavily relies on remote participation, PVM can become a proper individual strategy for employees who become more personally responsible than ever for staying focused and engaged during the day.

Similarly, SU interventions gained scientific terrain in recent years (Miglianico et al., 2020). A recent meta-analysis investigating the effectiveness of interventions targeting strengths identification, development, and use in organizations shows that such interventions generate moderate increases in well-being, slight increases in proactive personal strategies, and strong growth of personal resources (Virgă et al., 2022). Our results underline that when employees create opportunities for SU, they not only reap the direct benefits of this strategy but also gain more from their PVM. This suggests that a complementary development of these behavioral strategies could benefit employees the most.

## 4.3. Strengths, limitations, and future research

A significant strength of our research resides in the diary design, which allows a more naturalistic investigation of the relationships to WE, minimizing the risks of recall bias and capturing short-term reports close to the reality of everyday working life (Sonnentag et al., 2010, 2020). Regarding limitations, first, we collected self-report data, which raises concerns about common method bias. To minimize this risk, we have carefully analyzed and compared the proposed multilevel factor structure to solutions where measurements overlapped in a common latent

factor and assured that the proposed model represented the data best. Future research could obtain data from different sources (e.g., supervisors' ratings) to rule out other sources of common method bias (Podsakoff et al., 2003).

Second, the sample size at the employee level might limit our conclusions' robustness regarding the random and cross-level effects. L2 sample sizes greater than 30 tend to have a minimal impact on the accuracy of the fixed effects. However, recommendations for L2 units necessary for computing accurate standard errors of variance components range from 30 units to over 100 (Scherbaum and Ferreter, 2009). We also draw a cautionary note on the generalizability of these findings to the larger working population. Collecting the data within one organization contributes to the internal validity of our research, but it comes at the cost of external validity. Considering this, our findings apply primarily to highly educated white-collar female workers. Using this model in other work contexts could be inadequate because such proactive behaviors could have different boundary conditions and forms of manifestation in other contexts. Thus, knowing that PVM can contribute to daily engagement, it becomes essential that future research uncovers the structural and contextual antecedents and conditions of such behaviors. This could inform managers and HR practitioners about working conditions that impede or facilitate such proactive behaviors beyond the employee's initiative. For example, Van Scheppingen et al. (2015) have found that vitality at work was positively associated with a balanced orientation toward work and social capital at the workplace. Op den Kamp et al. (2020) have found that, alongside self-insight, social support at the workplace was a significant moderator of the positive effects of PVM. In the original validation study of the PVM concept (Op den Kamp et al., 2018), the authors highlighted that employees enjoying high levels of autonomy and skill variety might have more opportunities to engage in vitality management strategies, which might not be accessible in all occupations yet. However, they also pointed out that since these strategies are profoundly personal and can be tailored to anyone's preferences and context, workers across all industries and occupations can benefit from them with some progress in supporting their use. Therefore, replicating our results with a more extensive sample of individual employees and explicitly testing potential differences between industries and occupations could further our knowledge not only about PVM as a concept but also about the contexts which favor its' manifestation.

Finally, although the sequence we tested in this study from PVM to WE is based on theory and earlier research, other orderings are also plausible. It is also possible for WE to further predict PVM, similar to the daily cycles through which WE feed back into job crafting behaviors (Tims and Bakker, 2010; Bakker, 2015). Future research investigating gain cycles is an important and necessary development in deepening our current understanding of the dynamics of WE and proactivity in organizations (Bakker and Demerouti, 2018). Similarly, our model is aligned with the predominant discussions within the JD-R literature, emphasizing that personal resources can attract and protect other resources (Bakker and Demerouti, 2017).

However, some authors also stress a bidirectional, interactive relationship between resources and personal resources. For example, Kira et al. (2010) have discussed ways in which collaborative job design (i.e., job characteristics and resources shaped in close collaboration with employees and their needs) can support the development of personal resources. This potential reversed, and bidirectional causation is fundamental in our understanding of the modern world of work. Therefore, it creates exciting new directions for future research on proactivity in the workplace.

## 5. Conclusion

The current study showed that employees who proactively manage their physical and mental energy and use their key strengths to complete work report the highest daily engagement. Through PVM, employees actively manage their cognitive, emotional, and energetic resources and increase their engagement throughout the workday. Moreover, employees who rely on their key strengths to complete their work feel more engaged and benefit more from PVM. Thus, our results demonstrate that while proactive strategies are beneficial independently, they yield the most gains when combined and used complementary.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## References

- Bakker, A. B. (2014). Daily fluctuations in work engagement. *Eur. Psych.* 19, 227–236. doi: 10.1027/1016-9040/a000160
- Bakker, A. B. (2015). Towards a multilevel approach of employee well-being. *Eur. J. Work. Organ. Psychol.* 24, 839–843. doi: 10.1080/1359432X.2015.1071423
- Bakker, A. B. (2017). Strategic and proactive approaches to work engagement. *Org. Dynam.* 46, 67–75. doi: 10.1016/j.orgdyn.2017.04.002
- Bakker, A. B., and Demerouti, E. (2017). Job demands–resources theory: taking stock and looking forward. *J. Occup. Health Psychol.* 22, 273–285. doi: 10.1037/ocp0000056
- Bakker, A. B., and Demerouti, E. (2018). “Multiple levels in job demands-resources theory: implications for employee well-being and performance” in *Handbook of Wellbeing*. eds. E. Diener, S. Oishi and L. Tay (Salt Lake City, UT: DEF Publishers)
- Bakker, A. B., Petrou, P., Op den Kamp, E. M., and Tims, M. (2020). Proactive vitality management, work engagement, and creativity: the role of goal orientation. *Appl. Psychol.* 69, 351–378. doi: 10.1111/apps.12173
- Bakker, A. B., and van Wingerden, J. (2021). Do personal resources and strengths use increase work engagement? The effects of a training intervention. *J. Occup. Health Psychol.* 26, 20–30. doi: 10.1037/ocp0000266
- Bakker, A. B., and van Woerkom, M. (2018). Strengths use in organizations: a positive approach of occupational health. *Can. Psychol.* 59, 38–46. doi: 10.1037/cap0000120
- Bakker, A. B., and Xanthopoulou, D. (2009). The crossover of daily work engagement: test of an actor–partner interdependence model. *J. Appl. Psychol.* 94, 1562–1571. doi: 10.1037/a0017525
- Bălăceanu, A., and Virgă, D. (2022). How to increase employees' proactive vitality management? Testing the effect of a training intervention. *Int. J. Environ. Res. Public Health* 19:15898. doi: 10.3390/ijerph192315898

## Author contributions

ZP and DV contributed to the design, choice of theories, and elaboration of hypotheses. DV and DL collected and cleaned the data. DV contributed to constructing arguments and coordinated the writing process. ZP did the analyses and produced the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Bălăceanu, A., Virgă, D., and Sărbescu, P. (2022). Psychometric evaluation of the proactive vitality management scale: Invariance, convergent, and discriminant validity of the Romanian version. *Eval. Health Prof.* 45, 303–312. doi: 10.1177/0163278721998421
- Cheung, G. W., and Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Struct. Equ. Modeling* 9, 233–255. doi: 10.1207/S15328007SEM0902\_5
- Chu, X., Zhang, L., and Li, M. (2022). Nurses' strengths use and turnover intention: the roles of job crafting and self-efficacy. *J. Adv. Nurs.* 78, 2075–2084. doi: 10.1111/jan.15124
- Demerouti, E., Bakker, A. B., and Xanthopoulou, D. (2019). "Job demands-resources theory and the role of individual cognitive and behavioral strategies" in *The fun and frustration of modern working life: Contributions from an occupational health psychology perspective*. eds. T. W. Taris and H. De Witte (Antwerp, Belgium: Pelckmans Pro), 94–104.
- Ding, H., and Lin, X. (2020). Individual-focused transformational leadership and employee strengths use: the roles of positive affect and core self-evaluation. *Pers. Rev.* 50, 1022–1037. doi: 10.1108/PR-10-2019-0541
- Fritz, C., Lam, C. F., and Spreitzer, G. M. (2011). It's the little things that matter: An examination of knowledge workers' energy management. *Acad. Manag. Perspect.* 25, 28–39. doi: 10.5465/amp.25.3.zol28
- Hobfoll, S. E. (2011). Conservation of resource caravans and engaged settings. *J. Occup. Organ. Psychol.* 84, 116–122. doi: 10.1111/j.2044-8325.2010.02016.x
- Hu, L., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55.
- Kira, M., van Eijnatten, F. M., and Balkin, D. B. (2010). Crafting sustainable work: development of personal resources. *J. Organ. Chang. Manag.* 23, 616–632. doi: 10.1108/09534811011071315
- Kooij, D. T., van Woerkom, M., Wilkenloh, J., Dorenbosch, L., and Denissen, J. J. (2017). Job crafting towards strengths and interests: the effects of a job crafting intervention on person–job fit and the role of age. *J. Appl. Psychol.* 102, 971–981. doi: 10.1037/apl0000194
- Meyers, M. C., and van Woerkom, M. (2017). Effects of a strengths intervention on general and work-related well-being: the mediating role of positive affect. *J. Happ. Stud.* 18, 671–689. doi: 10.1007/s10902-016-9745-x
- Miglianico, M., Dubreuil, P., Miquelon, P., Bakker, A. B., and Martin-Krumm, C. (2020). Strength use in the workplace: a literature review. *J. Happ. Stud.* 21, 737–764. doi: 10.1007/s10902-019-00095-w
- Muthén, L. K., and Muthén, B. O. (1998). *Mplus User's Guide. Seventh Edition*. Los Angeles, CA: Muthén and Muthén
- Op den Kamp, E. M., Bakker, A. B., Tims, M., and Demerouti, E. (2020). Proactive vitality management and creative work performance: the role of self-insight and social support. *J. Create. Behav.* 54, 323–336. doi: 10.1002/jocb.368
- Op den Kamp, E. M., Tims, M., Bakker, A. B., and Demerouti, E. (2018). Proactive vitality management in the work context: development and validation of a new instrument. *Eur. J. Work. Organ. Psychol.* 27, 493–505. doi: 10.1080/1359432X.2018.1483915
- Parker, S. K., Bindl, U. K., and Strauss, K. (2010). Making things happen: a model of proactive motivation. *J. Manage.* 36, 827–856. doi: 10.1177/0149206310363732
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Preacher, K. J., Curran, P. J., and Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *J. Educ. Behav. Stat.* 31, 437–448. doi: 10.3102/10769986031004437
- Satorra, A., and Bentler, P. M. (2010). Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika* 75, 243–248. doi: 10.1007/s11336-009-9135-y
- Schaufeli, W. B., Bakker, A. B., and Salanova, M. (2006). The measurement of work engagement with a short questionnaire: a cross-national study. *Educ. Psychol. Meas.* 66, 701–716. doi: 10.1177/0013164405282471
- Scherbaum, C. A., and Ferreter, J. M. (2009). Estimating statistical power and required sample sizes for organizational research using multilevel modeling. *Organ. Res. Methods* 12, 347–367. doi: 10.1177/1094428107308906
- Singer, J. D., Willett, J. B., and Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence* Oxford University Press.
- Sonnentag, S., and Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *J. Occup. Health Psychol.* 12, 204–221. doi: 10.1037/1076-8998.12.3.204
- Sonnentag, S., Dormann, C., and Demerouti, E. (2010). "Not all days are created equal: the concept of state work engagement," in *Work engagement: A handbook of essential theory and research*. eds. A. B. Bakker and M. P. Leiter (Psychology Press), 25–38.
- Sonnentag, S., Eck, K., Fritz, C., and Kühnel, J. (2020). Morning reattachment to work and work engagement during the day: a look at day-level mediators. *J. Manage.* 46, 1408–1435. doi: 10.1177/0149206319829823
- Stander, F. W., and Mostert, K. (2013). Assessing the organisational and individual strengths use and deficit improvement amongst sport coaches. *SA J. Ind. Psychol.* 39, 1–13. <https://hdl.handle.net/10520/EJC144501>
- Tims, M., and Bakker, A. B. (2010). Job crafting: towards a new model of individual job redesign. *SA J. Ind. Psychol.* 36, 1–9. Available at: <https://hdl.handle.net/10520/EJC89228>. doi: 10.4102/sajip.v36i2.841
- Tims, M., Bakker, A. B., and Xanthopoulou, D. (2011). Do transformational leaders enhance their followers' daily work engagement? *Leader. Quart.* 22, 121–131. doi: 10.1016/j.leaqua.2010.12.011
- Tisu, L., Rusu, A., Sulea, C., and Virgă, D. (2022). Job resources and strengths use in relation to employee performance: a contextualized view. *Psychol. Rep.* 125, 1494–1527. doi: 10.1177/0033294121997783
- Tisu, L., and Virgă, D. (2022). Proactive vitality management, work-home enrichment, and performance: a two-wave cross-lagged study on entrepreneurs. *Front. Psychol.* 13:761958. doi: 10.3389/fpsyg.2022.761958
- Tisu, L., Virgă, D., and Mermeze, I. (2021). Autonomy and performance: proactive vitality management and work engagement as sequential mediators of the relationship. *Psychol. Rep.* 1–22. doi: 10.1177/00332941211048470
- van Scheepingen, A. R., de Vroome, E. M., Ten Have, K. C., Zwetsloot, G. I., Wiezer, N., and van Mechelen, W. (2015). Vitality at work and its associations with lifestyle, self-determination, organizational culture, and with employees' performance and sustainable employability. *Work* 52, 45–55. doi: 10.3233/WOR-141947
- Van Woerkom, M., and Meyers, M. C. (2019). Strengthening personal growth: the effects of a strengths intervention on personal growth initiative. *J. Occup. Organ. Psychol.* 92, 98–121. doi: 10.1111/joop.12240
- Van Woerkom, M., Mostert, K., Els, C., Bakker, A. B., De Beer, L., and Rothmann, S. Jr. (2016). Strengths use and deficit correction in organizations: development and validation of a questionnaire. *Eur. J. Work. Organ. Psychol.* 25, 960–975. doi: 10.1080/1359432X.2016.1193010
- Van Zoonen, W., and Sivunen, A. E. (2021). The impact of remote work and mediated communication frequency on isolation and psychological distress. *Eur. J. Work. Organ. Psychol.* 31, 610–621. doi: 10.1080/1359432X.2021.202299
- Virgă, D., Rusu, A., Pap, Z., Maricutoiu, L., and Tisu, L. (2022). Effectiveness of strengths use interventions in organizations: a pre-registered meta-analysis of controlled trials. *Appl. Psychol.* doi: 10.1111/apps.12451
- Virgă, D., Zaborilă, C., Sulea, C., and Maricutoiu, L. (2009). Romanian adaptation of Utrecht work engagement scale: the examination of validity and reliability. *Psihologia Resurselor Umane* 7, 58–74. doi: 10.24837/pru.v7i1.402
- Wood, A. M., Linley, P. A., Maltby, J., Kashdan, T. B., and Hurling, R. (2011). Using personal and psychological strengths leads to increases in well-being over time: a longitudinal study and the development of the strengths use questionnaire. *Pers. Individ. Differ.* 50, 15–19. doi: 10.1016/j.paid.2010.08.004



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# Sociodemographic, occupational, and personal factors associated with sleep quality among Chinese medical staff: A web-based cross-sectional study

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**Background:** Sleep quality among medical staff affects not only their own health but also the health of their patients. This study aimed to investigate the sociodemographic, occupational, and personal factors associated with sleep quality among medical staff in mainland China.

**Methods:** An online survey was conducted from January 10 to February 5, 2019, involving 3,684 medical staff (female: 84.9%; mean age: 31.6 ± 7.7; age range: 18–72). Sleep quality was measured by the Chinese version of the Pittsburgh Sleep Quality Index (C-PSQI). Sociodemographic, occupational characteristics, and personal lifestyle factors were measured by standard questions. Binary logistic regression analyses were used to determine the factors associated with sleep quality.

**Results:** 57.9% (95% CI: 56.3–59.5%) of the study population experienced poor sleep quality (C-PSQI > 5). Binary logistic regression showed that poor sleep quality were associated with lower level of education, higher level of hospital care, longer weekly working hours, more than 30 min of cell phone use at bedtime, shift work (OR 1.33, 95% CI[1.12–1.58],  $P = 0.001$ ), lack of regular naps (OR 1.46, 95% CI[1.26–1.69],  $P < 0.001$ ) and lack of routine exercise (OR 1.69, 95% CI[1.46–1.97],  $P < 0.001$ ).

**Conclusions:** Poor sleep quality is highly prevalent among medical staff in mainland China. The findings indicate that appropriate strategies, such as implementing regular breaks, regulating overtime work and vacation interruptions, as well as developing exercise programs, relaxation training, and stress-management programs could help improve the sleep quality of medical staff.

## KEYWORDS

sleep quality, medical staff, associated factors, napping, bedtime phone use

## 1. Introduction

Sleep is an important and necessary part of our life. Feeling well rested and getting good quality sleep are crucial to human productivity and health (1). Poor sleep quality can have serious consequences, such as memory loss, impaired cognitive processing speed, as well as an increased risk of depression and anxiety disorders (2). Poor sleep quality has also been found to be associated with work-related injuries or accidents (3). In addition, people with sleep disorders report impaired quality of life (4, 5) and are at a higher risk of all-cause mortality (6). Sleep-disordered symptoms are highly prevalent all over the world, with the prevalence of self-reported insomnia ranging from 12.2 to 51.0% (7–9).

Medical staff has been reported to suffer from poor sleep due to high workload and night shift, especially in large-scale hospitals (10, 11). According to previous reports, sleep problems were four times more prevalent among medical staff than among the general population (11, 12). Studies have shown that sleep problems among healthcare professionals not only influence their own mental and physical wellbeing, but also the health of their patients and the quality of care they provide (13).

Several studies have reported sociodemographic and occupational factors associated with sleep quality among medical staff, but the findings have been inconsistent. Kunzweiler et al. (1) found that nurses older than 50 years experienced poor sleep quality more frequently than their younger colleagues, while Alboghdady et al. (14) reported that poor sleep quality did not vary between age groups. In addition, Yu et al. (15) found that medical staff with junior professional titles were more likely to have poor sleep quality, on the contrary, Hsieh et al. (16) reported that professional title was not significantly associated with sleep quality among nurses. Marital status is also a factor related to sleep quality and it has been shown that people who are either married or divorced have poorer sleep quality than those who are not married (17). Occupational factors including shift work, work department, professional title and workload have been found to be associated with sleep quality among medical staff.

The association between sleep quality among medical staff and personal habits such as exercise, napping and cell phone use at bedtime has only been explored in a few studies to date. One of these studies showed that exercise was effective in improving sleep quality (18). Another recent study revealed that sleep quality was related to napping habit (19). Siesta, also known as afternoon sleep or midday nap is a common practice in some Asian countries. A few studies found that daytime naps were likely to disrupt nocturnal sleep and lead to poor sleep quality (20) while others reported that habitual napping could improve sleep quality (21, 22). With the widespread use of smartphones, many people have developed the habit of using their phones near bedtime; however, studies have shown that over-use of

mobile phone near bedtime is one of the negative factors that can influence sleep quality and increase the risk of daytime cognitive impairments (23).

In mainland China, the workload of medical staff is very high. According to the 2018 national health yearbook, 8,180 million outpatients and 240 million inpatients received services provided by only 6.2 million doctors and 3.8 million nurses in the year 2017 (24). The high workload, tense doctor-patient relationship and night shift make Chinese medical staff vulnerable to poor sleep quality and require more attention (25). However, little information is available about sleep quality and its associated factors of medical staff in Mainland China. What's more, previous studies only included medical staff of one-level hospitals and many factors mentioned above were not collected and evaluated (26–28).

Therefore, this study aimed to investigate the sleep quality among medical staff in mainland China and to explore its associated factors including sociodemographic, occupational, and personal factors (exercise, napping and smartphone use at bedtime). To provide information for scientific management and improvement of sleep quality.

## 2. Materials and methods

### 2.1. Study design and population

This was a cross-sectional online survey that investigated the sleep quality among 3,684 front-line medical staff working in different departments across various levels of hospital care in mainland China. The survey was conducted from January 10 to February 5, 2019. The inclusion criteria were as follows: (i) at least 6 months experience working in a hospital, (ii) having the ability to read Chinese (as the survey was written in Chinese), and (iii) being willing to take part in the survey. The exclusion criteria were being under 18 years old and not completing the questionnaire entirely.

### 2.2. Survey procedures

This online survey was conducted using a web-based questionnaire ([www.wjx.cn](http://www.wjx.cn)) through snowball convenience sampling. 40 nurses and doctors in the Second Xiangya Hospital of Central South University were initially invited to participate the survey and selected as “original deliverers.” They were asked to send the questionnaire links to their friends working in hospitals to participate in the online survey. And the link to the questionnaire was encouraged to spread among the respondents’ WeChat (a Chinese social media APP) groups.

## 2.3. Ethical considerations

This study was conducted in accordance with the Helsinki Declaration and Institutional Research Ethics guidelines. This study was approved by the ethics committee of the National Clinical Research Center of the Second Xiangya Hospital (No. 2018S007). All respondents were informed about the objectives and aims of this study and e-informed consent was obtained before the survey.

## 2.4. Measures

### 2.4.1. Sociodemographic characteristics and occupational factors

Sociodemographic information, including gender, age, marital status, and level of education (associate degree or below, bachelor's degree, and master's degree or above), as well as occupational information, including the level of hospital care (primary, secondary, and tertiary), professional titles (junior, mid-level, and senior), work schedule (shift or non-shift work), weekly working hours and years of experience were collected using a self-designed questionnaire.

### 2.4.2. Personal habit factors

Three aspects of habits were measured, including napping, exercise, and smartphone use at bedtime. The napping habit was assessed by the question: Do you have the habit of having a lunch break or midday nap (Twice per week at least)? (29). Exercise habit was evaluated *via* the question: Do you have the habit of exercising (At least once per week, more than 30 min each time)? (30). Both questions were defined as dichotomous questions (Yes/No). The assessment of smartphone use at bedtime was based on the following question: How much time do you usually spend on your smartphone before going to bed? The multiple-choice answers included: Zero, 0–30, 30–60, 60–120, and more than 120 min.

### 2.4.3. Sleep quality

Sleep quality was assessed using the Chinese version of the Pittsburgh Sleep Quality Index (C-PSQI, Cronbach's  $\alpha = 0.77$ ) (31). The C-PSQI consists of 18 items to evaluate seven aspects of sleep in the previous month, including the subject's sleep quality, sleep duration, sleep latency, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction (32). The score of each component ranges from 0 to 3; the total score is the sum of the component scores and ranges from 0 to 21, with higher scores representing lower sleep quality. Study participants with a C-PSQI score  $>5$  were classified as "poor sleep quality" (26).

## 2.5. Statistical analysis

All statistical analyses were performed using IBM software SPSS V.21.0 for Windows. Differences between good and poor sleep quality were examined by single-factor chi-square test. Odds ratios (ORs) and 95% confidence intervals (95% CI) were calculated to examine the association of sleep quality with occupational, personal, and demographic factors using binary logistic regression analysis (Forward LR). Initially, univariate analyses were performed, with each of the potential explanatory variables as independent variables, and sleep quality as the dependent variable. Pre-selection for the entry of all associated factors into the binary logistic regression model required a *P*-value of  $<0.05$  in the univariate analyses. A 5% significance level was accepted for all tests.

## 3. Results

Initially, a total of 3,706 respondents took part in the survey without any financial compensation. After removing 22 incomplete surveys, 3,684 respondents were included in the final analysis. 556 of these professionals were males (15.09%) and 3,128 were females (84.91%). The average age of the participants was  $31.6 \pm 7.7$  years and the average C-PSQI score was  $8.49 \pm 3.49$ . Poor sleep quality (C-PSQI  $> 5$ ) was recorded in 2,132 participants, accounting for 57.9% of the study population.

Table 1 shows that sleep quality was statistically related to age, level of education, level of hospital care, professional title, work schedule, weekly working hours, years of experience, profession, napping habit, exercise habit and smartphone use at bedtime ( $P < 0.05$ ). Both gender and marital status were not statistically related to sleep quality in medical staff ( $P > 0.05$ ).

Table 2 shows that sleep quality was independently related with age (30–39 years old, OR = 1.22, 95% CI [1.01–1.43];  $\geq 40$  years old, OR = 1.36, 95% CI [1.09–1.69]), level of education (associate degree or below, OR = 1.83, 95% CI [1.41–2.39]; bachelor's degree, OR = 1.66, 95% CI [1.34–2.06]), level of hospital care (secondary hospital, OR = 2.27, 95% CI [1.57–3.23]; tertiary hospital, OR = 2.44, 95% CI [1.71–3.49]), weekly working hours: (40–50 h/week, OR = 1.24, 95% CI [1.06–1.45];  $>50$  h/week, OR = 1.59, 95% CI [1.26–1.99]), smartphone use at bedtime (30–60 min, OR = 1.48, 95% CI [1.06–2.09]; 60–120 min, OR = 1.83, 95% CI [1.26–2.64],  $>120$  min, OR = 1.75, 95% CI [1.18–2.59]), shift work (OR = 1.33, 95% CI [1.12–1.58]), lack of regular napping (OR = 1.46, 95% CI [1.26–1.69]), and absence of exercise habit (OR = 1.69, 95% CI [1.46–1.97]). In other words, the risk factors for poor sleep quality in medical staff were a lower level of education, higher level of hospital care, longer weekly working hours, shift work, lack of regular

TABLE 1 Distribution of good and poor sleep quality by sociodemographic, occupational, and personal variables.

Variables	Sample size ( <i>n</i> = 3,684)	With good sleep quality ( <i>n</i> = 1,552)	With poor sleep quality ( <i>n</i> = 2,132)	Statistics	
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	$\chi^2$	<i>P</i>
Gender					
Male	556 (15.1)	1,299 (41.5)	1,829 (58.5)		
Female	3,128 (84.9)	253 (45.5)	303 (54.5)	3.060	0.085
Age group (years)					
<30	1,780 (48.3)	731 (41.1)	1,049 (58.9)		
30–39	1,306 (35.5)	536 (41.0)	770 (58.9)		
≥40	598 (16.2)	285 (47.7)	313 (52.3)	8.957	0.011
Marital status					
Married	2,423 (65.8)	1,027 (42.4)	1,396 (57.6)		
Unmarried	1,261 (34.2)	525 (41.6)	736 (58.4)	0.192	0.673
Level of education					
Associate degree or below	786 (21.3)	310 (39.4)	476 (60.6)		
Bachelor's degree	2,461 (66.8)	1,006 (40.9)	1,455 (59.1)		
Master's degree or above	437 (11.9)	236 (54.0)	201 (46.0)	29.190	<0.001
Level of hospital care					
Tertiary hospital	2,541 (68.9)	1,063 (41.8)	1,478 (58.2)		
Secondary hospital	987 (26.8)	389 (39.4)	598 (60.6)		
Primary/community hospital	156 (4.2)	100 (64.1)	56 (35.9)	33.973	<0.001
Professional title					
Senior	394 (10.7)	191 (48.5)	203 (51.5)		
Mid-level	1,021 (27.7)	459 (44.9)	562 (55.0)		
Junior	2,269 (61.6)	902 (39.8)	1,637 (60.3)	15.112	0.001
Work schedule					
Non-shift	984 (26.7)	505 (51.3)	479 (48.7)		
Shift	2,700 (73.3)	1,047 (38.8)	1,653 (61.2)	46.540	<0.001
Weekly working hours					
> 50 h	532 (14.4)	190 (35.7)	342 (64.3)		
40–50 h	2,140 (58.1)	885 (41.4)	1,255 (58.6)		
<40 h	1,012 (27.5)	477 (47.1)	535 (52.9)	19.904	<0.001
Years of experience					
<5	1,382 (37.5)	588 (42.6)	794 (57.5)		
6–10	1,054 (28.6)	399 (37.9)	655 (62.1)		
11–20	766 (20.8)	326 (42.6)	440 (57.4)		
> 20	482 (13.1)	239 (49.6)	243 (50.4)	19.042	<0.001
Profession					
Nurse	2,750 (74.7)	1,119 (40.7)	1,631 (59.3)		
Physician	934 (25.3)	433 (46.4)	501 (53.6)	9.190	0.003

(Continued)



TABLE 1 (Continued)

Variables	Sample size ( <i>n</i> = 3,684)	With good sleep quality ( <i>n</i> = 1,552)	With poor sleep quality ( <i>n</i> = 2,132)	Statistics	
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	$\chi^2$	<i>P</i>
<b>Exercise habit</b>					
No	2,546 (69.1)	946 (37.2)	1,600 (62.8)		
Yes	1,138 (30.9)	606 (53.3)	532 (46.7)	83.565	<0.001
<b>Regular napping</b>					
Yes	2,222 (60.3)	1,049 (47.2)	1,173 (52.8)		
No	1,462 (39.7)	503 (34.4)	959 (65.6)	59.303	<0.001
<b>Bedtime phone use time</b>					
0	174 (4.7)	90 (51.7)	84 (48.3)		
<30 min	1,731 (46.9)	805 (46.5)	926 (53.5)		
30–60 min	949 (25.8)	373 (39.3)	576 (60.7)		
60–120 min	487 (13.2)	165 (33.9)	322 (66.1)		
> 120 min	343 (9.3)	119 (34.7)	224 (65.3)	44.638	<0.001

TABLE 2 Binary logistic regression analysis of factors associated with poor sleep quality among medical staff.

The factors		<i>B</i>	SE	<i>Wald</i>	<i>P</i>	OR (95% CI)
Age group	<30			9.801		Ref
	30–39	0.199	0.080	6.148	0.013	1.22 (1.04–1.43)
	≥40	0.306	0.112	7.409	0.006	1.36 (1.09–1.69)
Level of education	Master's degree or above			23.813		Ref
	Associate degree or below	0.607	0.135	20.340	<0.001	1.83 (1.41–2.39)
	Bachelor's degree	0.505	0.110	21.017	<0.001	1.66 (1.34–2.06)
Level of hospital care	Primary/community hospital			24.020		Ref
	Secondary hospital	0.819	0.186	19.321	<0.001	2.27 (1.57–3.23)
	Tertiary hospital	0.894	0.182	24.019	<0.001	2.44 (1.71–3.49)
Weekly working hours	<40 h			16.856		Ref
	40–50 h	0.217	0.079	7.468	0.006	1.24 (1.06–1.45)
	>50 h	0.462	0.116	15.853	<0.001	1.59 (1.26–1.99)
Bedtime phone use time	0			29.076		Ref
	<30 min	0.136	0.166	0.677	0.410	1.15 (0.83–1.59)
	30–60 min	0.395	0.173	5.193	0.022	1.48 (1.06–2.09)
	60–120 min	0.602	0.187	10.336	0.001	1.83 (1.26–2.64)
	> 120 min	0.559	0.199	7.880	0.005	1.75 (1.18–2.59)
Shift work		0.282	0.087	10.466	0.001	1.33 (1.12–1.58)
Lack of routine exercise		0.527	0.077	46.463	<0.001	1.69 (1.46–1.97)
Lack of regular napping		0.377	0.074	25.815	<0.001	1.46 (1.26–1.69)

*B*, regression coefficient; SE, standard errors of regression coefficient.

The modified Hosmer-Lemeshow goodness-of-fit  $\chi^2$  test statistics was 2.80 (*P* = 0.946).

napping, lack of physical exercise and more than 30 min of smartphone use at bedtime.

## 4. Discussion

Our finding that 57.9% of the participants reported poor sleep quality is broadly consistent with the pooled prevalence (61.0%) of poor sleep quality among Chinese medical staff reported in a previous Meta-analysis of 53 studies (11).

Our study revealed that medical staff below 40 years of age and those without a master's degree or above suffered more frequently from poor sleep quality. These results were consistent with the findings of previous studies (33, 34). Considering this finding, it could be inferred that medical staff in mainland China with lower levels of education and younger ages are more likely to take up additional clinical work and night shifts in order to gain experience and refine the skill sets required in their specialties. In addition, they experience higher levels of pressure in the context of application for professional promotion, which makes them more vulnerable to sleep disturbances. Therefore, their sleep quality and psychological health issues deserve more attention.

Occupational factors including higher levels of hospital care, longer weekly working hours and shift work, which all reflect a heavy workload, were found to be significantly associated with poor sleep quality. Most patients treated in tertiary hospitals in China suffer from critical or serious illnesses or undergo major surgeries. Therefore, for medical staff in tertiary hospitals, staying up-to-date on advanced medical knowledge and clinical skills are essential, which may result in higher level of stress and lead to poor sleep quality (16). Various studies in the past have reported the association between shift work and negative health consequences such as heightened fatigue, anxiety, and poor sleep quality (16, 35, 36). Although shift work is unavoidable for medical staff, some measures could be taken on an individual and institutional level to improve sleep quality.

Maintaining good personal habits and leading a healthy lifestyle help to improve sleep quality and general wellbeing. Our study revealed that personal habits including napping, exercise and smartphone use at bedtime were significant associated factors for sleep quality among medical staff. Several studies have shown that a nap of <30 min during lunch break could restore wakefulness and promote work performance (21, 37). In their study, Zhan et al. (33) found that frontline nurses without the habit of napping were more vulnerable to insomnia. However, in China, doctors and nurses are busy dealing with routine clinical work during the daytime and even too busy to have lunch, let alone a nap. Therefore, hospitals could set up strategies such as the implementation of regular mandatory breaks for clinical doctors and nurses as a short nap is helpful for regaining energy as well as improving sleep quality and work performance.

Physical exercise, an economical and non-pharmacological intervention, which is available to a vast majority of people, was found to be an effective approach for improving sleep quality (18, 38). This finding of our study was consistent with previous studies. However, no more than one-third of participants in this study were found to have regular exercise habit. Nurses and doctors as healthcare providers are expected to care more about their own health, and lead a healthy lifestyle; however, the low rate of exercise habit may result from a busy work schedule and shortage of fitness equipment in the hospital setting. Labor unions of hospitals can help overcome this challenge by advocating for more workout spaces, organizing regular physical activities, and setting up sports curriculums for healthcare workers. Moreover, medical staff should develop the habit of doing regular exercise to improve their own sleep quality and act as an example for their patients.

In our study, more than 30 min of smartphone use at bedtime was associated with poor sleep quality. Liese et al. (39) also found that bedtime mobile phone use predicted a delayed rise time, increased fatigue and higher insomnia score. Three mechanisms could explain how smartphone use at bedtime might influence sleep quality. First, the secretion of melatonin will be suppressed by the light from cell phone screens, delaying sleep onset, and disrupting the circadian rhythm (40, 41). Second, smartphone use at bedtime is an unstructured leisure activity and has no fixed start or endpoint, especially when done later in the day or as part of a bedtime routine, which can lead to symptoms of circadian rhythm sleep-wake disorders (42). Third, exposure to sexual or violent content in media may cause fright, arousal, or stress reactions (43). This stimulation may be associated with difficulties in falling asleep or poor sleep quality. A randomized pilot trial found that restricting phone use at bedtime was effective in reducing sleep latency, increasing sleep duration, reducing pre-sleep arousal and improving positive affect and working memory (44). Therefore, healthcare professionals should try to restrict bedtime phone use to improve their sleep quality.

### 4.1. Limitations

There are some limitations to this study. First, this study includes the use of cross-sectional data and self-report measures. Although there are theoretically sound reasons to assume that the above-mentioned factors could affect the sleep quality of medical staff, no solid conclusion regarding causal relationships can be made from the data derived from this cross-sectional study. Second, this study was an online cross-sectional survey, although 3,684 medical staff responded, the sample was small compared to the large population of medical staff in mainland China. Therefore, the sample has limited representativeness, and the prevalence of poor sleep quality measured in this study

cannot fully represent the current status of sleep quality among Chinese medical staff.

## 5. Conclusion

This study shows that the overall rate of poor sleep quality among medical staff in mainland China is high. The associated factors for poor sleep quality were a lower level of education, higher level of hospital care, longer weekly working hours, shift work, lack of regular napping or routine exercise and more than 30 min of smartphone use at bedtime. A change in hospital policies coupled with individual efforts are crucial to improve sleep quality among medical staff through the management of the associated risk factors. Our study indicates that strategies such as the implementation of regular break times, the reduction of excessive overtime work, the regulation of vacation interruptions, and the establishment of exercise programs as well as relaxation and stress-management training could be developed to improve sleep quality and promote overall wellbeing among medical staff. In addition, medical staff themselves are expected to maintain healthy lifestyle habits. Sleep quality should be included on the list of objectives of health promotion as it is an important contributor to both the general health and workplace performance of medical staff.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the National Clinical Research Center of the Second Xiangya Hospital. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

JZ and YL contributed to conceiving the study concept and design. HC and YT analyzed the data and wrote the

first draft of the paper. YY, JY, JW, LL, JL, and HD contributed to the interpretation of data and were involved in revising the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

1. Kunzweiler K, Voigt K, Kugler J, Hirsch K, Bergmann A, Riemenschneider H. Factors influencing sleep quality among nursing staff: results of a cross sectional study. *Appl Nurs Res.* (2016) 32:241–44. doi: 10.1016/j.apnr.2016.08.007
2. Dong H, Zhang Q, Sun Z, Sang F, Xu Y. Sleep disturbances among Chinese clinical nurses in general hospitals and its influencing factors. *BMC Psychiatry.* (2017) 17:241. doi: 10.1186/s12888-017-1402-3

3. Shahly V, Berglund PA, Coulouvrat C, Fitzgerald T, Hajak G, Roth T, et al. The associations of insomnia with costly workplace accidents and errors: results from the America Insomnia Survey. *Arch General Psychiatry*. (2012) 69:1054–63. doi: 10.1001/archgenpsychiatry.2011.2188
4. Liu S, Chow IHI, Lu L, Ren YM, Yang HL, Jian SY, Ng CH, Ungvari GS, Wang F, Xiang YT. Comparison of sleep disturbances between older nursing home residents in high- and low-altitude areas. *J Geriatr Psychiatry Neurol*. (2020) 33:370–76. doi: 10.1177/0891988719892335
5. Chiu HFK, Xiang Y-T, Dai J, Chan SSM, Yu X, Ungvari GS, et al. Sleep duration and quality of life in young rural Chinese residents. *Behav Sleep Med*. (2013) 11:360–8. doi: 10.1080/15402002.2013.764524
6. Yin J, Jin X, Shan Z, Li S, Huang H, Li P, et al. Relationship of sleep duration with all-cause mortality and cardiovascular events: a systematic review and dose-response meta-analysis of prospective cohort studies. *J Am Heart Assoc*. (2017) 6:5947. doi: 10.1161/JAHA.117.005947
7. Benbir G, Demir AU, Aksu M, Ardic S, Firat H, Itil O, et al. Prevalence of insomnia and its clinical correlates in a general population in Turkey. *Psychiatry Clin Neurosci*. (2015) 69:543–52. doi: 10.1111/pcn.12252
8. Nowicki Z, Grabowski K, Cubala WJ, Nowicka-Sauer K, Zdrojewski T, Rutkowski M, et al. Prevalence of self-reported insomnia in general population of Poland. *Psychiatr Pol*. (2016) 50:165–73. doi: 10.12740/PP/58771
9. Vaag J, Saksvik-Lehouillier I, Bjørngaard JH, Bjerkset O. Sleep difficulties and insomnia symptoms in Norwegian musicians compared to the general population and workforce. *Behav Sleep Med*. (2016) 14:325–42. doi: 10.1080/15402002.2015.1007991
10. Dong H, Zhang Q, Zhu C, Lv Q. Sleep quality of nurses in the emergency department of public hospitals in China and its influencing factors: a cross-sectional study. *Health Qual Life Outcomes*. (2020) 18:116. doi: 10.1186/s12955-020-01374-4
11. Zeng L-N, Yang Y, Wang C, Li X-H, Xiang Y-F, Hall BJ, et al. Prevalence of poor sleep quality in nursing staff: a meta-analysis of observational studies. *Behav Sleep Med*. (2020) 18:746–59. doi: 10.1080/15402002.2019.1677233
12. Cao X-L, Wang S-B, Zhong B-L, Zhang L, Ungvari GS, Ng CH, et al. The prevalence of insomnia in the general population in China: a meta-analysis. *PLoS ONE*. (2017) 12:e0170772. doi: 10.1371/journal.pone.0170772
13. Feleke SA, Mulatu MA, Yesmaw YS. Medication administration error: magnitude and associated factors among nurses in Ethiopia. *BMC Nurs*. (2015) 14:53. doi: 10.1186/s12912-015-0099-1
14. Alboghdady A, Saad MJ, Kharshid AM, Shaalan MS, Alshawwa SZ. Assessment of anxiety level and sleep quality of medical staff treating patients with COVID-19. *Eur Rev Med Pharmacol Sci*. (2022) 26:312–19. doi: 10.26355/eurrev\_202201\_27783
15. Yu SJ, Cao YJ, Ma DD. [A survey on night sleep quality and daytime tiredness among shift nurses in a tertiary teaching hospital]. *Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chin J Ind Hyg Occup Dis*. (2018) 36:855–58. doi: 10.3760/cma.j.issn.1001-9391.2018.11.016
16. Hsieh M-L, Li Y-M, Chang E-T, Lai H-L, Wang W-H, Wang S-C. Sleep disorder in Taiwanese nurses: a random sample survey. *Nurs Health Sci*. (2011) 13:468–74. doi: 10.1111/j.1442-2018.2011.00641.x
17. Ouyang YQ, Zhou WB, Xiong ZF, Wang R, Redding SR. A web-based survey of marital quality and job satisfaction among Chinese nurses. *Asian Nurs Res*. (2019) 13:216–20. doi: 10.1016/j.anr.2019.07.001
18. Kelley GA, Kelley KS. Exercise and sleep: a systematic review of previous meta-analyses. *J Evid Based Med*. (2017) 10:26–36. doi: 10.1111/jebm.12236
19. Monk TH, Buysse DJ, Carrier J, Billy BD, Rose LR. Effects of afternoon “siesta” naps on sleep, alertness, performance, and circadian rhythms in the elderly. *Sleep*. (2001) 24:680–7. doi: 10.1093/sleep/24.6.680
20. Lin JN. Correlates and influences of taking an afternoon nap on nocturnal sleep in Chinese elderly: a qualitative study. *Geriatr Nurs*. (2018) 39:543–47. doi: 10.1016/j.gerinurse.2018.03.002
21. Katagi A, Miyai N. [Effects of short-term nap and light physical exercise on sleep among elderly patients with mild-to-moderate dementia in communal living group homes]. *Nihon eiseigaku zasshi Jpn J Hyg*. (2018) 73:365–72. doi: 10.1265/jjh.73.365
22. McDevitt EA, Sattari N, Duggan KA, Cellini N, Whitehurst LN, Perera C, et al. The impact of frequent napping and nap practice on sleep-dependent memory in humans. *Sci Rep*. (2018) 8:15053. doi: 10.1038/s41598-018-33209-0
23. Carter B, Rees P, Hale L, Bhattacharjee D, Paradkar MS. Association Between Portable Screen-Based Media Device Access or Use and Sleep Outcomes: A Systematic Review and Meta-analysis. *JAMA Pediatr*. (2016) 170:1202–08. doi: 10.1001/jamapediatrics.2016.2341
24. Commission NH. *China Health Statistics Year-Book*. Beijing: Peking Union Medical College Press (2018).
25. Ma J, Chen X, Zheng Q, Zhang Y, Ming Z, Wang D, et al. Serious workplace violence against healthcare providers in China between 2004 and 2018. *Front Public Health*. (2020) 8:574765. doi: 10.3389/fpubh.2020.574765
26. Chang Q, Xia Y, Bai S, Zhang X, Liu Y, Yao D, et al. Association between Pittsburgh sleep quality index and depressive symptoms in Chinese resident physicians. *Front Psychiatry*. (2021) 12:564815. doi: 10.3389/fpsyt.2021.564815
27. Deng X, Liu X, Fang R. Evaluation of the correlation between job stress and sleep quality in community nurses. *Medicine*. (2020) 99:e18822. doi: 10.1097/MD.00000000000018822
28. Sun T, Gao L, Li F, Shi Y, Xie F, Wang J, et al. Workplace violence, psychological stress, sleep quality and subjective health in Chinese doctors: a large cross-sectional study. *BMJ Open*. (2017) 7:e017182. doi: 10.1136/bmjopen-2017-017182
29. Mohammad Y. Siesta and risk for ischemic stroke: results from a case-control study. *Medicina*. (2020) 56:222. doi: 10.3390/medicina56050222
30. Kong L, Cui Y, Gong Q. Duration of keeping an exercise habit and mental illness and life attitude among University students. *Int J Environ Res Public Health*. (2022) 19:669. doi: 10.3390/ijerph191811669
31. Tsai P-S, Wang S-Y, Wang M-Y, Su C-T, Yang T-T, Huang C-J, et al. Psychometric evaluation of the Chinese version of the Pittsburgh Sleep Quality Index (CPSQI) in primary insomnia and control subjects. *Qual Life Res*. (2005) 14:1943–52. doi: 10.1007/s11136-005-4346-x
32. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. (1989) 28:193–213. doi: 10.1016/0165-1781(89)90047-4
33. Zhan Y, Liu Y, Liu H, Li M, Shen Y, Gui L, et al. Factors associated with insomnia among Chinese front-line nurses fighting against COVID-19 in Wuhan: a cross-sectional survey. *J Nurs Manag*. (2020) 28:1525–35. doi: 10.1111/jonm.13094
34. Cui ZY, Li L, Wang Y, Chao H, Huang Z. [A survey of sleep quality of employed nurses in military hospitals]. *Zhonghua lao Dong wei Sheng zhi ye Bing za zhi = Zhonghua Laodong Weisheng Zhiyebing Zazhi = Chin J Ind Hyg Occup Dis*. (2017) 35:578–81. doi: 10.3760/cma.j.issn.1001-9391.2017.08.005
35. Tribis-Arrospe B, Ballesteros-Peña S, Abecia Inchaurregui LC, Egea-Santaolalla C, Guerra-Martin L, de Larrinaga AA. [Sleep quality and adaptation to shift-work among ambulance staff in the Basque Country]. *An Sist Sanit Navar*. (2020) 43:189–202. doi: 10.23938/ASSN.0871
36. Pérez-Fuentes MDC, Jurado MDMM, Márquez MDMS, Linares JJG. Analysis of sociodemographic and psychological variables involved in sleep quality in nurses. *Int J Environ Res Public Health*. (2019) 16:3846. doi: 10.3390/ijerph16203846
37. Dhand R, Sohal H. Good sleep, bad sleep! The role of daytime naps in healthy adults. *Curr Opin Pulmon Med*. (2006) 12:379–82. doi: 10.1097/01.mcp.0000245703.92311.d0
38. Yang P-Y, Ho K-H, Chen H-C, Chien M-Y. Exercise training improves sleep quality in middle-aged and older adults with sleep problems: a systematic review. *J Physiother*. (2012) 58:157–63. doi: 10.1016/S1836-9553(12)70106-6
39. Exelmans L, Van den Bulck JJS. Bedtime mobile phone use and sleep in adults. *Soc Sci Med*. (2016) 148:93–101. doi: 10.1016/j.socscimed.2015.11.037
40. Chellappa SL, Steiner R, Oelhafen P, Lang D, Götz T, Krebs J, et al. Acute exposure to evening blue-enriched light impacts on human sleep. *J Sleep Res*. (2013) 22:573–80. doi: 10.1111/jsr.12050
41. Wood B, Rea MS, Plitnick B, Figueiro MG. Light level and duration of exposure determine the impact of self-luminous tablets on melatonin suppression. *Appl Ergon*. (2013) 44:237–40. doi: 10.1016/j.apergo.2012.07.008
42. Levenson JC, Shensa A, Sidani JE, Colditz JB, Primack BA. The association between social media use and sleep disturbance among young adults. *Prevent Med*. (2016) 85:36–41. doi: 10.1016/j.ypmed.2016.01.001
43. Anderson CA, Shibuya A, Ihori N, Swing EL, Bushman BJ, Sakamoto A, et al. Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: a meta-analytic review. *Psychol Bull*. (2010) 136:151–73. doi: 10.1037/a0018251
44. Ye J, Wen Y, Chu X, Li P, Cheng B, Cheng S, et al. Association between herpes simplex virus 1 exposure and the risk of depression in UK Biobank. *Clin Trans Med*. (2020) 10:e108. doi: 10.1002/ctm2.108



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# More exposure to medical injury news, better doctor-patient communication, but less doctors' professional identity: A moderated chain mediation model

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**Objectives:** In recent years, news of medical malignant injury events has become common in China. However, it is unclear how exposure to this news affects medical staff.

**Methods:** The present study collected data from a sample of 311 medical staff in China. It explored the effect of exposure to such news on medical staff's communication and willingness to let their children be doctors, which was an attitude that reflects their professional identity well. In addition, this study also examined the mediating roles of outgroup attribution and anxiety, and the moderating role of social support.

**Results:** The results showed that exposure to news of medical injury could positively and directly predict the quality of doctor-patient communication, but negatively and indirectly predict medical staff's willingness to let their children become doctors. These effects existed through the mediating role of anxiety and the chain mediating role of both outgroup attribution and anxiety. In addition, social support could mitigate the negative correlation between news exposure and outgroup attribution.

**Conclusions:** These results suggest that news of medical malignant injury events may incentivize medical staff to improve the quality of communication in the short term, but it is not conducive to medical staff's long-term mental health. That is, exposure to news of medical injury is likely to lead to a negative influence on their professional identity, although social support can alleviate this negative influence.

## KEYWORDS

news exposure, outgroup attribution, anxiety, doctor-patient communication, social support



## 1. Introduction

In the last 10 years, the dynamics of doctor-patient relationships in China have not been optimistic. According to a white paper on the Practice of Chinese Doctors published in 2018, 66% of doctors had experienced medical disputes of varying degrees (1). The very difficult relationships between patients and physicians have caused great concern in Chinese society.

The media, and especially media coverage, have a profound impact on doctor-patient relations (2). Social media portray almost one occurrence of violence against doctors every couple of days, which generally go viral instantly (3). Furthermore, in an effort to improve doctor-patient relations, recent news reports have tended to portray doctors as victims of vicious doctor-patient conflicts (4, 5). From the point of view of patients, some researches have confirmed that the news may improve doctor-patient trust by generating compassion for doctors (4, 6). However, few scholars have studied the influence of the coverage of medical malignant injury events on doctors' perceptions. How will such coverage affect the way doctors communicate with patients and their acceptance of the profession? Are the directions of these two effects consistent? To address these questions, we explore the effect of doctors' exposure to news of medical malignant injury events on both their communication quality and willingness to let children be doctors, and the mediation model of this effect through outgroup attribution and anxiety with the moderator of social support. And then the mechanism between doctors' exposure to medical injury news and their behavioral and psychological outcomes can be deeply analyzed so as to provide some suggestions for increasing doctors' professional health and identity and improving doctor-patient relations.

### 1.1. Superficial behavioral and deep psychological outcomes of exposure to violent coverage

We hoped to explore the influence of exposure to news of medical malignant injury events from two perspectives: superficial behavior and deep psychology. We speculated that it would be possible to obtain two opposite results.

From a behavioral perspective, we examined the effect of exposure to violent media coverage on doctor-patient communication behavior, which plays an important role in a good doctor-patient relationship. Chen et al. (7) found that doctor-patient communication was one of the top three factors that affect the doctor-patient relationships. Roter (8) employed a widely used system for coding both doctor and patient communication, which is called the Roter Interaction Analysis System (RIAS). It includes many mutually

exclusive and exhaustive categories, such as biomedical and psychosocial/lifestyle questions asking about positive talk, social chit-chat, and so on. A positive correlation has been found between strong communication and patient satisfaction (9).

However, the influence of exposure to news of medical malignant injury events on doctor-patient communication is not clear at all. According to the protection motivation theory (PMT), individuals can perceive and respond to threats in their environment (10). There is no doubt that the more people are exposed to such news, the greater they perceive patients as a threat. One possibility is that this perceived threat makes it harder for medical staff to communicate in a friendly manner with patients. Another possibility is that to protect themselves from this perceived threat, medical staff will have more procedural communication with patients (such as asking about the patient's health condition and avoiding aggravating the patient), which may help to improve the quality of communication. The PMT proposes that if an individual believes the behavior can mitigate or avoid the threat and that he or she has the ability to do so, the individual will engage in a coping behavior that protects against the identified threat (10). Salmeen et al's study (11) has also empirically shown that exposure to negative media coverage of minorities will motivate minorities to engage in collective action efforts aimed at improving their situation. And many surveys found that doctors had made some defensive practices of positive communication, such as more detailed patient explanations and note-taking, in order to avoid the possibility of a patient complaining or attacking (12, 13), because the miscommunications between medical staff and patients were major inducers for violent attacks (14). Therefore, we made a hypothesis supporting the latter possibility. That is:

**Hypothesis 1.** *Medical staff who are exposed to more news of medical malignant injury events have better doctor-patient communication.*

From a psychological perspective, how exposure to violent coverage influences a doctor's professional identity should be taken into consideration, since it is worth exploring whether doctors can remain in the occupation for the long term. Professional identity is a form of social identity, including deep insight into professional performance, and the establishment of professional values and goals that are widely accepted by staff (15). Previous studies have shown that professional identity improves work enthusiasm and the quality of care, reduces turnover intention, and optimizes hospital human resource management (16, 17). According to white papers, for many years, the Chinese Medical Doctor Association has been concerned about whether doctors are willing to let their children be doctors (1). This index is a great indicator of doctors' professional identity, because it can reflect doctors' overall appreciation of their compensation, practice safety, and social reputation.

The influence of exposure to news of medical malignant injury events on medical staff's willingness to let their children be doctors may be different from its influence on their superficial communication behavior. Since the wish to guard against dangers to life for oneself and one's children is basic to human nature, the perceived threat of exposure stemming from violent coverage may make medical staff prevent their children from being doctors. According to a survey related to medical malignant injury events in 2012, 78.6% of doctors were doubtful about their choices at the time, and some of them reported that they would not allow their children to engage in clinical work (18). Exposure to news of medical malignant injury events may increase medical staff's perception of workplace violence. And the perception of workplace violence has then been found to be negatively related to medical staff's professional identity (19) and be positively correlated with their professional burnout (20). Moreover, an investigation has found that violence against doctors leads to a 0.6% decrease in the number of students enrolled in medicine-related majors, and the violence-related news reduces the quality of medical students too (21). Thus, we proposed:

**Hypothesis 2.** *Medical staff who are exposed to more news of medical malignant injury events are less willing to let their children be doctors.*

## 1.2. The mediators: Outgroup attribution and anxiety

According to attribution theory (22), human beings have a natural need to understand the causes of events, especially when the outcomes are unexpected. This is likely to be the case with medical injury events, because they are regarded as a violation of interpersonal harmony norms. Furthermore, the theory argues that groups tend to attribute negative acts committed by an outgroup member to his/her internal, dispositional factors (23). They are more likely to attribute the injuries that other groups have committed against them to others' internal characteristics (24), especially when such injuries occur frequently. Previous studies about interpersonal violence have also found that an escalation in the severity and frequency of violence tends to make victims more likely to attribute the violence to external factors such as the attackers (25). Walter et al. (26) confirmed that exposure to the information of collective victimization would heighten the perceived responsibility of the outgroup for the injuries. In addition, He (27) suggested that doctors who had recently experienced conflict with patients were more likely to view the patient as the source of the conflict. And Enosh et al. (28) found that community-based family physicians who were exposed to patients' aggression attributed to the attacker's internal locus. Therefore, we speculated that exposure to news of

medical malignant injury events might make doctors more likely to attribute to the outgroup (i.e., patients).

**Hypothesis 3.** *Medical staff who are exposed to more news of medical malignant injury events are more likely to attribute these events to the outgroup.*

It has also become clear that anything that implies important, harmful consequences for the individual can generate an emotional reaction (29). And when a person experiences an intense concern that something negative will befall her/himself in the future, a feeling of anxiety will emerge (30). Exposure to medical malignant injury events increases the perceived threat posed by patients and thus naturally leads to an anxiety response in doctors (31). Previous researches regarding the outcomes of violence initiated by patients have indeed shown that it causes severe anxiety (32, 33). Therefore, we proposed:

**Hypothesis 4.** *Medical staff who are exposed to more news of medical malignant injury events are more anxious.*

Outgroup attribution means that the occurrences of these medical events are due to the patients and out of the doctors' control, which result in perceptions of low control and high risk on the doctors' part. When doctors perceive high risks with low control, they take defensive medical behaviors to avoid conflicts between themselves and their patients (27), which may influence their communication style (34). And the findings are inconsistent. Some studies have suggested that doctors may not communicate frankly with the patient regarded as a potential threat, or even take threatening patients off their lists (27, 34). But these behaviors happen more often to the doctors with high control. For the doctors perceiving high risks with low control (e.g., the medical injuries are completely attributed to patients), some other studies have supported the theory that doctors may communicate with their patients and families more effectively and compassionately at every encounter, helping them understand clinical recommendations and so on (35). Thus, we hypothesized that exposure to medical injury events might lead to outgroup attribution by doctors, making them defensive with low control and improving their communication quality. After all, the best care is the best defense (36). Therefore, we proposed:

**Hypothesis 5.** *Outgroup attribution mediates the positive relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.*

Similar to the role of outgroup attribution, anxiety is also a sign of high-risk perceptions and a low sense of control (37). When people perceive a threat, they become anxious and attempt to restore control, which may cause them to be hypervigilant and take some defensive behaviors (38). Wohl and Branscombe (39) have found that reminders of historical victimization initiate anxiety and then result in ingroup defensive responses. Therefore, we also hypothesized that the anxiety caused by exposure to medical injury events might improve doctors' communication quality, and proposed:

**Hypothesis 6.** *Anxiety mediates the positive relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.*

On the contrary, although the greater injury risk and lower sense of control caused by outgroup attribution may create incentives for doctors to communicate better, it will also no doubt increase their psychological burden. Therefore, outgroup attribution can affect individual career decision-making self-efficacy (40), career certainty, and professional development (41). For example, Liu et al. (42) found that lack of control negatively affected the professional identity of nurses. Previous studies have also confirmed that workplace violence reduces medical staff's sense of control over their work (43), and finally leads to turnover intentions (44). Therefore, we proposed:

**Hypothesis 7.** *Outgroup attribution mediates the negative relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.*

In addition, many studies have found that anxiety is negatively correlated with professional identity (45, 46). Violence increases medical staff's anxiety (47), and thus increases their turnover intentions (48). Therefore, we proposed:

**Hypothesis 8.** *Anxiety mediates the negative relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.*

Moreover, it can be argued that affective reactions depend on the interpretation and labeling of cognitive structures, and they are inseparable (49). Some theorists have suggested that blaming others means admitting weak personal control in the attribution of causality, and these processes serve the function of reducing an individual's sense of control over their environment and perceived avoidability (50), which may cause inevitable anxiety (37, 51). Furthermore, empirical research also indicates that anxiety is significantly greater in "blame-others" victims than in "self-blame" victims (52, 53). Therefore, we proposed:

**Hypothesis 9.** *Outgroup attribution and anxiety have a chain mediating effect on the relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.*

**Hypothesis 10.** *Outgroup attribution and anxiety have a chain mediating effect on the relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.*

### 1.3. The moderator: Social support

Typically, people want to talk with others about stressful life events due to their basic needs for belonging and love (54). An individual sharing stress-related thoughts and feelings with members of their social network reflects their attained social support (55). Social support may help to buffer people from the negative effects of violence exposure through a variety

of mechanisms, such as reducing the perceived threat and enhancing their sense of control (56, 57). Thus, social support is a process used to gain security. Past researchers have theorized that peers of accident perpetrators tend to externalize accident responsibility, lest they be blamed for similar accidents (58). Additionally, the security gained from social support may help people to interpret and explain medical injury events more objectively, combining internal and external attributions (59) rather than only focusing on outgroup attributions. This suggests that social support may moderate the relationship between exposure and outgroup attribution.

Furthermore, social support is considered as a social resource. Individuals who possess social support view themselves as valued and worthy of love and appreciation, and they have been found to demonstrate better resilience and mental health in the face of stressful situations (60). Previous studies have proven that social support can buffer the association between various acts of violence and anxiety (61, 62). Bourne et al. (63) also found that the more often doctors spoke to their colleagues, the less likely they were to suffer from anxiety. Therefore, we proposed hypotheses 11 and 12:

**Hypothesis 11.** *Social support moderates the relationship between medical staff's exposure to news of medical malignant injury events and their outgroup attribution. Specifically, the association between exposure and outgroup attribution is weakened for doctors with high social support.*

**Hypothesis 12.** *Social support moderates the effect of medical staff's exposure to news of medical malignant injury events on their anxiety. Specifically, the association between exposure and anxiety is weakened for doctors with high social support.*

In summary, the theoretical model of this paper is shown in Figure 1.

## 2. Methods

### 2.1. Participants and procedures

The study adopted convenient sampling method and online questionnaire to investigate medical staff working in Chinese hospitals in August 2021. After reading the informed consent, participants completed the questionnaire anonymously. Assuming a moderate size of correlations ( $r = 0.3$ ) among variables, a priori power analysis via the Monte Carlo simulation method was conducted to estimate the required sample size in testing a serial mediator model. It was estimated that a sample of 300 participants would provide 88% of statistical power (64). A total of 311 medical staff (see Table 1) including 102 males were finally recruited by an online questionnaire.

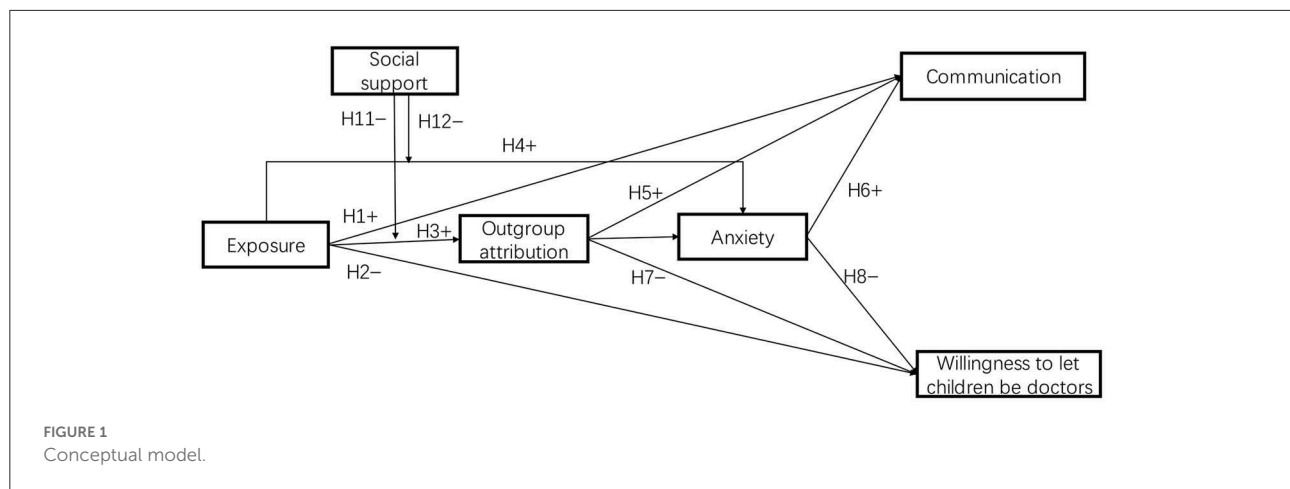


TABLE 1 Demographic information.

		n (%)
Gender	Male	102 (32.8%)
	Female	209 (67.2%)
Age	<30	57 (18.3%)
	31–40	112 (36.0%)
	41–50	42 (13.5%)
	51–60	43 (13.8%)
	>60	57 (18.3%)
Professional title	Chief/senior	46 (14.8%)
	Associate chief/senior	50 (16.1%)
	Intermediate/in charge	135 (43.4%)
	Junior	80 (25.7%)
Hospital grade	General hospital	245 (78.8%)
	Regional hospital	52 (16.7%)
	Community hospital	14 (4.5%)
Department	Clinic	212 (68.2%)
	Medical detection	70 (22.5%)
	Management	29 (9.3%)

## 2.2. Measures

### 2.2.1. Exposure to news of medical malignant injury events

The frequency of browsing news of violent events against medical staff was measured by the question “How often did you read news of malignant medical injuries in the past 2 years?” Participants responded on a five-point scale ranging from 1 (not at all) to 5 (very often).

### 2.2.2. Outgroup attribution

The attributional style was measured by the question “In general, to what extent are the patients primarily responsible for injuries to doctors?” Participants responded on a five-point scale ranging from 1 (not at all) to 5 (very much).

### 2.2.3. Anxiety

Nine items adapted from Li and Li (65) assessed the anxiety felt when participants thought of violent events against medical staff (e.g., “I feel nervous and anxious”). Participants responded on a five-point scale ranging from 1 (not at all) to 5 (very much), with a higher average score indicating more anxiety ( $\alpha = 0.877$ ).

### 2.2.4. Social support

Seven items adapted from the Social Support Revalued Scale (66) assessed the extent of social support, including 5 single-choice questions (e.g., “How much support and care have you received from family members?”), and 2 multiple-choice questions (e.g., “In the past, what sources of comfort and care did you get when you were in urgent situations?”). The single-choice questions were responded on a five-point scale ranging from 1 (not at all) to 5 (very much), and the multiple-choice questions are scored according to the number of options chosen. The scores for all questions were summed and ranged from 5 to 45, with a higher score indicating greater social support ( $\alpha$  of the total scale was 0.704).

### 2.2.5. Doctor-patient communication

According to the Roter interaction analysis system (8), we developed a four-item scale for doctor-patient communication quality assessment (e.g., “When you communicate with patients, will you express consent, listening, affirmation, praise, etc., such as ‘you did the right thing’ and ‘well, yes, I know?’”). Participants responded on a five-point scale ranging from 1 (not at all) to

5 (very often), with a higher average score indicating higher communication quality ( $\alpha = 0.810$ ).

### 2.2.6. Willingness to let children be doctors (index of professional identity)

This was measured by the question “Would you like your child to study medicine in the future?” Participants responded on a five-point scale ranging from 1 (not at all) to 5 (very much).

### 2.2.7. Control variables

The control variables included gender, age, professional title, departments, and the grade of their hospitals.

## 2.3. Statistical analyses

The SPSS software package was used to organize and clean the dataset, as well as to generate the descriptive statistical analysis and correlations.

In order to test our hypothesized model (see Figure 1), data were analyzed *via* path analysis models in the Lavaan package (67); (version 0.6–9) in R (version 3.3.0). Path analysis modeling was performed using Maximum Likelihood (ML) as the estimator. Model fit was assessed by multiple fit indices, including: ratio of the chi-square to its degree of freedom, comparative fit index (CFI), goodness-of-fit index (GFI), root-mean-square error approximation (RMSEA) and standardized root mean square residual (SRMR) (68, 69). And a bootstrapping method with 5,000 resamples was used to test the indirect and direct effects in the path analysis models.

After testing the hypothesized model, adjustments were made to improve fit by eliminating paths that were not statistically significant so that the most parsimonious model that was empirically and theoretically justified was found finally. The readjusted models were then retested by using the same procedures of above path analysis modeling.

## 3. Results

### 3.1. Preliminary analyses

The means, standard deviations, and bivariate correlations of all study variables are shown in Table 2. Gender, age, professional title, departments and the grade of hospital were included as covariates in subsequent analyses.

Notably, exposure to news of medical malignant injury events was positively correlated with outgroup attribution ( $r = 0.19$ ;  $p = 0.001$ ) and anxiety ( $r = 0.36$ ;  $p < 0.001$ ), supporting Hypotheses 3 and 4. Furthermore, it was positively correlated with the quality of communication ( $r = 0.28$ ;  $p < 0.001$ ), consistent with Hypothesis 1. However, it was not significantly

related to medical staff's willingness ( $r = 0.01$ ;  $p = 0.89$ ) to let their children be doctors; therefore, Hypothesis 2 was not supported.

Additionally, outgroup attribution was significantly correlated with anxiety ( $r = 0.43$ ;  $p < 0.001$ ). And anxiety was positively correlated with communication quality ( $r = 0.30$ ;  $p < 0.001$ ) and negatively correlated with willingness ( $r = -0.17$ ;  $p = 0.003$ ).

## 3.2. Structural model testing

Controlling the covariates, we used the Lavaan package (version 0.6–9) in R (version 3.3.0) to test the model with the Bootstrap method. The initial test of the hypothesized model (see Figure 1) yielded a poor fit ( $\chi^2(11) = 50.028$ , CFI = 0.851, GFI = 0.998, RMSEA = 0.107, SRMR = 0.050). Outgroup attribution did not predict the quality of communication ( $\beta = -0.03$ ,  $se = 0.05$ ,  $p = 0.69$ ) and doctors' willingness to let their children be doctors ( $\beta = 0.01$ ,  $se = 0.08$ ,  $p = 0.88$ ), hypothesis 5 and 7 were thus not supported. Meanwhile, the interaction variable of exposure  $\times$  social support was not a significant predictor of anxiety ( $\beta = 0.04$ ,  $se = 0.01$ ,  $p = 0.46$ ). Hypothesis 12 was not supported either.

Therefore, to adjust the model for improving the fit, above three paths that were not statistically significant were eliminated in the SEM analysis. Consequently, the model fit indices were improved greatly ( $\chi^2(8) = 19.436$ , CFI = 0.952, GFI = 0.971, RMSEA = 0.068, SRMR = 0.024). This final model with standardized estimates of path coefficients is presented in Figure 2.

The final SEM model suggested that exposure to news of medical malignant injury events positively predicted the quality of communication ( $\beta = 0.19$ ,  $se = 0.06$ ,  $p = 0.001$ ), supporting Hypothesis 1. But the path coefficient between exposure to medical injury news and willingness to let children be doctors was not significant ( $\beta = 0.08$ ,  $se = 0.10$ ,  $p = 0.23$ ). Hypothesis 2 was not supported. In addition, exposure to such news could affect these two outcome variables through the mediating role of anxiety and the chain mediating role of both outgroup attribution and anxiety. Specifically, exposure to medical injury news positively predicted outgroup attribution ( $\beta = 0.16$ ,  $se = 0.06$ ,  $p = 0.002$ ), supporting Hypothesis 3. Exposure also positively predicted anxiety ( $\beta = 0.28$ ,  $se = 0.04$ ,  $p < 0.001$ ), supporting Hypothesis 4. At the same time, the path coefficient from outgroup attribution to anxiety was 0.36 ( $se = 0.04$ ,  $p < 0.001$ ), indicating that outgroup attribution had a significant positive impact on anxiety. Furthermore, anxiety positively predicted the quality of communication ( $\beta = 0.21$ ,  $se = 0.07$ ,  $p < 0.001$ ) while negatively predicted willingness to let children be doctors ( $\beta = -0.20$ ,  $se = 0.10$ ,  $p < 0.001$ ), indicating that anxiety had a significant positive mediating effect between exposure to medical injury news and doctors'



TABLE 2 Means, standard deviations, and bivariate correlations for all study variables.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1. Gender	-	-										
2. Age	2.78	1.39	0.04									
3. Professional title	2.80	0.99	0.08	-0.67***								
4. Departments	1.26	0.53	-0.06	0.34***	0.05							
5. The grade of hospital	1.41	0.66	0.13*	0.12*	0.01	0.08						
6. Exposure	3.65	0.77	-0.05	0.04	-0.02	-0.09	-0.06					
7. Social support	25.88	5.34	0.11 <sup>†</sup>	0.21***	-0.25***	0.03	0.05	0.11 <sup>†</sup>				
8. Outgroup attribution	4.16	0.87	0.04	-0.16**	-0.03	-0.26***	-0.06	0.19**	0.08			
9. Anxiety	4.14	0.65	0.05	0.06	-0.17**	-0.21***	-0.07	0.36***	0.12*	0.43***		
10. Communication	3.86	0.75	0.04	0.25***	-0.19**	0.05	-0.14*	0.28***	0.21***	0.07	0.30***	
11. Willingness of children to be physicians	2.68	1.16	-0.03	0.23***	-0.14*	0.14*	0.06	0.01	0.21***	-0.11	-0.17**	0.04

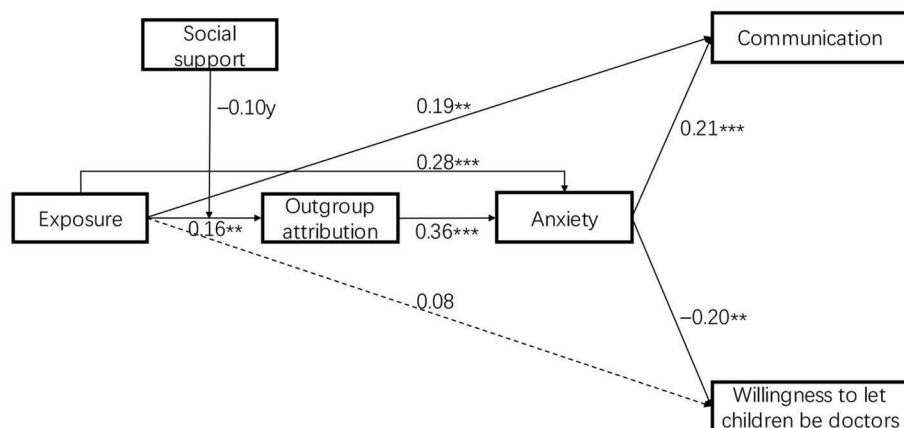
<sup>†</sup> $p < 0.1$ .\* $p < 0.05$ .\*\* $p < 0.01$ .\*\*\* $p < 0.001$ .

FIGURE 2

Estimation of final moderated mediation model. <sup>†</sup> $p < 0.1$ , \*\* $p < 0.01$ , and \*\*\* $p < 0.001$ .

communication, and a significant negative mediating effect between exposure to medical injury news and willingness to let children be doctors. Hypothesis 6 and 8 were therefore verified. And outgroup attribution and anxiety had a significant chain mediating effect between exposure to medical injury news and doctors' communication and willingness to let children be doctors, supporting Hypothesis 9 and 10. Results of Bootstrap = 5,000 in Table 3 showed that these indirect effects mentioned above were all significant.

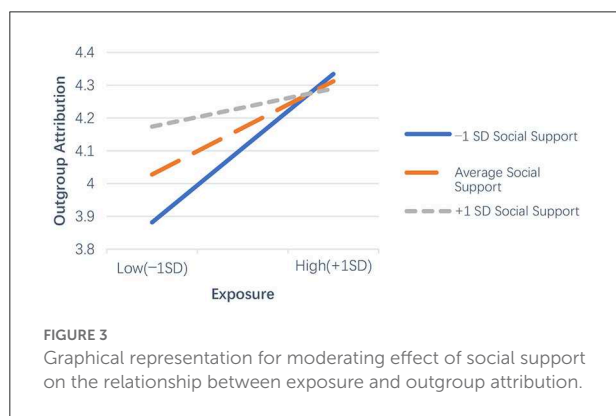
Besides, the analysis also showed that the interaction variable of exposure  $\times$  social support was a marginally significant

predictor of outgroup attribution ( $\beta = -0.10$ ,  $se = 0.01$ ,  $p = 0.097$ ). To probe and visualize the interaction, we plotted the slopes of interaction at the values of social support corresponding to one standard deviation above and below the mean, while setting the covariates to their sample means. As shown in Figure 3, simple slope analyses revealed that exposure was positively related to outgroup attribution when social support was low (*simple slope* = 0.29,  $se = 0.08$ ,  $t = 3.63$ ,  $p < 0.001$ ) or average (*simple slope* = 0.18,  $se = 0.06$ ,  $t = 2.97$ ,  $p = 0.003$ ), but was not correlated with outgroup attribution when social support was high (*simple slope* =

TABLE 3 Mediating effect and 95% confidence interval estimated by the Bootstrap method.

Path		Indirect effect estimation	CI at 95% level	
Ex→ Co: Total effect		0.265	0.151	0.369
Indirect effect	Ex→ An→ Co	0.059	0.025	0.105
	Ex→ OA→ An→ Co	0.012	0.004	0.030
Ex→ Wi: Total effect		0.008	−0.163	0.193
Indirect effect	Ex→ An→ Wi	−0.056	−0.153	−0.036
	Ex→ OA→ An→ Wi	−0.012	−0.044	−0.006

CI, confidence interval; Ex, exposure to news of medical malignant injury events; OA, outgroup attribution; An, anxiety; Co, communication; Wi, willingness to let children be doctors.



0.08,  $se = 0.09$ ,  $t = 0.83$ ,  $p = 0.408$ ). Hypothesis 11 was thus supported.

Then, we analyzed the moderated chain mediating effect under different conditions of social support. The bootstrapping results showed that the indirect effect of exposure on the quality of communication through outgroup attribution and anxiety was significant at low levels of social support [effect = 0.020, 95% CI = (0.006, 0.047)], but not significant in the condition of high social support [effect = 0.005, 95% CI = (−0.005, 0.023)]. Similarly, the indirect effect of exposure on willingness to let children be doctors through outgroup attribution and anxiety was also significant at low levels of social support [effect = −0.019, 95% CI = (−0.064, −0.011)], but not significant when social support was high [effect = −0.005, 95% CI = (−0.034, 0.007)]. The moderated chain mediation model in Figure 2 was verified. The results of the hypothesis testing are presented in Table 4.

## 4. Discussion

The present research aimed to explore how exposure to news of medical malignant injury events influences doctors' superficial behavior (i.e., communication with patients) and deep psychology (i.e., professional identity) in opposite directions. Regarding the impact of exposure on doctors'

communication behavior, we found that most medical staff indeed read violent news in daily life (61.7% of them chose “often” or even “very often”,  $M = 3.65$ ), and the more often medical staff read violent news, the more positive their communication. Previous research has shown that the more doctors ask for patients' information and use more positive language, the higher the satisfaction the patient feels (9). This seems to indicate that frequent exposure to news of medical malignant injury events does not reduce the quality of doctor-patient communication, and thus may not impair patient satisfaction and doctor-patient relations either. However, we also found that the positive effect of exposure to violent news on doctor-patient communication was significantly mediated by anxiety, and serially mediated by outgroup attribution and anxiety. This means that the more medical staff are exposed to violent news, the more likely they will blame the patient and, thus, be more anxious. In addition, exposure to violent news was found to directly increase anxiety. These findings are consistent with previous reports that violence can affect the cognitions and emotions of medical staff (70), and reflect that under the perceived threat of frequent violence, medical staff have a strong sense of potential insecurity and low control. In order to protect themselves, they may hide their true emotions and adopt more procedural and normative communication, such as asking about the physical and psychological states of patients. This kind of normative communication may not show any damage to patient satisfaction and the doctor-patient relationships in the short term, but it is not a healthy doctor-patient relationship per se.

Regarding the effect of exposure to violent news on doctors' professional identity, the stress and negative emotions with long-term exposure to such news will lead to decreased job satisfaction (71), increased absenteeism, intention to quit work (72), and decreased quality of patient care (73). Our findings also provide experimental evidence demonstrating that medical staff's exposure to news of medical malignant injury events negatively predicts their willingness to let their children be doctors, which is significantly mediated by anxiety, and serially mediated by outgroup attribution and anxiety too. More importantly, exposure to news of medical injury events was found to directly affect the quality of doctors' communication,

TABLE 4 Results of hypothesis testing.

Hypotheses	Results
<b>Hypothesis 1(H1):</b> Medical staff who are exposed to more news of medical malignant injury events have better doctor-patient communication.	Supported
<b>Hypothesis 2(H2):</b> Medical staff who are exposed to more news of medical malignant injury events are less willing to let their children be doctors.	Not supported
<b>Hypothesis 3(H3):</b> Medical staff who are exposed to more news of medical malignant injury events are more likely to attribute these events to the outgroup.	Supported
<b>Hypothesis 4(H4):</b> Medical staff who are exposed to more news of medical malignant injury events are more anxious.	Supported
<b>Hypothesis 5(H5):</b> Outgroup attribution mediates the positive relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.	Not supported
<b>Hypothesis 6(H6):</b> Anxiety mediates the positive relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.	Supported
<b>Hypothesis 7(H7):</b> Outgroup attribution mediates the negative relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.	Not supported
<b>Hypothesis 8(H8):</b> Anxiety mediates the negative relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.	Supported
<b>Hypothesis 9(H9):</b> Outgroup attribution and anxiety have a chain mediating effect on the relationship between medical staff's exposure to news of medical malignant injury events and their quality of communication.	Supported
<b>Hypothesis 10(H10):</b> Outgroup attribution and anxiety have a chain mediating effect on the relationship between medical staff's exposure to news of medical malignant injury events and their willingness to let their children be doctors.	Supported
<b>Hypothesis 11(H11):</b> Social support moderates the relationship between medical staff's exposure to news of medical malignant injury events and their outgroup attribution. Specifically, the association between exposure and outgroup attribution is weakened in medical staff with high social support.	Supported
<b>Hypothesis 12(H12):</b> Social support moderates the effect of medical staff's exposure to news of medical malignant injury events on their anxiety. Specifically, the association between exposure and anxiety is weakened in medical staff with high social support.	Not supported

but to indirectly affect their willingness to let their children be doctors, which did not support our hypothesis 2. It may suggest that the latter involves more long-term effects. That is, exposure to violent news might have a potentially terrible influence on the professional identity of existing doctors.

Meanwhile, the current study also found that outgroup attribution did not affect doctors' communication behavior and psychological identity directly, which did not support our hypothesis 5 and 7. However, outgroup attribution could affect doctors' communications and willingness to let children be doctors through anxiety. This supports the idea that our cognitive structure can affect our emotions and, therefore, our behaviors (49). And emotion is a much closer predictor of behavior than cognition (74). Furthermore, social support had a significant moderating effect on the relationship between exposure and outgroup attribution. This suggests that adequate social support can reduce medical staff's tendency to blame medical events on patients, thereby reducing their anxiety, which contributes to long-term and friendly doctor-patient relationships. Usually, social support has been considered as one of the fundamental protective factors that buffer individuals from risk and threat. It can help to reduce medical staff's perceived stress (75) and increase their subjective happiness (76). Therefore, we should pay more attention to medical staff and offer them more social support and psychological assistance. Hospitals should establish effective communication channels

with doctors, understand the difficulties they encounter in work and life, and give them timely help. In addition, hospitals can also provide psychological counseling and psychological guidance for doctors, so as to prevent or reduce doctors' anxiety and job burnout.

Moreover, we found that anxiety directly mediated the relationship between exposure to violent news and doctors' communication behavior and psychological identity. This suggests that, compared to outgroup attribution, anxiety is a more direct antecedent variable of doctors' communications and willingness to let children be doctors. However, social support did not moderate the relationship between exposure and anxiety, which did not support our hypothesis 12. This may suggest that the emotional impact of exposure to medical injury events is so large, immediate, and hard to avoid, that even social support cannot mitigate it effectively. These results imply that, besides social support from families, friends and hospitals, the government should vigorously plan and set up emergency disposal systems and modern medical systems in a legal environment, reducing medical injury events at the source. At the same time, when a medical injury event occurs, the media should report it objectively, avoiding tarnishing the images of physicians or patients blindly. On the contrary, the government and the media should increase the propagation and publicity of positive examples of good doctor-patient relationships so that doctors can feel respected and appreciated.

## 5. Limitations and future research

A pertinent limitation of this study was the cross-sectional design, which precluded inferences of the causal relationship between exposure to news of medical malignant injury events and medical staff's psychology and behaviors. Future studies can try to manipulate the medical staff's exposure by pushing relevant news regularly, increase social support they get, and intervene their outgroup attribution or anxiety to test the casual effects of our moderated chain mediation model. Besides, the self-reported measurements of all study variables may induce some bias and possibly exaggerate the medical staff's reports related to communications. Future research can use observational methods to attain the quality of doctor-patient communication or collect more objective data such as average consultation time and satisfaction rate by patients in a field study.

## 6. Conclusions

The present research provided evidence that exposure to news of medical malignant injury events can positively affect medical staff's communication in the short term, but negatively affect their willingness to let their children become doctors through the mediating roles of outgroup attribution and anxiety. In addition, social support can reduce the negative impact of exposure on outgroup attribution, which means that medical staff with a high level of social support are less likely to attribute medical malignant injury events to patients even if they have read a lot of violent news, hence leading to better and healthier doctor-patient relations.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

1. Chinese Medical Doctor Association. *White Paper on the Practice of Chinese Doctors*. (2018). Available online at: <http://www.cmda.net/rdxw2/11526.jhtml/> (accessed July 20, 2022)
2. Chai M, Tian Q, Wang X. The impact and mechanism of online coverage -comment on doctor-patient dispute on audience's tendency to trust doctors. *J Psychol Sci*. (2020) 43:1411–7. doi: 10.16719/j.cnki.1671-6981.20200619
3. Reddy IR, Ukrani J, Indla V, Ukrani V. Violence against doctors: a viral epidemic? *Indian J Psychiatry*. (2019) 61:S782–5. doi: 10.4103/psychiatry.IndianJPsychiatry\_120\_19
4. An N. *Content Analysis of the Media Image of Doctors Based on Data from 2011-2015 on Sina.com.cn*. Dissertation. Chongqing: College of Journalism of Chongqing University (2016).
5. Jia S. *The study on the Construction of Doctors' Media Image*. Dissertation. Wuhan: Central China Normal University (2017).
6. Zhao M. *Research on Media Image Construction of Doctors in China News Network (2010-2020)*. Dissertation. Jiangxi: Jiangxi University of Finance And Economics (2021).
7. Chen Y, Mu Y, Chen L, Li S. Research and analysis of the influencing factors of the physician-patient relationships. *Chongqing Med*. (2012) 41:277–8. doi: 10.3969/j.issn.1671-8348.2012.03.026
8. Roter D, Larson S. The Roter interaction analysis system (RIAS): utility and flexibility for analysis of medical interactions. *Patient Educ Couns*. (2002) 46:243–51. doi: 10.1016/S0738-3991(02)00012-5

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Subcommittee of Institute of Psychology, Chinese Academy of Sciences. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

QL and JZ conceived and designed the study and contributed to the manuscript writing and data analysis. LC conceived and designed the study and contributed to the data collection. All authors have read and agreed to the published version of the manuscript.

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9. Yin H, Zhao J. Study on the relationship between doctor-patient interaction and treatment satisfaction. *J Nanjing Med Univ.* (2020) 20:6. doi: 10.7655/NYDXBSS20200112
10. Rogers RW. A protection motivation theory of fear appeals and attitude change. *J Psychol.* (1975) 91:93. doi: 10.1080/00223980.1975.9915803
11. Saleem M, Hawkins I, Wojcieszak ME, Roden J. When and how negative news coverage empowers collective action in minorities. *Commun Res.* (2021) 48:291–316. doi: 10.1177/0093650219877094
12. Catino M. Blame culture and defensive medicine. *Cogn Technol Work.* (2009) 11:245. doi: 10.1007/s10111-009-0130-y
13. Moosazadeh M, Movahednia M, Movahednia N, Amiresmaili M, Aghaei I. Determining the frequency of defensive medicine among general practitioners in Southeast Iran. *Int J Health Policy Manag.* (2014) 2:119–23. doi: 10.15171/ijhpm.2014.28
14. Saeedi M, Al-Othman N, Rabayaa M. Breaching the bridge: an investigation into doctor-patient miscommunication as a significant factor in the violence against healthcare workers in Palestine. *Biomed Res Int.* (2021) 2021:9994872. doi: 10.1155/2021/9994872
15. Chai X. *Research on the Status Quo and Influencing Factors of Nurses' Professional Identity*. Dissertation. Taiyuan: Shanxi Medical University (2012).
16. Hao C, Zhu L, Zhang S, Rong S, Zhang Y, Ye J, et al. Serial multiple mediation of professional identity, and psychological capital in the relationship between work-related stress and work-related well-being of ICU nurses in China: a cross-sectional questionnaire survey. *Front Psychol.* (2020) 11:535634–535634. doi: 10.3389/fpsyg.2020.535634
17. Zhou H, Han X, Zhang J, Sun J, Hu L, Hu G, et al. Job satisfaction and associated factors among medical staff in tertiary public hospitals: results from a national cross-sectional survey in China. *Int J Environ Res Public Health.* (2018) 15:1528. doi: 10.3390/ijerph15071528
18. Guo M, Liang W. The status analysis of the town doctor's working environment in Hunan Zhuzhou six regions. *World Health Digest Medical Periodical.* (2012) 9:38–9. Available online at: <http://jour.duxiu.com/JourDetail.jsp?dxNumber=100202480486&d=F4CDF0E88EBA9E06D2FC5B925D9D6487&fenlei=1604110201> (accessed December 13, 2012).
19. Lingyan Z, Dongyan L, Zhenlan L, Mengqi X, Linfang S, Sanlian H. *Workplace Violence and its Impact on the Professional Identity among Nursing Students in China: A Multicenter Cross-Sectional Study.* (2022). Available online at: <https://assets.researchsquare.com/files/rs-1528710/v1/2020b76e-fl5e-46b8-9ab1-0ee164ff1c53.pdf?c=1649709336> (accessed July 20, 2022).
20. Yang Q, Yang L, Yang C, Wu X, Chen Y, Yao P. *Workplace Violence Against Nursing Interns and Patient Safety: The Multiple Mediation Effect of Professional Identity and Professional Burnout.* (2022). Available online at: [https://assets.researchsquare.com/files/rs-1631542/v1\\_covered.pdf?c=1652810639](https://assets.researchsquare.com/files/rs-1631542/v1_covered.pdf?c=1652810639) (accessed July 20, 2022).
21. Bo S, Chen J, Song Y, Zhou S. Media attention and choice of major: evidence from anti-doctor violence in China. *J Econ Behav Organ.* (2020) 170:1–19. doi: 10.1016/j.jebo.2019.11.012
22. Weiner B. *An Attributional Theory of Motivation and Emotion*. New York, NY: Springer (1986).
23. Pettigrew TF. The ultimate attribution error: extending Allport's cognitive analysis of prejudice. *Pers Soc Psychol Bull.* (1979) 5:461–76. doi: 10.1177/014616727900500407
24. Bilali R, Vollhardt JR. Victim and perpetrator groups' divergent perspectives on collective violence: implications for intergroup relations. *Polit Psychol.* (2019) 40:75–108. doi: 10.1111/pops.12570
25. Auerbach Walker LE, Browne A. Gender and victimization by intimates. *J Pers.* (1985) 53:179–95. doi: 10.1111/j.1467-6494.1985.tb00363.x
26. Walter N, Demetriades SZ, Kelly R, Gillig TK. Je Suis Charlie? The framing of ingroup transgression and the attribution of responsibility for the Charlie Hebdo attack. *Int J Commun.* (2016) 10:19. Available online at: <https://ijoc.org/index.php/ijoc/article/view/5387> (accessed December 13, 2022).
27. He AJ. The doctor–patient relationship, defensive medicine and overprescription in Chinese public hospitals: evidence from a cross-sectional survey in Shenzhen city. *Soc Sci Med.* (2014) 123:64–71. doi: 10.1016/j.socscimed.2014.10.055
28. Enosh G, Freund A, Goldblatt H, Drach-Zahavy A, Guindy M, Ofer-Bialer G. Whose fault is it? Attribution of causes of patient violence among exposed and unexposed community-based family physicians. *Health Soc Care Commun.* (2021) 29:175–84. doi: 10.1111/hsc.13080
29. Lazarus RS. *Emotion and Adaptation*. New York, NY: Oxford University Press (1991).
30. Barlow DH. *Anxiety and Its Disorders: The Nature and Treatment of Anxiety and Panic*. New York, NY: Guilford press (2004).
31. Juhl J, Routledge C. Putting the terror in terror management theory: evidence that the awareness of death does cause anxiety and undermine psychological well-being. *Curr Dir Psychol Sci J Am Psychol Soc.* (2016) 25:99–103. doi: 10.1177/0963721415625218
32. Lafta R, Qusay N, Mary M, Burnham G. Violence against doctors in Iraq during the time of COVID-19. *PLoS ONE.* (2021) 16:e0254401. doi: 10.1371/journal.pone.0254401
33. Sun T, Gao L, Li F, Shi Y, Xie F, Wang J, et al. Workplace violence, psychological stress, sleep quality and subjective health in Chinese doctors: a large cross-sectional study. *BMJ Open.* (2017) 7:e017182. doi: 10.1136/bmjopen-2017-017182
34. Garcia-Retamero R, Galesic M. On defensive decision making: how doctors make decisions for their patients. *Health Expect.* (2014) 17:664–9. doi: 10.1111/j.1369-7625.2012.00791.x
35. Bilimoria KY, Chung JW, Minami CA, Sohn M-W, Pavey ES, Holl JL, et al. Relationship Between State Malpractice Environment and Quality of Health Care in the United States. *Jt Comm J Qual Patient Saf.* (2017) 43:241–50. doi: 10.1016/j.jcjq.2017.02.004
36. Weinberger SE, Sulmasy LS. Better care is the best defense: high-value clinical practice vs defensive medicine. *Cleve Clin J Med.* (2014) 81:465. doi: 10.3949/ccjm.81a.14037
37. Huang Y, Jiang J, Yao N, Zhao N, Qian M. Self-focused attention and social anxiety: the mediation effect of sense of control. *Chin J Clin Psychol.* (2019) 27:1232–6.
38. Fiske ST, Morling B, Stevens LE. Controlling self and others: a theory of anxiety, mental control, and social control. *Pers Soc Psychol Bull.* (1996) 22:115–23. doi: 10.1177/0146167296222001
39. Wohl MJA, Branscombe NR. Collective angst: how threats to the future vitality of the ingroup shape intergroup emotion. In: Wayment HA, Bauer JJ. *Transcending Self-Interest: Psychological Explorations of the Quiet Ego. Decade of Behavior*. Washington, DC: American Psychological Association (2008). p. 171–81.
40. Ulas O, Yildirim I. Influence of locus of control, perceived career barriers, negative affect, and hopelessness on career decision-making self-efficacy among Turkish university students. *Int J Educ Voc Guidance.* (2018) 19:85–109. doi: 10.1007/s10775-018-9370-9
41. Gimenez Lozano JM, Martinez Ramon JB, Morales Rodriguez FM. Doctors and nurses: a systematic review of the risk and protective factors in workplace violence and burnout. *Int J Environ Res Public Health.* (2021) 18:1–19. doi: 10.3390/ijerph18063280
42. Liu L, Hao Y, Li L, Liu X. The Relationship between locus of control and professional identity of nursing students. *J Nursing.* (2010) 17:4–6. doi: 10.16460/j.issn1008-9969.2010.02.006
43. Yeh TF, Chang YC, Feng WH, Sclerosis M, Yang CC. Effect of workplace violence on turnover intention: the mediating roles of job control, psychological demands, and social support. *Inquiry.* (2020) 57:46958020969313. doi: 10.1177/0046958020969313
44. Bon AT, Shire A. The impact of job demands on employees' turnover intentions: A study on telecommunication sector. *Int J Sci Res Publ.* (2017) 7:406–12.
45. Monrouxe LV, Bullock A, Tseng HM, Wells SE. Association of professional identity, gender, team understanding, anxiety and workplace learning alignment with burnout in junior doctors: a longitudinal cohort study. *BMJ Open.* (2017) 7:e017942–e017942. doi: 10.1136/bmjopen-2017-017942
46. Washington AL. *Effects of Desktop Virtual Reality Environment Training on State Anxiety and Vocational Identity Scores Among Persons With Disabilities During Job Placement/Voc Readiness Activities*. Dissertation. Stillwater: Oklahoma State University (2013).
47. Yang Y, Wang P, Kelifa MO, Wang B, Liu M, Lu L, et al. How workplace violence correlates turnover intention among Chinese health care workers in COVID-19 context: the mediating role of perceived social support and mental health. *J Nurs Manag.* (2021) 00:1–8. doi: 10.1111/jonm.13325
48. Li N, Zhang L, Xiao G, Chen J, Lu Q. The relationship between workplace violence, job satisfaction and turnover intention in emergency nurses. *Int Emerg Nurs.* (2019) 45:50–5. doi: 10.1016/j.ienj.2019.02.001
49. Beck AT. *Cognitive Therapy and the Emotional Disorders*. East Rutherford: Penguin Publishing Group (1979).
50. Abramson LY. *Social Cognition and Clinical Psychology: A Synthesis*. New York, NY: Guilford (1988).



51. Hou Y, Hou W, Zhang Y, Liu W, Chen A. Relationship between working stress and anxiety of medical workers in the COVID-19 situation: a moderated mediation model. *J Affect Disord.* (2022) 297:314–20. doi: 10.1016/j.jad.2021.10.072
52. Hickling EJ, Blanchard EB, Buckley TC, Taylor AE. Effects of attribution of responsibility for motor vehicle accidents on severity of PTSD symptoms, ways of coping, and recovery over six months. *J Trauma Stress.* (1999) 12:345–53. doi: 10.1023/A:10247847111484
53. Islam S, Cole JL, Walton GM, Dinan TG. Does attribution of blame influence psychological outcomes in facial trauma victims? *J Oral Maxillofac Surg.* (2012) 70:593–8. doi: 10.1016/j.joms.2011.09.005
54. Derlega VJ, Berg JH. *Self-Disclosure: Theory, Research, and Therapy.* New York, NY: Plenum Press (1987).
55. Kaynak Ö, Lepore SJ, Klierer WL. Social support and social constraints moderate the relation between community violence exposure and depressive symptoms in an urban adolescent sample. *J Soc Clin Psychol.* (2011) 30:250–69. doi: 10.1521/jscp.2011.30.3.250
56. Benight CC, Bandura A. Social cognitive theory of posttraumatic recovery: the role of perceived self-efficacy. *Behav Res Ther.* (2004) 42:1129–48. doi: 10.1016/j.brat.2003.08.008
57. Lepore SJ. Social environmental influences on the chronic stress process. In: Gottlieb BH, editor. *Coping With Chronic Stress.* New York, NY: Plenum Press (1997). p.133–60.
58. Chaikin AL, Darley JM. Victim or perpetrator? Defensive attribution of responsibility and the need for order and justice. *J Person Soc Psychol.* (1973) 25:268. doi: 10.1037/h0033948
59. Hofmann DA, Stetzer A. The role of safety climate and communication in accident interpretation: Implications for learning from negative events. *Acad Manag J.* (1998) 41:644–57. doi: 10.5465/256962
60. Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav.* (2011) 52:145–61. doi: 10.1177/0022146510395592
61. Hardaway CR, McLoyd VC, Wood D. Exposure to violence and socioemotional adjustment in low-income youth: an examination of protective factors. *Am J Community Psychol.* (2011) 49:112–26. doi: 10.1007/s10464-011-9440-3
62. Weiss BJ, Garvert DW, Cloitre M. PTSD and trauma-related difficulties in sexual minority women: the impact of perceived social support. *J Trauma Stress.* (2015) 28:563–71. doi: 10.1002/jts.22061
63. Bourne T, De Cock B, Wynants L, Peters M, Van Audenhove C, Timmerman D, et al. Doctors' perception of support and the processes involved in complaints investigations and how these relate to welfare and defensive practice: a cross-sectional survey of the UK physicians. *BMJ Open.* (2017) 7:e017856–e017856. doi: 10.1136/bmjopen-2017-017856
64. Schoemann AM, Boulton AJ, Short SD. Determining power and sample size for simple and complex mediation models. *Soc Psychol Person Sci.* (2017) 8:379–86. doi: 10.1177/1948550617715068
65. Li Y, Li B. Analysis of metal health of medical staff based on SAS. *Guide China Med.* (2013) 11:785–6. doi: 10.15912/j.cnki.gocm.2013.24.072
66. Xian H, Zhang Y, Yang Y, Zhang X, Wang X, A. Descriptive, cross-sectional study among chinese patients to identify factors that affect psychosocial adjustment to an enterostomy. *Ostomy Wound Manage.* (2018) 64:8–17. doi: 10.25270/owm.2018.7.817
67. Hox J, Bechger T. An introduction to structural equation modeling. *Fam Sci Rev.* (1998) 11:354–73.
68. Browne MW, Cudeck R. Alternative ways of assessing model fit. *Sociol Methods Res.* (1992) 21:230–58. doi: 10.1177/0049124192021002005
69. Bollen KA. *Structural Equations With Latent Variables.* New York, NY: Wiley (1989).
70. Dillon BL. Workplace violence: impact, causes, and prevention. *Work.* (2012) 42:15–20. doi: 10.3233/WOR-2012-1322
71. Gates DM, Gillespie GL, Succop P. Violence against nurses and its impact on stress and productivity. *Nurs Econ.* (2011) 29:59–66.
72. Winstanley S, Whittington R. Anxiety, burnout and coping styles in general hospital staff exposed to workplace aggression: a cyclical model of burnout and vulnerability to aggression. *Work Stress.* (2002) 16:302–15. doi: 10.1080/0267837021000058650
73. Kowalenko T, Gates D, Gillespie GL, Succop P, Mentzel TK. Prospective study of violence against ED workers. *Am J Emerg Med.* (2013) 31:197–205. doi: 10.1016/j.ajem.2012.07.010
74. Cuddy AJC, Fiske ST, Glick P. Warmth and competence as universal dimensions of social perception: the stereotype content model and the BIAS map. *Adv Exp Soc Psychol.* (2008) 40:61–149 doi: 10.1016/S0065-2601(07)00002-0
75. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. *J Pers Assess.* (1988) 52:30–41. doi: 10.1207/s15327752jpa5201\_2
76. Liu Y, Aunguroch Y, Gunawan J, Zeng D. Job stress, psychological capital, perceived social support, and occupational burnout among hospital nurses. *J Nurs Scholarsh.* (2021) 53:511–8. doi: 10.1111/jnu.12642



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# Job-demand and family business resources in pandemic context: How they influence burnout and job satisfaction

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This research aims to explore how work demands and resource variables affect the burnout and satisfaction of employees of family businesses in the context of the pandemic (COVID-19) and the moderation effect of fear of COVID-19 on this relationship. A sample of 214 Chilean family business employees is used for hypotheses testing. Results indicate that the demands and resources partially explain the burnout and satisfaction of employees of family firms during the pandemic. Employees' fear of COVID-19 moderates the relationship between resources-demands and burnout-job satisfaction in family firms. This work contributes to understanding how these organizations can manage adverse scenarios to survive and continue operations.

## KEYWORDS

job satisfaction, burnout—professional, job demand-resources (JD-R) model, family firm, COVID-19

## 1. Introduction

Job satisfaction and burnout are two related variables that inform about employees' psychosocial risk and occupational health in the workplace (Giménez-Espert et al., 2020). The most acknowledged models to assess organizational health based on these two variables are the job demand-control-support model (JD-CS) and job demand-resource (JD-R) (Karasek and Theorell, 1990; Demerouti et al., 2001). These models proposed that the psychological work environment is defined by a combination of job demands, job control, and social support (Baka, 2020). In the assessment of the organizations' psychosocial risk, these variables have been mostly assessed in relation to burnout and job satisfaction, proving their predictive ability (Pelfrene et al., 2001; Jalilian et al., 2019; Dutheil et al., 2020; Ellison and Caudill, 2020; Fernemark et al., 2020). Although the available research on this type of variables, as well as this reference model seems to be scarce in the context of family businesses. Recently, JD-R has

been successfully used to predict job satisfaction among entrepreneurs running their own family business (McDowell et al., 2019).

The impact of the so-called psychosocial risks on the health of workers and, by extension, the productivity of organizations can be affected by external shocks, such as the case of the health emergency and its social, economic, and political consequences caused by the COVID-19 pandemic (Prado-Gascó et al., 2020).

The COVID-19 pandemic has caused an unprecedented economic impact worldwide due to the closure of businesses, the cessation of any non-essential activity, and the reduction of mobility during the different confinements, which has led to the closure of many companies and a large destruction of employment (Apedo-Amah et al., 2020).

De Massis and Rondi (2020) have argued that the COVID-19 pandemic has triggered challenges for family business management and research. One area in which this assumption is questioned is how emotions and stress resulting from the pandemic pressure influence these firms' behaviors and ability to survive. Recent research on the family businesses' ability to face external disruptions has suggested that the priority for preserving socioemotional wealth is an engine which supports these businesses' continuity when facing adversities (Alonso-Dos-Santos and Llanos-Contreras, 2019; Llanos-Contreras et al., 2020). Socioemotional wealth also enhances these firms' concern for binding social ties with external and internal stakeholders, such as their employees (Berrone et al., 2012; Llanos-Contreras and Alonso-Dos-Santos, 2018). For this reason, it is expected that, despite the adverse consequences of the pandemic, these organizations would be concerned about keeping their worker's occupational health under control. Hence, understanding the factors behind this problem is important for family firms, particularly in a pandemic which increases psychological risk at work and in parallel places the business' continuity at risk.

In this context, the JD-R model has proven to be reliable even under highly stressful scenarios as the COVID-19 pandemic (e.g., Prado-Gascó et al., 2020; Jamal et al., 2021). However, it has never been tested for the assessment of employees' satisfaction and burnout in family firms when these are facing adverse scenarios. There is research studying family firms' post-disaster performance and behaviors (Marshall et al., 2015; Alonso-Dos-Santos and Llanos-Contreras, 2019; Salvato et al., 2020; Mahto et al., 2022). These studies acknowledged these firms' abilities to adapt to challenging conditions, take risks, and leverage all their available resources to survive. But the focus has been mostly on general management issues at the family and business level, and no attention has been paid to employees' responses toward external shock which increases the psychosocial risk.

For this reason, in this research, we aim to respond to the questions of how demands and resources variables affect the level of burnout and satisfaction of employees of family businesses in the context of the pandemic (COVID-19) and

how fear of COVID-19 affects the influence of demands and resources variables on the level of burnout and employee satisfaction in family firms.

To answer these questions, a partial least squares structural equation analysis (SEM-PLS) was implemented using variables of organizational support, workload, and job insecurity to explain burnout and satisfaction in 214 employees of Chilean family businesses. Data were collected at the peak of the pandemic in Chile in terms of deaths and sanitary restrictions. To determine how fear of COVID-19 affects the relationships in the model, a multigroup analysis (MGA) was performed by grouping individuals into three categories: high, medium, and low, according to their level of fear of the pandemic. The results suggest that the demands and resources model partially support the predictions. Workers' fear of COVID-19 was also found to have a moderating influence on the relationship between resources-demands and burnout-job satisfaction in family firms.

In this way, we contribute to family firm theory by making progress in the understanding of how these organizations can manage adverse scenarios to survive and continue operations (Marshall and Schrank, 2020; Mahto et al., 2022). Particularly, this research focused on determining job resources and demand that need to be correctly managed in order to keep psychological risk at work under control. In this way, we also contribute to the literature on organizational psychology (Bennis et al., 1966; Beehr, 1998), particularly on the study of psychosocial risk, by testing the prediction ability of the JD-R model in the particular context of family firms and the pandemic. Finally, we contribute to the very scant research in family firms in Latin America, a region where these organizations are particularly prevalent (Gomez-Mejia et al., 2020; Vazquez et al., 2020).

This article is organized as follows: The next section provides a discussion of the theoretical framework supporting the hypotheses. Then, the methods section informs the research design as well as data collection and data analysis procedures. Hereafter, results are presented and discussed. Subsequently, findings are discussed in light of previous literature and conclusions are stated. Finally, theoretical contributions and practical implications are presented, and the research limitations are acknowledged.

## 2. Theoretical framework

### 2.1. Job demand-resource in family business

Karasek (1979) proposed the job demand-control model, which states that a psychological work environment is defined by a combination of job demands and job control. This proposal later evolved into the JDCS, which has been widely used to explain variables influencing the stress level of an organization's employees (Karasek and Theorell, 1990;

Baka, 2020). Demerouti et al. (2001) proposed the job demands and resources (JD-R) model as an extension of the JDCS proposal by Karasek (1979). The JDCS and JD-R model considers that job demands are related to workload, time pressure, and role conflicts, among others (Karasek et al., 1998; Van der Doef and Maes, 1999). Support refers to the social integration of the individual in the workplace (Van der Doef and Maes, 1999).

The JD-R model has been shown to be reliable in different settings. Recently Jamal et al. (2021) have reported that task interdependence, workload pressure, professional isolation, and family interference in work relate to exhaustion and stress. They also suggest that work autonomy, flexibility, and the available technology resources have a positive influence on work-life balance and job satisfaction. Karasek and Theorell (1990) found that employees' most adverse reactions (e.g., burnout) to work conditions relate to higher levels of work demand and low levels of support at workplace. Ellison and Caudill (2020) found that higher job demands were associated with more job stress among prison officers. Pelfrene et al. (2001) concluded that "feeling stressed" was more strongly associated with psychological demands than with freedom of decision or social support.

When these variables are tested in relation to work satisfaction additional support has been found in relation to the model's ability to explain occupational health at the workplace. Fernemark et al. (2020) demonstrate that social support when working with a digital practice increased physicians' job satisfaction in the context of telemedicine services. Yeh (2015) found that the positive influences of job resources on job satisfaction were greater than the negative effect of demands on satisfaction in workers from the East Asian region. Jang et al. (2017) evaluated the factors influencing home health care workers' job satisfaction and found that demands negatively affect, and resources positively affect these employees' levels of satisfaction.

Despite their interest, these models have hardly been considered in the specific context of family businesses, and no study has been observed that analyzes the impact that COVID-19 has had on them.

The JDCS and JD-R model has recently been used to test occupational health in highly stressful work environments, proving again to be reliable (e.g., Prado-Gascó et al., 2020). Accordingly, it is expected that it will also be reliable in assessing burnout and job satisfaction in family businesses which are facing difficulties as a consequence of the pandemic. Family businesses are a particularly interesting setting to assess this model as these organizations are acknowledged for being closely connected to their employees (Cruz et al., 2012; Llanos-Contreras et al., 2019). Accordingly, they would deploy high levels of support to employees. But also, the COVID-19 pandemic put their continuity under risk which would increase the organizational stress as it has financial and socioemotional

wealth costs (Llanos-Contreras et al., 2020; Salvato et al., 2020). The above analysis supports the following two hypotheses and the model proposed in the Figure 1.

**H1a.** Resources (support) reduce the level of burnout of employees in family businesses.

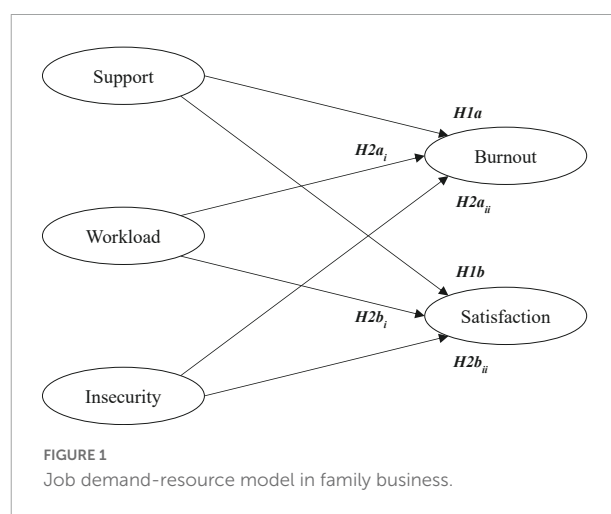
**H1b.** Resources (support) improve job satisfaction of employees in family businesses.

**H2a.** Demands (workload and job insecurity) will have a positive effect on burnout levels of employees in family businesses.

**H2b.** Demands (workload and job insecurity) will have a negative effect on job satisfaction levels of employees in family businesses.

## 2.2. Fear to COVID-19 and job demand-resource model: Crisis management in family firms

With the development of the COVID-19 pandemic, several studies have explored the consequences of this disaster on people's mental health (e.g., Bohlken et al., 2020; Ornell et al., 2020; Pfefferbaum and North, 2020; Rajkumar, 2020). Previous research has shown that people are heterogeneous in terms of the levels of fear of this pandemic (Fitzpatrick et al., 2020; Harper et al., 2020; Broche-Pérez et al., 2022). These studies have also shown that the level of fear has direct and indirect effects on people's mental health and occupational health, as well as in their behavior and mood at work.



In relation to the direct effect, this research agrees that fear of COVID-19 has a negative influence on people's mental health, level of stress, and generally on people's mood. Thus, [Chen and Eyoun \(2021\)](#) found that fear of COVID-19 is positively associated with job insecurity and emotional exhaustion in restaurant employees. [Labrague and Santos \(2020\)](#) conclude that a higher level of fear of COVID-19 generates lower job satisfaction and greater psychological distress in nurses on the front line of health care. [Khattak et al. \(2020\)](#) proved that fear of COVID-19 has a significant positive impact on the psychological distress and turnover intention of nurses in Pakistan.

Fear of COVID-19 has also proven to have an indirect effect on variables assessing psychological risk. In this way, [Gasparro et al. \(2020\)](#) found that the effect of perceived job insecurity on depressive symptoms in healthcare workers was weaker among employees with low fear of COVID-19. Similarly, [Khan et al. \(2021\)](#) concluded that the effect of perceived job insecurity on people's mental health was stronger when employees had a greater fear of COVID-19. It suggested that in a work environment, employees' fear of COVID-19 will enhance the negative effect of job demand on burnout and job satisfaction, while it will weaken the positive effect of job support on these same variables.

Taken together, people have differences in the level of fear of COVID-19, and empirical results in recent research suggest that fear of COVID-19 would have a moderating effect on the relationships proposed by the JD-R model. It supports the following two hypotheses.

**H3a.** Workers' fear in disaster situations (e.g., COVID-19) will have a moderating effect on the role of resources and demands on burnout of employees in family businesses.

**H3b.** Workers' fear in disaster situations (e.g., COVID-19) will have a moderating effect on the role of resources and demands on job satisfaction of employees in family businesses.

## 3. Research design

### 3.1. Questionnaire

Data were collected through an online questionnaire applied in January 2021. The questionnaire includes questions about variables of interest, namely: burnout, insecurity, satisfaction, support, workload, and fear of COVID-19, as well as demographic data. The Burnout Assessment Tool (BAT) of 22 items representing the four dimensions of burnout: exhaustion, mental distance, emotional impairment, and cognitive impairment was used to assess the level of burnout ([Schaufeli and Desart, 2020](#)). The job insecurity scale was adapted from [De Witte \(2000\)](#) to assess this construct. To

measure the level of job satisfaction and organizational support, a scale of [Eisenberger et al. \(1997\)](#) was adapted. To measure workload, the UNIPSCO battery was adapted ([Gil-Monte, 2016](#)). Finally, the COVID-19 fear measure was an adaptation from a scale proposed by [Fitzpatrick et al. \(2020\)](#). All items have been measured using a 5-point Likert scale.

The sample contains 214 observations of family business employees from Chile surveyed after 10 month the pandemic in this country. The age of the respondents ranges from 22 to 81 years, with an average of 43 ( $M = 43.29$ ;  $SD = 11.94$ ), and the number of men ( $n = 105$ ) and women ( $n = 109$ ) is balanced. Most of the respondents have a technical or professional higher education degree.

### 3.2. Methods

Each of the latent constructs' psychometric properties was tested, and satisfactory fit measures were obtained for all the reflective models ([Table 1](#)). The constructs' internal consistency was evaluated with Cronbach's  $\alpha$  and composite reliability (CR), finding adequate indicators, except for the construct workload with a Cronbach's  $\alpha$  of 0.666. However, the variable is maintained in the model considering the rest of the satisfactory fit measures of the construct ([Hair et al., 2014](#)).

To determine the sample adequacy for factor analysis, the Kaiser-Meyer-Olkin (KMO) test was used. All constructs have a KMO greater than 0.600; moreover, excepting Workload, the KMO is greater than 0.700, which are considered acceptable ([Shrestha, 2021](#)). The convergent validity of the reflective models was tested by the factor loadings (above 0.700) and the average variance extracted (AVE) (above 0.500) ([Hair et al., 2014](#)). To assess the discriminant validity the heterotrait-monotrait ratio of correlations (HTMT) was used.

TABLE 1 Reliability and validity assessment.

Construct	KMO	AVE	CR	Cronbach's $\alpha$	Factor loadings
Burnout	0.907	0.663	0.887	0.830	>0.700***
Exhaustion				0.892	>0.700***
Mental distance				0.800	>0.700***
Emotional impairment				0.880	>0.700***
Cognitive impairment				0.823	>0.700***
Insecurity	0.713	0.722	0.912	0.871	>0.700***
Satisfaction	0.711	0.744	0.897	0.828	>0.700***
Support	0.828	0.689	0.917	0.886	>0.700***
Workload	0.661	0.596	0.815	0.666	>0.700***

CR, composite reliability; AVE, average variance extracted. \*/\*\*/\*\*Significance level at 0.10/0.05/0.01.



TABLE 2 Results of the SEM-PLS analysis.

	Burnout		Satisfaction		Fit measures	
	Path	$f^2$	Path	$f^2$	$R^2$	$Q^2$
Support	-0.084	0.009	0.454***	0.275		
Workload	0.495***	0.359	-0.049	0.003		
Insecurity	0.219***	0.062	-0.274***	0.097		
Burnout					0.412	0.261
Satisfaction					0.415	0.297

\*/\*\*/\*\*\*Significance level at 0.10/0.05/0.01; effect sizes (Cohen, 1988):  $f^2 > 0.35$  strong effect;  $f^2 > 0.15$  moderate effect;  $f^2 > 0.02$  weak effect.

According to Hair et al. (2016), the discriminant validity has been established between two reflective constructs, if the HTMT value is below 0.900. We tested all pairs of constructs and found no HTMT greater than 0.900, thus, indicators were satisfactory for all cases.

A partial least squares structural equation model (SEM-PLS) was used to test the proposed hypotheses, using burnout and satisfaction levels as dependent variables, organizational support as an explanatory variable of resource, and workload and job

insecurity as independent variables of demand. To evaluate the moderating effect of fear of COVID-19, a MGA was used considering three subsamples: individuals with high, medium, and low fear of COVID-19 (Hair et al., 2017a).

## 4. Results

### 4.1. Job demand-control-support in family firms

The multiple correlation coefficient ( $R^2 = 0.412$ ) and Stone-Geisser's predictive relevance test ( $Q^2 = 0.261$ , blindfolding procedure, omission distance = 7) indicate that the structural model for the dependent variable burnout is relevant and predictive (Chin, 1998, 2010). Also, the standardized root-mean-square residual (SRMR), as a goodness of fit measure, indicates a good fit (SRMR = 0.079) (Henseler et al., 2014). In the model with dependent variable satisfaction, good measurement indicators were also observed ( $R^2 = 0.415$ ;  $Q^2 = 0.297$ , blindfolding procedure, omission distance = 7). It is possible to confirm the significance of both models (Hair et al., 2017b).

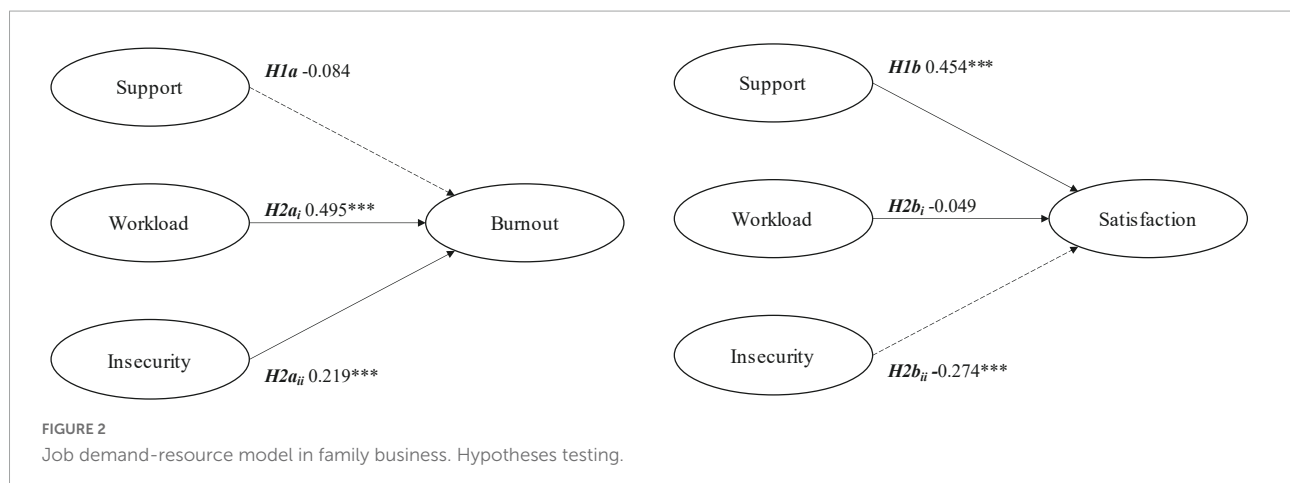


TABLE 3 Results of the multigroup analysis.

		Low fear			Medium fear			High fear	
		Path	$f^2$		Path	$f^2$		Path	$f^2$
Support → burnout	–	0.247*	0.119		0.047	0.007	–	0.233**	0.073
Workload → burnout		0.675***	1.075		0.450***	0.264		0.496***	0.408
Insecurity → burnout		0.000	0.000		0.347***	0.154		0.150	0.030
$R^2$ burnout		0.652			0.409			0.434	
Support → satisfaction		0.249	0.067		0.590***	0.528		0.396***	0.216
Workload → satisfaction	–	0.257	0.086		0.018	0.000	–	0.024	0.001
Insecurity → satisfaction	–	0.278	0.089	–	0.218**	0.070	–	0.373***	0.189
$R^2$ satisfaction		0.372			0.490			0.446	

\*/\*\*/\*\*\*Significance level at 0.10/0.05/0.01; effect sizes (Cohen, 1988):  $f^2 > 0.35$  strong effect;  $f^2 > 0.15$  moderate effect;  $f^2 > 0.02$  weak effect.

The SRMR indicates a good fit ( $SRMR = 0.075$ ) (Henseler et al., 2014).

Support was not found for hypothesis 1a since no significant relationship was found between organizational support and employees' burnout level in family businesses (Table 2). The analysis results support hypothesis 1b, i.e., organizational support in family businesses improves worker satisfaction in a positive and significant way. Hypothesis 2a is accepted since demands (workload and job insecurity) positively and significantly affect employees' burnout levels in family businesses. Hypothesis 2b is partially supported since only a negative and significant relationship was found between job insecurity and satisfaction, and no significant effect of workload on job satisfaction was observed. Figure 2 summarizes these informed results.

## 4.2. Demands and resources model in a pandemic scenario

The MGA shows significant differences among the three proposed groups. Thus hypothesis 3 is supported, confirming that fear of COVID-19 has a moderating effect on the influence that resources and demands have on burnout and job satisfaction. The variable "support" significantly decreases burnout in employees of family firms with high fear of COVID-19. However, it does not affect the satisfaction of workers with a lower level of fear of the disease. Job insecurity presents a positive and significant influence on burnout only for employees with a medium level of fear of COVID-19. It has no effect on job satisfaction in employees of family firms with a low level of fear of COVID-19. The workload effects on burnout level and job satisfaction show similar results to the overall model, but the effect of workload on burnout is highest for employees with low fear of COVID-19. Table 3 presents all these results.

## 5. Discussion and conclusion

It is acknowledged in family firm literature that for these organizations, continuity and survival (transgenerational) are one of their main goals (Kotlar and De Massis, 2013; Llanos-Contreras and Jabri, 2021), and COVID-19 had been a major shock which has threatened this aim in recent times. One way through which the pandemic challenged these firms' continuity was by the impact it has had on their human resources' psychological risk, due to psychological risk impact on individuals' health, organizational climate, and firm productivity (Bergh et al., 2018). Psychological risk can arise as consequence of poor social context, work, and organizational design, and COVID-19 is considered to have had a great negative impact on these (Prado-Gascó et al., 2020). Importantly, burnout, and job satisfaction are related

to psychological risk at work (Guadix et al., 2015; Elshaer et al., 2018). For this reason, this article focuses on responding to the questions: how do demands and resources variables affect the level of burnout and satisfaction of employees of family businesses in the context of the pandemic (COVID-19)? How does fear of COVID-19 affect the influence of demands and resource variables on the level of burnout and employee satisfaction in family firms?

In relation to job demands, this study's results confirm the theoretical predictions that workload and insecurity positively influence burnout, as well as confirming that job insecurity negatively influences job satisfaction. This is in line with previous studies on psychological risk at work (e.g., Elshaer et al., 2018; Ellison and Caudill, 2020; Jamal et al., 2021). Job demands produce important negative effects on occupational health in firms facing stressful scenarios. Family firms need to be careful about how they manage these two elements particularly when facing stressful scenarios like the one imposed by COVID-19. While adapting operations to new conditions and challenges imposed by the external shock will increase workload, the highly acknowledged family commitment with business continuity can be a positive signal to enhance job stability (Gómez-Mejía et al., 2007; Llanos-Contreras et al., 2019). Thus, family firms, particularly those small and medium size ones which have fewer resources to adjust to the changes required by an external shock, would be able to counterbalance the additional demand of workload with clear signals of commitment to business continuity and job stability.

In relation to job resources, results provide empirical support to the idea that job support positively influences job satisfaction. Similar to the prediction on job demands, these results reinforce previous literature in relation to the importance of this for an organization to keep psychological risk under control (Yeh, 2015; Jang et al., 2017; Fernemark et al., 2020). Karasek (1979)'s model proposes that occupational health problems arise as a consequence of the imbalance between psychological demands and the resources workers have available to manage such demands. Job support is a critical resource for keeping psychological demand and resources in balance and providing good occupational health. Job support is related to the concern the organization sets on the workers' welfare, their availability to provide help when the workers have a problem, the firm's disposition to consider the workers' opinion and/or help in solving problems if the worker were to make any mistake (Eisenberger et al., 1997; Zeng et al., 2020). In line with Prado-Gascó et al. (2020)'s results, this study suggests that job support was important for people at work to overcome the stress, uncertainty, and pressure consequences of the pandemic scenario.

In relation to how fear of COVID-19 affects the influence of demands and resources on burnout and job satisfaction in family firms, overall, the proposed moderating effect is confirmed. It is interesting to see that despite the fact that the

whole sample analysis did not provide empirical support to the predicted negative influence of support on burnout, this relationship is confirmed when responses from people with high levels of fear of COVID-19 are analyzed. Similarly, a moderating effect of fear of COVID-19 is also observed for the relationships between insecurity and burnout, support and satisfaction, as well as for the relationship between insecurity and satisfaction. These results are in line with recent research indicating that people are heterogeneous in terms of their level of fear of COVID-19 and that this heterogeneity is important in people's mental health assessment (Gasparro et al., 2020; Harper et al., 2020; Labrague and Santos, 2020; Chen and Eyoun, 2021; Broche-Pérez et al., 2022). This is important for organization management and family firm theory as managers and family business owners need to consider such heterogeneity in fear of COVID-19 when making decisions that affect workload, insecurity, and job support at work. Family business owners and managers need to be particularly concerned about those workers who present higher levels of fear of COVID-19, as they will be particularly sensitive to be negatively affected by actions and situations increasing job demands and less likely to positively respond to job support policies.

Overall, the results discussed in the previous section confirm the JR-D model predictions for family business workers facing the shock of the COVID-19 pandemic (Karasek, 1979; Demerouti et al., 2001). This is important because it proves the reliability of the model even under conditions of extreme external pressure. Data were collected when the pandemic was at its peak in Chile, before the vaccine was found and under conditions of high uncertainty about how long it would last and what consequences it would have for people, small-medium family businesses, and the economy. Thus, support is given to the idea that family firms facing stressful scenarios can control psychological risk at work by managing job demand and resources in order to enhance continuity and survive. Literature on family businesses shows these organizations as highly resilient and suggests that owners-managers look to continue operating despite minimal financial reward and highly adverse conditions (Glover and Reay, 2015; Llanos-Contreras et al., 2020; Mahto et al., 2022). However, in this work, it is suggested that keeping workers' occupational health under control is central to meet this aim, and for this family, firms need to be aware of the effect of their decisions on JD-R.

## 5.1. Contributions to theory and practice

This study makes contributions for theory and practice. In terms of theoretical contributions: First, contributions are made to the literature on how family firms face severe external shocks and survive (Marshall and Schrank, 2020; Mahto et al., 2022). Family firms are particularly acknowledged for their priority of preserving the firm through generations which

leads them to do everything within their reach to overcome difficulties and survive. Such resilience has been related to the priority for preserving the socioemotional wealth the firm provides to the family. However, continuing business operation is not just about motivation for preserving socioemotional wealth, but also about these firm's ability to manage shock and adapt to changing contextual conditions (Alonso-Dos-Santos and Llanos-Contreras, 2019; Salvato et al., 2020). In this work we suggest that managing occupational health is an important factor. Thus, the psychological resources and demands these firms should consider managing when their workers face stressful scenarios are analyzed. Second, this study also contributes to the literature on organizational psychology (Bennis et al., 1966; Beehr, 1998), particularly to the study of factors influencing psychosocial risk. The study first applied the acknowledged JD-R model to determine how demand and resource factors influenced psychological risk in family firms when faced with the COVID-19 pandemic. In this way, the importance of balancing workload, job insecurity, and job support to keep occupational health under control is discussed.

The study also shows the importance of observing workers' heterogeneity in terms of fear of COVID-19 as it is a driver which can increase or decrease the impact of the resources and demand variables on psychological risk. Finally, this study contributes to the very scant research on Latin American family firms, a region where these organizations are particularly prevalent (Gomez-Mejia et al., 2020; Vazquez et al., 2020). Chile was acknowledged for its efficiency in managing the crises generated by COVID-19 from a public health point of view. However, it imposed severe restrictions on economic activities and high demands on companies to continue to operate under pandemic conditions. This implies pressure and stress not only for family business owners whose income is reduced and face additional expenses for adapting their operation but also for workers who see their occupational health and job at risk and face changes in the way they do their jobs.

This article also has important practical implications. Family business owners and managers can benefit by learning how they should manage workload, send the correct signals about business continuity to enhance workers' perception of job stability, and provide enough job support in order to keep psychological risk at work under control. This is not only important for business policy but also for public policy, since government authorities have much to do in terms of providing the correct information and certainty about what these firms need to do to continue operations in a safe way. This will be important for the business' operation but also for their workers' occupational health. Practitioners can also learn about the importance of considering the asymmetries on the level of fear of COVID-19 that people present. This is important in order to develop differentiated policies that address the specific needs of groups of people with different levels of risk of presenting occupational health problems.

## 5.2. Limitations and future research

This research has some limitations that can be considered as a starting point for future work. The development of the pandemic demonstrated that countries have very different capacities and resources to deal with this type of event. It is possible that the best prepared countries will be able to maintain an economic flow that will allow companies to survive in these uncertain contexts. Thus, the economic situation of the country during the COVID-19 pandemic may influence workers' perceptions and their fear of the pandemic. Future research can use samples from different countries to contrast results, for example, between developed and emerging economies. The findings of this study can even be analyzed among autonomous states belonging to the same country to understand the differences within a decentralized governmental system.

This study has not considered how family firms monitor and cope with employees' fear of disastrous events (e.g., COVID-19 pandemic). It would be interesting to study the behavior of family firms in terms of the mechanisms they use to manage employees' negative perceptions, insecurities, and fear, which can compromise the survival of the firm. Moreover, the way family businesses act toward their employees in times of crisis can influence the reputation of the firm and threaten one of the main competitive advantages of the family business. In this vein, an avenue of research can turn its attention to the strategies that family firms implement for managing human resources during disasters (e.g., COVID-19 pandemic) and how these strategies affect the reputation of the company.

Considering the heterogeneity of family businesses, some of them may be better prepared than others to face the pandemic or may be in sectors that have not been negatively affected by this event. Analyzing the differences in the capabilities of family businesses to cope with the pandemic may serve as an example for other family businesses to adopt successful strategies to survive during adverse events.

## References

- Alonso-Dos-Santos, M., and Llanos-Contreras, O. (2019). 'Family business performance in a post-disaster scenario: The influence of socioemotional wealth importance and entrepreneurial orientation'. *J. Bus. Res.* 101, 492–498. doi: 10.1016/j.jbusres.2018.12.057
- Apedo-Amah, M. C., Besart, A., Xavier, C., Marcio, C., Elwyn, D., Arti, G., et al. (2020). *Unmasking the impact of COVID-19 on businesses: Firm level evidence from across the world*. Washington, DC: World Bank, doi: 10.1596/1813-9450-9434
- Baka, L. (2020). 'Types of job demands make a difference. Testing the job demand-control-support model among Polish police officers'. *Int. J. Hum. Resour. Manag.* 31, 2265–2288. doi: 10.1080/09585192.2018.1443962
- Beehr, T. (1998). "An organizational psychology meta-model of occupational stress," in *Theories of organizational stress*, ed. C. L. Cooper (Oxford: Oxford University Press), 6–27.
- Bennis, W., Katz, D., and Kahn, R. (1966). 'The social psychology of organizations'. *Am. Sociol. Rev.* 31:745. doi: 10.2307/2091895
- Bergh, L. I. V., Leka, S., and Zwetsloot, G. I. J. M. (2018). 'Tailoring psychosocial risk assessment in the oil and gas industry by exploring specific and common psychosocial risks'. *Saf. Health Work* 9, 63–70. doi: 10.1016/j.shaw.2017.05.001
- Berrone, P., Cruz, C., and Gomez-Mejia, L. (2012). 'Socioemotional wealth in family firms: Theoretical dimensions, assessment approaches, and agenda for future research'. *Fam. Bus. Rev.* 25, 258–279.
- Bohlken, J., Schömig, F., Lemke, M., Pumberger, M., and Riedel-Heller, S. (2020). 'COVID-19 pandemic: Stress experience of healthcare workers - a short current review'. *Psychiatr. Prax.* 47, 190–197. doi: 10.1055/a-1159-5551

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Broche-Pérez, Y., Fernández-Fleites, Z., Jiménez-Puig, E., Fernández-Castillo, E., Rodríguez-Martin, B. C. (2022). Gender and fear of COVID-19 in a Cuban population sample. *Int. J. Ment. Health Addict.* 20, 83–91. doi: 10.1007/s11469-020-00343-8
- Chen, H., and Eyou, K. (2021). 'Do mindfulness and perceived organizational support work? Fear of COVID-19 on restaurant frontline employees' job insecurity and emotional exhaustion. *Int. J. Hosp. Manag.* 94:102850. doi: 10.1016/j.ijhm.2020.102850
- Chin, W. (1998). 'The partial least squares approach to structural equation modeling'. *Modern Methods Bus. Res.* 295, 295–336.
- Chin, W. (2010). "How to write up and report PLS analyses," in *Handbook of partial least squares*, (Berlin: Springer), 655–690. doi: 10.3390/foods10092224
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. 2 Edn, Chap. Hillsdale, NJ: Lawrence Erlbaum.
- Cruz, C., Justo, R., and De Castro, J. O. (2012). 'Does family employment enhance MSEs performance?'. *J. Bus. Vent.* 27, 62–76. doi: 10.1016/j.jbusvent.2010.07.002
- De Massis, A., and Rondi, E. (2020). 'Covid-19 and the future of family business research'. *J. Manag. Stud.* 57, 1727–1731. doi: 10.1111/joms.12632
- De Witte, H. (2000). "Arbeidsethos en jobonzekerheid: Meting en gevolgen voor welzijn, tevredenheid en inzet op het werk [Work ethic and job insecurity: Assessment and consequences for well-being, satisfaction and performance at work]" in *Van groep naar gemeenschap [From group to community]*, eds R. Bouwen, et al. (Leuven: Garant. Liber Amicorum Prof. Dr. Leo Lagrou), 325–350.
- Demerouti, E., Bakker, A. B., Nachreiner, F., and Schaufeli, W. B. (2001). 'The job demands-resources model of burnout'. *J. Appl. Psychol.* 86, 499–512. doi: 10.1037/0021-9010.86.3.499
- Dutheil, F., Charkhabi, M., Ravoux, H., Brousse, G., Dewavrin, S., Cornet, T., et al. (2020). 'Exploring the link between work addiction risk and health-related outcomes using job-demand-control model'. *Int. J. Environ. Res. Public Health* 17:7594. doi: 10.3390/ijerph17207594
- Eisenberger, R., Cummings, J., Armeli, S., and Lynch, P. (1997). 'Perceived organizational support, discretionary treatment, and job satisfaction'. *J. Appl. Psychol.* 82, 812–820. doi: 10.1037/0021-9010.82.5.812
- Ellison, J., and Caudill, J. (2020). 'Working on local time: Testing the job-demand-control-support model of stress with jail officers'. *J. Crim. Just.* 70:101717. doi: 10.1016/j.jcrimjus.2020.101717
- Elshaer, N. S. M., Moustafa, M. S., Aiad, M. W., and Ramadan, M. I. (2018). 'Job stress and burnout syndrome among critical care healthcare workers'. *Alex. J. Med.* 54, 273–277. doi: 10.1016/j.ajme.2017.06.004
- Fernemark, H., Skagerström, J., Seing, I., Ericsson, C., and Nilsen, P. (2020). 'Digital consultations in Swedish primary health care: A qualitative study of physicians' job control, demand and support'. *BMC Fam. Pract.* 21:241. doi: 10.1186/s12875-020-01321-8
- Fitzpatrick, K., Harris, C., and Drawve, G. (2020). Fear of COVID-19 and the mental health consequences in America. *Psychol. Trauma Theory Res. Pract. Policy* 12(S1), S17–S21. doi: 10.1037/tra0000924
- Gasparro, R., Scandurra, C., Maldonato, N. M., Dolce, P., Boichichio, V., Valletta, A., et al. (2020). 'Perceived job insecurity and depressive symptoms among Italian dentists: The moderating role of fear of COVID-19'. *Int. J. Environ. Res. Public Health* 17:5338. doi: 10.3390/ijerph17155338
- Gil-Monte, P. R. (2016). 'The UNIPSCO questionnaire: Psychometric properties of the scales measuring psychosocial demands'. *Arch. Prev. Riesgos Labor.* 19, 86–94. doi: 10.12961/apr.2016.19.02.2
- Giménez-Espert, M., Prado-Gascó, V., and Soto-Rubio, A. (2020). Psychosocial risks, work engagement, and job satisfaction of nurses during COVID-19 pandemic. *Front. Public Health* 8:566896. doi: 10.3389/fpubh.2020.566896
- Glover, J. L., and Reay, T. (2015). 'Sustaining the family business with minimal financial rewards'. *Fam. Bus. Rev.* 28, 163–177. doi: 10.1177/0894486513511814
- Gómez-Mejía, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J. L., and Moyano-Fuentes, J. (2007). 'Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills'. *Adm. Sci. Q.* 52, 106–137. doi: 10.2189/asqu.52.1.106
- Gomez-Mejía, L., Basco, R., Gonzalez, A., Cristina, Cross Cultural, C. G. M., and Management, S. (2020). 'Family business and local development in Iberoamerica'. *Cross Cult. Strat. Manag.* 27, 121–136. doi: 10.1108/CCSM-02-2020-223
- Guadix, J., Carrillo-Castrillo, J., Onieva, L., and Lucena, D. (2015). 'Strategies for psychosocial risk management in manufacturing'. *J. Bus. Res.* 68, 1475–1480. doi: 10.1016/j.jbusres.2015.01.037
- Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2017a). "Outlook on advanced methods," in *A primer on partial least squares structural equation modeling (PLS-SEM)*, 2 Edn, (Los Angeles: Sage), 275–311.
- Hair, J. F., Sarstedt, M., Ringle, C. M., and Gudergan, S. P. (2017b). *Advanced issues in partial least squares structural equation modeling*. Thousand Oaks, CA: SAGE Publications.
- Hair, J. F. Jr., Sarstedt, M., Hopkins, L., and Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *Eur. Bus. Rev.* 26, 106–121. doi: 10.1108/EBR-10-2013-0128
- Hair, J., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Thousand Oaks, CA: Sage publications.
- Harper, C., Satchell, L., Fido, D., and Latzman, R. (2020). Functional fear predicts public health compliance in the COVID-19 pandemic. *Int. J. Ment. Health Add.* 19, 1875–1888. doi: 10.1007/s11469-020-00281-5
- Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., et al. (2014). Common beliefs and reality about partial least squares. *Org. Res. Methods* 17, 182–209.
- Jalilian, H., Shouroki, F. K., Azmoon, H., Rostamabadi, A., and Choobineh, A. (2019). 'Relationship between job stress and fatigue based on job demand-control-support model in hospital nurses'. *Int. J. Prevent. Med.* 10:56. doi: 10.4103/ijpvm.IJPVM\_178\_17
- Jamal, M. T., Anwar, I., Khan, N. A., and Saleem, I. (2021). 'Work during COVID-19: Assessing the influence of job demands and resources on practical and psychological outcomes for employees'. *Asia Pacific J. Bus. Adm.* 13, 293–319. doi: 10.1108/APJBA-05-2020-0149
- Jang, Y., Lee, A. A., Zadrozny, M., Bae, S., Kim, M. T., and Marti, N. C. (2017). 'Determinants of job satisfaction and turnover intent in home health workers'. *J. Appl. Gerontol.* 36, 56–70. doi: 10.1177/0733464815586059
- Karasek, R. (1979). 'Job demands, job decision latitude, and mental strain: Implications for job redesign. *Adm. Sci. Quart.* 24:285. doi: 10.2307/2392498
- Karasek, R., and Theorell, T. (1990). *Healthy work: Stress, productivity, and the reconstruction of working life*. New York, NY: Basic Books.
- Karasek, R., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., and Amick, B. (1998). 'The job content questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics'. *J. Occup. Health Psychol.* 3, 322–355. doi: 10.1037/1076-8998.3.4.322
- Khan, K. I., Niazi, A., Nasir, A., Hussain, M., and Khan, M. I. (2021). 'The effect of COVID-19 on the hospitality industry: The implication for open innovation'. *J. Open Innov. Technol. Market. Comp.* 7:30. doi: 10.3390/oiotmc7010030
- Khattak, S., Saeed, I., Rehman, S. U., and Fayaz, M. (2020). Impact of fear of COVID-19 pandemic on the mental health of nurses in Pakistan. *J. Loss Trauma* 26, 421–435. doi: 10.1080/15325024.2020.1814580
- Kotlar, J., and De Massis, A. (2013). 'Goal setting in family firms: Goal diversity, social interactions, and collective commitment to family-centered goals. *Entrep. Theory Pract.* 37, 1263–1288. doi: 10.1111/etap.12065
- Labrague, L., and Santos, J. (2020). Fear of COVID-19, psychological distress, work satisfaction and turnover intention among frontline nurses'. *J. Nurs. Manag.* 9, 395–403. doi: 10.1111/jonm.13168
- Llanos-Contreras, O., and Alonso-Dos-Santos, M. (2018). 'Exploring the asymmetric influence of socioemotional wealth priorities on entrepreneurial behaviour in family businesses'. *Eur. J. Int. Manag.* 12, 576–595. doi: 10.1504/EJIM.2018.094458
- Llanos-Contreras, O., Alonso-Dos-Santos, M., and Ribeiro-Soriano, D. (2020). 'Entrepreneurship and risk-taking in a post-disaster scenario'. *Int. Entrep. Manag. J.* 16, 221–237. doi: 10.1007/s11365-019-00590-9
- Llanos-Contreras, O., and Jabri, M. (2021). Socioemotional wealth of family firms: The theoretical perspective and challenges. *Eur. J. Int. Manag.* 16:60. doi: 10.1504/EJIM.2021.116701
- Llanos-Contreras, O., Jabri, M., and Sharma, P. (2019). 'Temporality and the role of shocks in explaining changes in socioemotional wealth and entrepreneurial orientation of small and medium family enterprises'. *Int. Entrep. Manag. J.* 15, 1269–1289. doi: 10.1007/s11365-019-00595-4
- Mahto, R. V., Llanos-Contreras, O., and Hebles, M. (2022). 'Post-disaster recovery for family firms: The role of owner motivations, firm resources, and dynamic capabilities'. *J. Bus. Res.* 145, 117–129. doi: 10.1016/j.jbusres.2022.02.089
- Marshall, M. I., and Schrank, H. L. (2020). 'Sink or swim? Impacts of management strategies on small business survival and recovery. *Sustainability* 12:6229. doi: 10.3390/su12156229



- Marshall, M. I., Niehm, L. S., Sydnor, S. B., and Schrank, H. L. (2015). 'Predicting small business demise after a natural disaster: An analysis of pre-existing conditions'. *Nat. Hazards* 79, 331–354. doi: 10.1007/s11069-015-1845-0
- McDowell, W. C., Matthews, L. M., Matthews, R. L., Aaron, J. R., Edmondson, D. R., and Ward, C. B. (2019). 'The price of success: Balancing the effects of entrepreneurial commitment, work-family conflict and emotional exhaustion on job satisfaction'. *Int. Entrep. Manag. J.* 15, 1179–1192. doi: 10.1007/s11365-019-00581-w
- Ornell, F., Schuch, J., Sordi, A., and Kessler, F. (2020). "Pandemic fear" and COVID-19: Mental health burden and strategies'. *Braz. J. Psychiatry* 42, 232–235. doi: 10.1590/1516-4446-2020-0008
- Pelfrene, E., Vlerick, P., Mak, R. P., de Smet, P., Kornitzer, M., and Backel, G. G. De (2001). 'Scale reliability and validity of the Karasek "Job Demand-Control-Support" model in the Belstress study'. *Work Stress* 15, 297–313. doi: 10.1080/02678370110086399
- Pfefferbaum, B., and North, C. (2020). 'Mental health and the Covid-19 pandemic'. *N Engl. J. Med.* 383, 510–512. doi: 10.1056/NEJMp2008017
- Prado-Gascó, V., Gómez-Domínguez, M., Soto-Rubio, A., Díaz-Rodríguez, L., and Navarro-Mateu, D. (2020). Stay at home and teach: A Comparative study of psychosocial risks between Spain and Mexico during the pandemic'. *Front. Psychol.* 11:566900. doi: 10.3389/fpsyg.2020.566900
- Rajkumar, R. (2020). 'COVID-19 and mental health: A review of the existing literature'. *Asian J. Psychiatry* 52:102066. doi: 10.1016/j.ajp.2020.102066
- Salvato, C., Sargiacomo, M., Amore, M. D., and Minichilli, A. (2020). 'Natural disasters as a source of entrepreneurial opportunity: Family business resilience after an earthquake'. *Strat. Entrep. J.* 14, 594–615. doi: 10.1002/sej.1368
- Schaufeli, W., and Desart, S. (2020). *Manual burnout assessment tool (BAT) – Version 2.0*. 1–143.
- Shrestha, N. (2021). 'Factor analysis as a tool for survey analysis'. *Am. J. Appl. Math. Stat.* 9, 4–11. doi: 10.12691/ajams-9-1-2
- Van der Doef, M., and Maes, S. (1999). 'The job demand-control (-Support) Model and psychological well-being: A review of 20 years of empirical research'. *Work Stress* 13, 87–114. doi: 10.1080/026783799296084
- Vazquez, P., Carrera, A., and Cornejo, M. (2020). 'Corporate governance in the largest family firms in Latin America'. *Cross Cult. Strat. Manag.* 27, 137–163. doi: 10.1108/CCSM-11-2018-0194
- Yeh, H.-J. (2015). 'Job demands, job resources, and job satisfaction in East Asia'. *Soc. Indic. Res.* 121, 47–60. doi: 10.1007/s11205-014-0631-9
- Zeng, X., Zhang, X., Chen, M., Liu, J., and Wu, C. (2020). The influence of perceived organizational support on police job burnout: A moderated mediation model. *Front. Psychol.* 11:948. doi: 10.3389/fpsyg.2020.00948



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# Burnout among postgraduate medical trainees in Lebanon: Potential strategies to promote wellbeing

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**Objective:** Burnout is a widespread issue in healthcare for many years. Lebanon combatted political and economic crises before the coronavirus disease 2019 (COVID-19) pandemic, in addition to the port explosion in August 2020. The study aimed to identify the determinants of personal burnout, patient-related burnout, and work-related burnout among postgraduate medical trainees (PGMT) and evaluate its relationship with sociodemographic characteristics.

**Design:** A cross-sectional study utilized the Copenhagen Burnout Inventory (CBI) involving electronic, voluntary, and anonymous survey. The survey was completed by 188 PGMT including residents and fellows from all specialties and all levels of training.

**Results:** The prevalence rates are 68.6% for personal burnout, 63.3% for work-related burnout, and 35.1% for patient-related burnout.

**Conclusion:** Results improve our understanding of the phenomenon of burnout, and the role of program leadership in shaping the impact of burnout on training and promoting wellbeing of PGMT. Discussion focuses on providing potential wellbeing strategies for program directors to follow for mitigating burnout.

## KEYWORDS

postgraduate medical trainees, COVID-19, burnout—professional, wellbeing, leadership and physicians, program directors

## Introduction

Burnout is a complicated concern in the occupational sector that does not have a standard definition (1). The World Health Organization (WHO) reclassified workplace burnout in the 11th Revision of the International Classification of Diseases (ICD-11). Burnout depicts the following symptoms: Feelings of energy depletion or exhaustion; increased mental distance from one's job, or feelings of negativism or cynicism related to one's job and reduced professional efficacy (2). Herbert Freudenberger first described burnout in the 1970's and referred to it as worsening, wearing out, or becoming tired by making extreme demands on energy, strength, or resources (3). It regularly happens ~1

year after someone has begun working in an organization, when several elements come into play (3). Burnout manifests as a steady emotional depletion and loss of motivation and the ones who are prone to it are those who are dedicated and committed individuals (3). It can lead to physical and psychological problems, and compromised mental health (4). It is a contagious concept wherein those who experience burnout can negatively influence their colleagues by personal conflict and disruption of work assignments (1). Burnout was initially described as a syndrome for those who work with people, i.e., “human services” (5) prior to including information and other services (6). Burnout is widely illustrated as a syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment (7).

Burnout is common in medicine due to the demanding and challenging profession (8). It arises in graduate medical training wherein the prevalence has ranged between 45 and 71% in medical students (8) and in a recent study among 315 medical students in China, the prevalence rate was 45.9% (9). Burnout continues throughout postgraduate medical training and physicians’ career (10). There has been a surge in mental illness and suicides in the medical community in the past years (11). Extensive research has been performed in the field of healthcare to alleviate burnout (1). Postgraduate medical trainees (PGMT) represent a unique occupational group with an increased risk of burnout. Their wellbeing is an important organizational asset since it is linked to performance and safety behavior (12). Recently, the coronavirus disease 2019 (COVID-19) pandemic had a dramatic strain on the overall residency and fellowship training especially on the clinical and procedural workload and educational activities (13, 14). For example, PGMT in charge of patients with COVID-19 are more prone to feel anxious and stressed (15).

Several factors lead to burnout during the pandemic, and they comprise: elongated duty hours, longer patients’ list, sicker patients, further responsibility, fear of getting infected and infecting colleagues, friends, and family members (16). PGMT who directly care for infected patients or are redeployed to COVID-19 units, are most likely to feel so too because of increased exposure to the virus which is associated with fear (17). Other factors include shortages of personal protective equipment, daily changes in shifts, further work, obligations to family and others outside the hospital premises, and provision of childcare (15).

Lebanon has plunged into one of the most cataclysmic times in its history with economic, financial, and social collapse. Challenges that arose include sudden drop of the national currency over 80%, inflation of prices by 200% and deterioration of the banking sector and brain drain of skilled employees (18). The Beirut Port explosion in August 2020 that resulted in about 220 deaths ruined the city and caused massive infrastructure damage and homelessness. Other challenges include partial removal of subsidies on essential medicines, diesel and other

basic needs, severe shortages of medicine and increase of price of medications and cost of treatment for chronic diseases. Diesel prices rose around 2,000 per cent within a year, which made it very difficult and costly for most workers to report to work (18). The wiping out of lifetime savings by the banking sector, wherein the politically well-connected and wealthy individuals transferred their capital out of Lebanon made a substantial impact on the economy. Nonetheless, the country had already suffered from civil wars, increased influx of Syrian and Palestinian refugees, camps, and dramatic rise in unemployment and poverty (18).

The Medical Center is a tertiary medical center located in Beirut, Lebanon. The center provides 20 residency training programs. PGMT are trained by a clinical teaching team, and each program is directed by a program director with the support of a program coordinator and the Graduate Medical Education office. The programs are accredited by the Accreditation Council for Graduate Medical Education—International (ACGME-I). The years of training are from Post Graduate Year (PGY) 1 until PGY5 (the digits representing the year of training, PGY1 = 1st year) for some programs and PGY6 for other sub-specialties. The 7th year (PGY7) is for fellows. A previous study conducted in two academic hospitals in Beirut, Lebanon reported a worrying rate of burnout among Lebanese medical residents across both public and private hospitals (19) amidst the difficult and challenging circumstances that the country has been struggling with for decades especially the war in 2006 and the assassinations of politicians and regular bombings in random regions. All these factors have a great toll on the mental health of citizens in general. The primary objective of the study is to evaluate the sociodemographic characteristics of PGMT and their relationship with the different scales of burnout given by a validated instrument.

## Methods

### Study design and sample

#### Instrument

An anonymous web-based questionnaire was conducted to assess burnout using the well-known inventory called the Copenhagen Burnout Inventory (CBI). The core of burnout in this tool is fatigue and exhaustion which is in conformity with the historical development of the theory of burnout, and with recent definition by leading researchers in the field which have emphasized these keywords (20). The author explained that there is a feature in addition to fatigue and exhaustion that needs to be addressed in the instrument. This feature is the attribution of fatigue and exhaustion to domains in an individual’s life which is work and specifically client work (20) and for these reasons the author created the CBI.

The CBI is a validated tool and consists of three sub-dimensions: personal burnout, work-related burnout, and client-related burnout (20). The three scales are intended to be applied in different domains. The personal burnout questions represent an actual generic scale that anyone can answer and a general state of fatigue and exhaustion. The work-related burnout questions are for people with paid work and represents the degree of burnout perceived by the person to be related to his/her work. This scale can only be used if people have work of some kind. The client-related burnout questions include the term “client” (or a similar term when appropriate such as patient, student, etc.). This is the level of burnout perceived by the person as related to working with clients (patients, students, children, etc.). The use of this scale is restricted to employees who work with clients (20). The client-related burnout will be replaced by patient-related burnout in this study. The three subscales have 19 questions in total distributed as follows: The personal burnout has six questions; the work-related burnout has seven questions and the client-related burnout has six questions. Ratings are given based on a five-point Likert scale. Each item is scored from 0 to 100 (0 = never/almost never, 25 = seldom, 50 = sometimes, 75 = often, 100 = always) (20). Although the author of the CBI does not recommend the use of cutoff scores and dichotomization, burnout was defined as high and low burnout, in several studies, using the cutoff score of 50 that is the middle value of 0–100-point for each scale (21).

## Data collection

The target population consisted of PGMT of all levels of training including residency and fellowship programs. The electronic survey was anonymous and confidential and was distributed electronically. An email was sent to all PGMT on February 15, 2022, through the Lime Survey portal. There were three reminders sent exactly 1 week apart from the initial email. PGMT were included if they were male and female residents or fellows, aged 18 years and above, employed by the institution and consented to participate in the survey. The survey was voluntary and did not include any personal identifiers. The Institutional Review Board (IRB) of the university approved the study (SBS-2021-0219). The email presented the name of the principal investigator and study coordinator and the objectives of the study. Those who were interested to participate had to click on the link provided in the email. The documentation of written consent was waived to avoid collection of identifying information and due to the online nature of the survey. Participants were required to verify that they consented to participate before beginning the survey. They were informed of the anonymity of the study and the protection rights of the data. The questionnaire included the 19 original questions from the three dimensions found in the CBI and at the end included demographic questions such as gender, age, marital status, and year of training. We decided to use the three scales from the

CBI to capture all the different dimensions of burnout for a better understanding of the theory. Only valid participants were included in the analysis. Missing questionnaires were excluded.

## Statistical analysis

In the descriptive analysis of the sample, summary statistics were applied as appropriate. The mean values were calculated for the subscales of the CBI. The Independent *T*-test was used for comparison of mean scores in two groups and if there were more than two groups involved, we used the one-way analysis of variance (ANOVA). Reliability of the test was assessed by measuring Cronbach's alpha. For descriptive analysis, variables were presented with mean, and standard deviation (SD) for continuous data and with frequencies and percentages for categorical data. The mean item score was calculated per scale based on the proposed scoring system of the questionnaire (20). The Independent *T*-test was used to compare means between two groups, whereas the ANOVA to compare between three groups or more, after checking for homogeneity of variances. Binomial Logistic Regression was used to explore association extent between the demographic variables and the three scales: personal, work-related, and patient-related burnout.

Cronbach's alpha was determined to measure the internal consistency or reliability of the survey items. The whole inventory had a score of ( $\alpha = 0.938$ ) and each one separately as follows: personal burnout ( $\alpha = 0.895$ ), work-related burnout ( $\alpha = 0.900$ ), and patient-related burnout ( $\alpha = 0.912$ ). The collected data was entered into Microsoft Excel with a double-entry method to avoid errors. Statistical Package for the Social Sciences (SPSS; IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp) was used. Demographic variables such as gender, marital status and year of training were included as independent variables. Age was not used in our analysis since the range was very close in the sample (26–32 years) and a previous study conducted in Lebanon showed that age was not related to burnout (19). A *p*-value of  $< 0.05$  was considered statistically significant.

## Results

Survey invitations were sent to 389 PGMT. There were 213 unique responses collected. There were 25 missing items either in the questions or in the demographic information and hence were excluded. The final sample comprised 188 valid responses with a response rate of 48.32%.

Descriptive statistics are presented in Table 1. Most participants are females (60.1%). The range of age is 26–32 years for both males and females. Approximately half of the participants are single (55.3%), others in a relationship (26.6%), while 17.0% are married and 1.1% are divorced. Most trainees are in the 1st year of training (27.7%), followed by 3rd year

TABLE 1 Demographic characteristics of the trainees ( $n = 188$ ).

Gender	Frequency (%)
Females	113 (60.1)
Males	75 (39.9)
<b>Marital status</b>	
Single	104 (55.3)
In a relationship	50 (26.6)
Married	32 (17.0)
Divorced/separated	2 (1.1)
<b>Year of training*</b>	
PGY1	52 (27.7)
PGY2	26 (13.8)
PGY3	42 (22.3)
PGY4	35 (18.6)
PGY5	17 (9.0)
PGY6	14 (7.4)
PGY7	2 (1.1)

\*The years of training are from Post Graduate Year (PGY) 1 until PGY5 (the digits representing the year of training, PGY1 = 1st year) for some programs and PGY6 for other sub-specialties. The 7th year (PGY7) is for fellows.

(22.3%), 4th year (18.6%), 2nd year (13.8%), 5th year (9.0%), 6th year (7.4%), and 7th year (1.1%).

Tables 2A–C shows the detailed scales presented in frequencies, percentages, mean and SD scores. Among its subscales, personal burnout was highest (mean = 59.17), followed by work-related burnout (mean = 54.86) and client-related burnout (mean = 37.69). The highest mean score for items in each of the dimensions were as follows: “How often do you feel tired?” (mean = 71.14), followed by “How often are you emotionally exhausted” (mean = 65.69), “How often are you physically exhausted?” (mean = 65.42) for personal burnout. For work-related burnout, “Do you feel worn out at the end of the working day?” (mean = 65.82), “Is your work emotionally exhausting?” (mean = 62.76), and “Do you feel burnt out because of your work?” (mean = 57.57). For patient-related burnout, “Do you feel that you give more than you get back when you work with patients?” (mean = 53.85), “Does it drain your energy to work with patients?” (mean = 38.43), and “Do you find it hard to work with patients?” (mean = 35.10). The prevalence rate is as follows: 68.6% for personal burnout, 63.3% for work-related burnout, and 35.1% for patient-related burnout.

The Independent *T*-test in Table 3 shows that there is a statistical difference between males and females in experiencing personal burnout ( $p = 0.002$ ) with the mean of female PGMT is higher than that of male PGMT (62.68 vs. 53.88). The mean of work-related burnout ( $p = 0.067$ ) and patient-related burnout ( $p = 0.408$ ) is almost the same for females and males. For marital status, the One-Way ANOVA test shows that the difference between the means of personal burnout is statistically significant

( $p = 0.033$ ) with the highest mean for those who are single vs. those who are divorced (60.97 vs. 25.00; Table 4A). There is a statistical difference between the means of work-related burnout for the different marital status groups ( $p = 0.008$ ) with the highest mean for those who are single vs. those who are divorced (56.25 vs. 19.64). The One-Way ANOVA test reports that the means of personal burnout are statistically significant for the different years of training ( $p = 0.010$ ) with the highest mean for those who are PGY1 vs. those who are PGY7 (62.98 vs. 27.08; Table 4B). The result is similar for work-related burnout ( $p = 0.014$ ) with the highest mean for those who are PGY1 vs. those who are PGY7 (57.00 vs. 32.14). The mean of patient-related burnout is almost the same across all groups in years of training.

Binary Logistic Regression analysis was conducted to define significant predictors of personal, work-related, and patient-related burnout (Table 5). The variables used were gender, marital status, and year of training. For analysis purposes, those who are in a relationship and those who are married are grouped in one new cluster. Those who are single and divorced are grouped in one cluster and used as the reference group. Those who are in the 6th year of training and 7th year of training are grouped together. The reason is that the number of those who are separated/divorced and the number of those in the 7th year of training is small and to yield better results. Gender is a significant predictor of personal burnout ( $p = 0.001$ ). Males have 30.8% less risk of experiencing personal burnout than females ( $p = 0.001$ , 95% CI = 0.154–0.613). Trainees in the 6 and 7th year have 13.1% less risk of personal burnout ( $p = 0.002$ , 95% CI = 0.036–0.480), 11.3% less risk of work-related burnout ( $p = 0.002$ , 95% CI = 0.028–0.454), and 20% less risk of patient-related burnout ( $p = 0.047$ , 95% CI = 0.041–0.975) than those in the 1st year of training.

## Discussion

The study took place in a tertiary medical center in Beirut, which is the capital of Lebanon, and this center has the largest number of PGMT in various specialties of medicine. The author of the CBI has stated in case any scholar would like to report an overall scale for burnout from the CBI, he/she should use the scale of the personal burnout. Our study showed that the mean of 188 PGMT for personal burnout is 59.17% and the prevalence rate of personal burnout is 68.6%. The following studies used the same inventory: In one study among 113 PGMT in Pakistan, personal burnout was the highest (mean = 49.74), followed by work-related burnout (mean = 46.99) and client-related burnout (mean = 46.13) (22). Another one among 210 PGMT in India reported 51.8% for personal burnout, 37.2% for work-related burnout (measured among 151 PGMT), and 22.47% for client-related burnout (measured among 91 PGMT) (21). Another study among 245 PGMT in Colombo, Sri Lanka



TABLE 2A Frequency distribution, mean and SD of the personal burnout scale.

	Personal burnout					Mean (SD)
	Frequency (%)					
	Never/ almost never (0)	Seldom (25)	Sometimes (50)	Often (75)	Always (100)	
How often do you feel tired?	-	2 (1.1)	56 (29.8)	99 (52.7)	31 (16.5)	71.14 (17.39)
How often are you physically exhausted?	3 (1.6)	13 (6.9)	63 (33.5)	83 (44.1)	26 (13.8)	65.42 (21.66)
How often are you emotionally exhausted?	3 (1.6)	16 (8.5)	64 (34.0)	70 (37.2)	35 (18.6)	65.69 (23.40)
How often do you think: “I can’t take it anymore?”	21 (11.2)	49 (26.1)	60 (31.9)	47 (25.0)	11 (5.9)	47.07 (27.20)
How often do you feel worn out?	4 (2.1)	31 (16.5)	64 (34.0)	72 (38.3)	17 (9.0)	58.90 (23.34)
How often do you feel weak and susceptible to illness?	22 (11.7)	50 (26.6)	64 (34.0)	34 (18.1)	18 (9.6)	46.80 (28.33)
Total		59.17 (19.29)				

TABLE 2B Frequency distribution, mean and SD of the work-related burnout scale.

	Work-related burnout					Mean (SD)
	Frequency (%)					
	Never/ almost never	Seldom	Sometimes	Often	Always	
Do you feel worn out at the end of the working day?	-	20 (10.6)	67 (35.6)	63 (33.5)	38 (20.2)	65.82 (23.10)
Are you exhausted in the morning at the thought of another day at work?	11 (5.9)	37 (19.7)	60 (31.9)	50 (26.6)	30 (16.0)	56.78 (28.15)
Do you feel that every working hour is tiring for you?	24 (12.8)	60 (31.9)	61 (32.4)	30 (16.0)	13 (6.6)	43.05 (27.33)
Do you have enough energy for family and friends during leisure time? (reversed scoring)	10 (5.3)	48 (25.5)	73 (38.8)	44 (23.4)	13 (6.9)	50.22 (24.79)
Is your work emotionally exhausting?	8 (4.3)	20 (10.6)	62 (34.0)	64 (34.0)	34 (18.1)	62.76 (26.04)
Does your work frustrate you?	24 (12.8)	38 (20.2)	72 (38.3)	39 (20.7)	15 (8.0)	47.73 (27.81)
Do you feel burnt out because of your work?	15 (8.0)	22 (11.7)	69 (36.7)	55 (29.3)	27 (14.4)	57.57 (27.58)
Total		54.86 (17.49)				

TABLE 2C Frequency distribution, mean and SD of the patient-related burnout scale.

	Patient-related burnout					Mean (SD)
	Frequency (%)					
	Never/ almost never (0)	Seldom (25)	Sometimes (50)	Often (75)	Always (100)	
Do you find it hard to work with patients?	41 (21.8)	58 (30.9)	66 (35.1)	18 (9.6)	5 (2.7)	35.10 (25.41)
Does it drain your energy to work with patients?	33 (17.6)	59 (31.4)	34 (34.0)	26 (13.8)	6 (3.2)	38.43 (25.90)
Do you find it frustrating to work with patients?	44 (23.4)	62 (33.0)	56 (29.8)	22 (11.7)	4 (2.1)	34.04 (25.81)
Do you feel that you give more than you get back when you work with patients?	24 (12.8)	29 (15.4)	62 (33.0)	40 (21.3)	33 (17.6)	53.85 (31.28)
Are you tired of working with patients?	51 (27.1)	64 (34.0)	55 (29.3)	11 (5.9)	7 (3.7)	31.25 (25.93)
Do you sometimes wonder how long you will be able to continue working with patients?	57 (30.3)	50 (26.6)	54 (28.7)	14 (7.4)	13 (6.9)	33.51 (29.60)
Total		37.69 (22.86)				

**TABLE 3** Independent *T*-test between the mean of the three scales and gender.

	Gender	Mean	SD	<i>P</i> -value
Personal burnout	Females	62.68	18.23	0.002
	Males	53.88	19.75	
Work-related burnout	Females	56.76	17.36	0.067
	Males	52.00	17.41	
Patient-related burnout	Females	38.82	22.04	0.408
	Males	36.00	24.08	

showed that the prevalence of personal burnout was 41.6%, for work-related burnout 30.6% and for client-related burnout 8.9% (23).

Studies that used other inventories like the Maslach Burnout Inventory and the Oldenburg Burnout Inventory had various results (9, 11, 19, 24–27). The prevalence rate of burnout was 46.3% among 393 trainees in the United States (US) (24), 35.8% among 560 trainees in the US (25), 48.6% among 3,071 residents in Brazil (11), 33% among 427 neurosurgery residents in the US (28), and 37.4% among 340 pediatric residents in France (27). Different scores for burnout imply different explanations. The difference in the prevalence rate of burnout in studies may be partly explained by the difference of the instrument employed (25). Specialty of training plays a role in burnout. For example, pediatric trainees are less likely to be confronted with emergencies than other trainees (27) and may hence report less burnout.

The high prevalence rates seen in our study reflect the challenging conditions in the country in addition to the pandemic as explained above. All these factors have placed an unprecedented strain on the medical education, training, and wellbeing of PGMT. The most important justification for the high rate of burnout in Lebanon includes the gravities and pressures that arise for PGMT residing in Lebanon who have witnessed and experienced extremely harsh conditions engraved in uncertainty and ambiguity adding to their already stressful life. The numerous and complex factors in the country have contributed to drastic and extensive changes to their sense of value, autonomy, and mental health. This is also explained by the high mean scores for the questions in our sample that revolve around feeling tired, feeling emotionally and physically exhausted, feeling worn out and having their energy drained.

The study showed high rates of personal and work-related burnout and lower rate of patient-related burnout like other studies (23). The reason for low patient-related burnout may be that PGMT become adapted to high patient loads from the beginning of their training and therefore may not perceive patient work as a burden especially in the senior years (23). This implies that patient care is not the primary cause of burnout,

**TABLE 4A** One Way ANOVA Test between the mean of the three scales and marital status.

	Marital status	Mean	SD	<i>P</i> -value
Personal burnout	Single	60.97	19.26	0.033
	In a relationship	59.41	16.83	
	Married	55.07	21.34	
	Divorced	25.00	11.78	
Work-related burnout	Single	56.25	17.16	0.008
	In a relationship	56.42	16.05	
	Married	50.11	18.55	
	Divorced	19.64	7.57	
Patient-related burnout	Single	38.78	23.11	0.340
	In a relationship	39.16	21.12	
	Married	33.20	24.60	
	Divorced	16.66	22.86	

**TABLE 4B** One Way ANOVA Test between the mean of the three scales and year of training.

	Year of training	Mean	SD	<i>P</i> -value
Personal burnout	PGY1	62.98	16.92	0.010
	PGY2	61.53	23.13	
	PGY3	63.49	17.95	
	PGY4	54.16	19.28	
	PGY5	55.14	12.45	
	PGY6	49.70	23.02	
	PGY7	27.083	14.73	
Work-related burnout	PGY1	57.00	15.54	0.014
	PGY2	59.47	22.40	
	PGY3	58.50	15.29	
	PGY4	51.12	14.94	
	PGY5	51.89	16.56	
	PGY6	43.62	20.73	
	PGY7	32.14	20.20	
Patient-related burnout	PGY1	40.38	22.43	0.110
	PGY2	44.55	23.94	
	PGY3	39.98	22.95	
	PGY4	34.88	22.80	
	PGY5	29.16	25.34	
	PGY6	28.57	13.85	
	PGY7	16.66	17.67	

but personal and work-related factors are. PGMT may adapt to patient care and load due to experience and years of training. PGMT know very well prior to training that most of their work revolves around patients and hence they become prepared for patient care. An earlier study conducted in two hospitals in Lebanon reported that the number of calls (more than eight calls per month), working continuously for more than 80 h

**TABLE 5** Binary Logistic Regression for the scales and gender, marital status, and year of training.

<b>Personal burnout</b>			
	<b>Odds ratio</b>	<b>CI</b>	<b>P-value</b>
Gender	0.308	0.154–0.613	0.001
Reference (Female)			
Marital status	1.771	0.848–3.697	0.128
Reference (Single and Divorced)			
Year of training			
Reference (PGY1)			
PGY2	0.916	0.302–2.773	0.876
PGY3	1.293	0.462–3.623	0.624
PGY4	0.419	0.152–1.153	0.092
PGY5	0.416	0.121–1.435	0.165
PGY6 and PGY7	0.131	0.036–0.480	0.002
<b>Work-related burnout</b>			
Gender	0.744	0.391–1.417	0.368
Reference (Female)			
Marital status	1.091	0.559–2.132	0.789
Year of training			
Reference (PGY1)			
PGY2	1.104	0.399–3.052	0.849
PGY3	1.345	0.544–3.326	0.521
PGY4	0.697	0.277–1.756	0.444
PGY5	0.895	0.273–2.938	0.855
PGY6 and PGY7	0.113	0.028–0.454	0.002
<b>Patient-related burnout</b>			
Gender	0.952	0.502–1.805	0.881
Reference (Female)			
Marital status	0.911	0.472–1.758	0.781
Reference (Single and Divorced)			
Year of training			
Reference (PGY1)			
PGY2	0.724	0.272–1.926	0.518
PGY3	1.137	0.499–2.592	0.760
PGY4	0.562	0.218–1.444	0.231
PGY5	0.439	0.122–1.575	0.207
PGY6 and PGY7	0.200	0.041–0.975	0.047

per week, type of specialty, postgraduate years, and number of continuous working hours were statistically associated with high burnout (19). A study conducted on 387 community pharmacists in Lebanon showed that the prevalence of personal, work-related, and client-related burnout was 77.8, 76.8, and 89.7%, respectively (29).

Moreover, female trainees report higher personal burnout than male trainees and the result is statistically significant. This is like other studies (23, 29, 30) and can be explained by the variations in gender roles and cultural differences (23).

Female trainees especially married ones may assume more responsibilities when it comes to work and family balance, emotional demands, family concerns and childcare for those who have children. Although marital status is not a determinant of personal burnout, we assume that female trainees may report more personal burnout because of fatigue and exhaustion emerged from their additional responsibilities due to work-life balance eventually increasing vulnerability and stress. A trainee who was a female, who worked more than 30 h and who experienced a major stress in the past 6 months had significantly increased odds of high emotional exhaustion burnout by 2.54, 2.91, and 3.38, respectively (19). Literature shows that female PGMT in Lebanon face other social pressures and burden ranging from stigma of living alone, away from family to the urgent need of relatively early marriage vs. the academic and long-year commitment of the medical profession (19). Trainees in the 6 and 7th training year reported lower risk of personal and work-related burnout vs. the 1st year of training. This is in contrast with other studies (19, 30). For example, in a study conducted in Bahrain, chief residents had higher levels of personal and work-related burnout in comparison to other job positions (30).

The wellbeing of PGMT during and after the pandemic remains a chief responsibility of leaders and program directors in graduate medical education (17). The COVID-19 pandemic presents an opportunity to reflect on assessment and support of PGMT wellbeing (17). Literature shows that employees tolerate workload if they feel that they are well-rewarded for their efforts (1). Therefore, an intervention could emphasize the areas of appreciation, value, and reward (1). Another study showed that feeling valued by leaders and program directors is associated with 66% lower odds of psychiatric symptoms and 59% lower odds of burnout (25). Another study showed that social support, particularly subjective support might offer a protecting effect against stress and hence lessen the likelihood of having burnout (9). Therefore, PGMT burnout can be overturned with leadership that places appreciation, transparency, and practical initiatives at the core of its actions.

## Theoretical and practical implications

This research makes several theoretical contributions. Our work contributes to helping literature, as previous attempts to alleviate burnout among PGMT were not very fruitful especially in lieu of the pre-existing burnout among PGMT before the COVID-19 pandemic. The narrowness of the topic of wellbeing in curbing burnout has led scholars to call for research that examines the many different roles that burnout plays in organizational settings. We shed light on when and why PGMT training should rise again to normal levels following a preceding failure by seeing the role of employee self-reflection about addressing failure to

generate pragmatic solutions. PGMT should notice that their organization aligns the strategy and plan with the values of their profession wherein their voice and feedback are appreciated and acknowledged (31).

The study results show that external factors play a major role in organizational performance. The negative conditions of a certain country act as a barrier to the overall function of an institution such as a healthcare system eventually affecting the training program. While the whole world has been turned upside down with the COVID-19 pandemic, PGMT in Lebanon have additional economic and political challenges that further exacerbated their situation and quality of life. The situation in the country plays a detrimental role in the mental health of healthcare workers especially PGMT who are in training. The experience at the center shows that PGMT are surviving well-evidenced by graduating on time and securing positions in reputable centers in North America, Europe, and Gulf countries. This is aided by the continuous support from program directors, program coordinators, Graduate Medical Education office and leaders in all departments.

The authors present the following recommendations based on previous studies for leaders and program directors in graduate medical education to consider (8, 25):

- Promoting frank communication and awareness on wellbeing, burnout, and resilience.
- Demonstrating appreciation of trainees through town halls, direct messaging, and acts of gratefulness.
- Normalizing mental health and removing the stigma associated with its utilization.
- Integrating self-care and healthy lifestyle to the teaching curricula of postgraduate medical education.
- Encouraging adequate amount of sleep, physical exercise, healthy diet, and healthcare.
- Creating flexible schedules to avoid extra duty hours and superfluous administrative assignments.
- Incorporating open door policy for program directors by ensuring confidentiality and privacy.
- Increasing the number of hospitalists or part-timers if funding is available.
- Increasing time for trainees to spend with family/partners/children.
- Adapting social support through family and friends.
- Providing support programs for spouses, children, and dependents.
- Establishing wellness programs and supportive working environments with colleagues.
- Meeting to ensure that trainees meet the minimum case requirements prior to graduation. Discussing the possibility of future electives in other centers for those who need to meet the number.
- Discussing ways to compensate for missed educational opportunities and reduced job opportunities.

- Providing financial support for research and academic conferences at different levels if possible.
- Providing women especially those who are married or have children with creative avenues to stay engaged with the workplace and with their personal life.

## Limitations and directions for future research

The present study has several limitations. Burnout can be defined in numerous ways and can be assessed by different inventories. For example, numerous studies used the Maslach Burnout Inventory (27). However, the Maslach Burnout Inventory is commercially available, while the CBI is available for non-commercial research. The study was conducted in a single hospital in Beirut. This limits the ability to generalize to other institutions with postgraduate medical training program across the country. The cross-sectional design does not evaluate burnout over time, i.e., only correlation can be assessed and not causation and therefore, we cannot deduce causality between the variables. There is lack of periodic comparison of results such as pre-pandemic, intra-pandemic and post-pandemic findings which could be helpful but is challenging to obtain. Selection bias, wherein trainees with more free time may have responded to the survey, may cause under-reporting of burnout due to the difficulty of capturing residents with less spare time. Response bias in which those with burnout are more or less likely to respond to the survey. Reporter bias exists, because participants may answer how they believe others would like them to respond. PGMT may feel averted or hesitant to complete surveys due to the challenging conditions in the country, or perhaps due to doubt about the effectiveness of surveys in general. We cannot find out whether participants answered the survey questions honestly. We can only assume that they did so based on the country conditions.

Future research should assess the impact of wellbeing interventions during and post COVID-19 pandemic and the outcome on burnout. Future studies should focus on evaluating burnout among different specialties and emphasize the impact of wellness initiatives and the effect on wellbeing. It is important to pay attention to the following points: screening for burnout, providing comfort for PGMT to feel free to ask for support from their supervisors, organizing workload, improving scheduling, and working conditions, and promoting psychological wellbeing. Program directors and leaders should strive to improve resident operative autonomy by fostering positive interpersonal relationships, professionalism, conference presentations, problem solving and operative planning (32). Research questions to focus on include if burnout is a contributing factor in the migration of PGMT, what altering working conditions decrease burnout among PGMT and how to move to a smooth post-COVID-19 transition period.

## Conclusion

The COVID-19 pandemic has put a considerable toll on the physical, social, economic, and mental wellbeing of PGMT. Understanding the different factors affecting burnout is crucial to curb its occurrence. The wellbeing of PGMT is vital and should be closely followed-up even after the pandemic. Preventive strategies and potential interventions such as improved work-life balance, increased organizational and peer support, can help curtail the level of chronic stress, promote work satisfaction, improve education and training and foster career advancement and satisfaction. One of the most suitable and promising directions for theories of emergence is the opportunity to discover how and why burnout symptoms emerge with a focus on differences in demographic characteristics. Insights from these findings can guide both future research and practical interventions designed to enhance wellbeing seeking behaviors in organizations.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

This study was approved by the Institutional Review Board (IRB) of the university approved the study (SBS-2021-0219). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## References

- Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol.* (2001) 52:397–422. doi: 10.1146/annurev.psych.52.1.397
- World Health Organization. *Burn-out an “Occupational Phenomenon”*; *International Classification of Diseases.* (2020). Available online at: <https://www.sedgwick.com/blog/2020/01/03/icd-11-classifies-burnout-as-an-occupational-condition#:text=According%20to%20the%20handbook%2C%20a,Reduced%20professional%20efficacy> (accessed November 21, 2022).
- Freudenberger H. Staff burn-out. *J Soc Iss.* (1974) 30:159–65. doi: 10.1111/j.1540-4560.1974.tb00706.x
- Freudenberger H. The issues of staff burnout in therapeutic communities. *J Psychoactive Drugs.* (1986) 18:247–51. doi: 10.1080/02791072.1986.10472354
- Maslach C, Jackson SE. The measurement of experienced burnout. *J Occup Behav.* (1981) 2:205. doi: 10.1002/job.4030020205
- Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. *J Appl Psychol.* (2001) 86:499–512. doi: 10.1037/0021-9010.86.3.499
- Maslach C, Jackson SE, Leiter MP. Maslach burnout inventory: third edition. In: *Evaluating Stress: A Book of Resources.* Lanham, MD: Scarecrow Education (1997). p. 191–218.
- Ishak W, Nikraves R, Lederer S, Perry R, Ogunyemi D, Bernstein C. Burnout in medical students: a systematic review. *Clin Teach.* (2013) 10:242–5. doi: 10.1111/tct.12014
- Zhang X, Jiang X, Ni P, Li H, Li C, Zhou Q, et al. Association between resilience and burnout of front-line nurses at the peak of the COVID-19 pandemic: positive and negative affect as mediators in Wuhan. *Int J Ment Health Nurs.* (2021) 30:939–54. doi: 10.1111/inm.12847
- Tang OY, Dunn KA, Yoon JS, Ponce FA, Sonntag VKH, Lawton MT. Neurosurgery resident wellness and recovery from burnout: a 39-year single-institution experience. *World Neurosurg.* (2020) 138:e72–81. doi: 10.1016/j.wneu.2020.01.236

## Author contributions

AY, JD, and SZ: conceptualization, methodology, formal analysis, investigation, and writing—original draft preparation. AY, JD, AD-B, and SZ: validation and writing—review and editing. JN and RA: resources. AY: data curation. AY, JD, JN, RA, and SZ: visualization. JD and SZ: supervision. JN, RA, and AD-B: project administration. All authors have read and agreed to the published version of the manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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11. Steil A, Pereira Tokeshi AB, Bernardo LS, da Silva Neto GP, Davi RFJ, Bárbara AFS, et al. Medical residents' mental distress in the COVID-19 pandemic: an urgent need for mental health care. *PLoS ONE*. (2022) 17:e0266228. doi: 10.1371/journal.pone.0266228
12. Demerouti E, Veldhuis W, Coombes C, Hunter R. Burnout among pilots: psychosocial factors related to happiness and performance at simulator training. *Ergonomics*. (2019) 62:233–45. doi: 10.1080/00140139.2018.1464667
13. Rosen GH, Murray KS, Greene KL, Pruthi RS, Richstone L, Mirza M. Effect of COVID-19 on urology residency training: a nationwide survey of program directors by the Society of Academic Urologists. *J Urol*. (2020) 204:1039–45. doi: 10.1097/JU.0000000000001155
14. Sattler SS, Kraus CN, Wu JJ. How the COVID-19 pandemic is affecting graduating dermatology residents and fellows. *Dermatol Online J*. (2021) 27:D3273052783. doi: 10.5070/D3273052783
15. Wu AW, Connors C, Everly GS Jr. COVID-19: peer support and crisis communication strategies to promote institutional resilience. *Ann Intern Med*. (2020) 172:822–3. doi: 10.7326/M20-1236
16. Palacios Huatucó RM, Liaño JE, Moreno LB, Ponce Beti MS. Analysis of the impact of the pandemic on surgical residency programs during the first wave in Argentina: a cross-sectional study. *Ann Med Surg*. (2021) 62:455–9. doi: 10.1016/j.amsu.2021.01.065
17. Wong CR, Moltaji S, Cross K, Wanzel KR. Impact of the COVID-19 pandemic on the wellness of Canadian plastic surgery residents. *Plast Reconstr Surg Glob Open*. (2022) 10:e4259. doi: 10.1097/GOX.0000000000004259
18. United Nations. *Report of the Special Rapporteur on Extreme Poverty and Human Rights, Olivier De Schutter*. San Francisco, CA (2022).
19. Ashkar K, Romani M, Musharrafieh U, Chaaya M. Prevalence of burnout syndrome among medical residents: experience of a developing country. *Postgrad Med J*. (2010) 86:266–71. doi: 10.1136/pgmj.2009.09.2106
20. Kristensen TS, Borritz M, Villadsen E, Christensen KB. The Copenhagen Burnout Inventory: a new tool for the assessment of burnout. *Work Stress*. (2005) 19:192–207. doi: 10.1080/02678370500297720
21. Ratnakaran B, Prabhakaran A, Karunakaran V. Prevalence of burnout and its correlates among residents in a tertiary medical center in Kerala, India: a cross-sectional study. *J Postgrad Med*. (2016) 62:157–61. doi: 10.4103/0022-3859.184274
22. Majeed F, Liaqat N, Hussain MM, Iqbal A, Hashim I, Saleem M. Burnout among postgraduate residents using Copenhagen Burnout Inventory. *J Ayub Med Coll Abbottabad*. (2022) 34:463–7. doi: 10.55519/JAMC-03-9594
23. Fernando BMS, Samaranayake DL. Burnout among postgraduate doctors in Colombo: prevalence, associated factors and association with self-reported patient care. *BMC Med Educ*. (2019) 19:373. doi: 10.1186/s12909-019-1810-9
24. Kannampallil TG, Goss CW, Evanoff BA, Strickland JR, McAlister RP, Duncan J. Exposure to COVID-19 patients increases physician trainee stress and burnout. *PLoS ONE*. (2020) 15:e0237301. doi: 10.1371/journal.pone.0237301
25. Kaplan CA, Chan CC, Feingold JH, Kaye-Kauderer H, Pietrzak RH, Peccoralo L, et al. Psychological consequences among residents and fellows during the COVID-19 pandemic in New York City: implications for targeted interventions. *Acad Med*. (2021) 96:1722–31. doi: 10.1097/ACM.0000000000004362
26. Khalafallah AM, Lam S, Gami A, Dornbos DL, Sivakumar W, Johnson JN, et al. A national survey on the impact of the COVID-19 pandemic upon burnout and career satisfaction among neurosurgery residents. *J Clin Neurosci*. (2020) 80:137–42. doi: 10.1016/j.jocn.2020.08.012
27. Treluyer L, Tourneux P. Burnout among paediatric residents during the COVID-19 outbreak in France. *Eur J Pediatr*. (2021) 180:627–33. doi: 10.1007/s00431-020-03907-x
28. Shakir HJ, Cappuzzo JM, Shallwani H, Kwasnicki A, Bullis C, Wang J, et al. Relationship of grit and resilience to burnout among U.S. neurosurgery residents. *World Neurosurg*. (2020) 134:e224–36. doi: 10.1016/j.wneu.2019.10.043
29. Youssef D, Youssef J, Hassan H, Abou-Abbas L. Prevalence and risk factors of burnout among Lebanese community pharmacists in the era of COVID-19 pandemic: results from the first national cross-sectional survey. *J Pharm Policy Pract*. (2021) 14:111. doi: 10.1186/s40545-021-00393-w
30. Abuzeyad F, Bashmi L, Das P, Ansari A, Hsu S, Qasim G, et al. Burnout and stress among emergency physicians in the Kingdom of Bahrain. *Saudi J Er Med*. (2021) 2:1–10. doi: 10.24911/SJEMed/72-1622453157
31. Shanafelt T, Trockel M, Rodriguez A, Logan D. Wellness-centered leadership: equipping health care leaders to cultivate physician well-being and professional fulfillment. *Acad Med*. (2021) 96:641–51. doi: 10.1097/ACM.00000000000003907
32. Miles VP, Schroll RW, Beaty JS. Empowering the resident learner. *J Surg Educ*. (2022) 79:909–17. doi: 10.1016/j.jsurg.2022.03.009



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# How perceptual differences between leaders and followers affect the resilience-workability relationship

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Drawing on Conservation of Resources theory and its notion of resource passageways, the aim of this study is to investigate the relationship between resilience and workability, and particularly the extent in which this relationship is buffered or strengthened by differences in perception between leaders and employees about the degree in which a certain influence tactic (pressure or rational persuasion) is used. To this end, this study uses a two-wave time-lagged survey design with a multi-sourced sample of 146 leader-follower dyads. Findings indicate that leader-follower perceptual differences about the use of pressure as an influence tactic buffers the positive resilience-workability relationship of followers. No evidence was found of a similar effect with respect to rational persuasion as an influence tactic.

## KEYWORDS

resilience, workability, influence tactics, rational persuasion, pressure, two-waved, dyads

## 1. Introduction

Over the past years studies have emphasized the importance of resilience at the workplace (e.g., Kuntz et al., 2016; Caniëls and Hatak, 2019; Näswall et al., 2019). Resilience refers to the capability to bounce back from adversity and adapt to changing circumstances and setbacks (Näswall et al., 2019). Resilient employees are expected to display high levels of workability (Semeijn et al., 2019). Workability is defined as the extent to which employees positively assess their ability to work at their current employer (Ilmarinen et al., 2005). Studies have shown that resilience is positively related to health (Smith et al., 2008; Papazoglou and Andersen, 2014) and health is known to positively affect workability (Van den Berg et al., 2009). The idea that resilience is beneficial for workability is in line with Conservation of Resources theory (COR; Hobfoll, 1989). COR theory states that employees with resources - such as the personal resource of resilience - have more possibilities to invest these resources to gather new resources, than employees who lack the initial resources. Hence, drawing on COR theory, it is likely that resilient employees (as opposed to less resilient employees) have more opportunities to conserve resources and invest them, thereby increasing their workability.

Despite its importance, the relationship between resilience and workability has only scarcely been studied. A cross-sectional study among 44 breast cancer survivors (Gómez-Molinero et al., 2019) showed a significant positive association between a global resilience measure and workability, while in a study among police officers (Semeijn et al., 2019) a resilience-workability relationship could not be established due to technicalities in the model assessment. Consequently, little is known about the resilience-workability relationship among office workers. Even less is known about how organizational supportive factors influence this resilience-workability relationship. Examining these supportive factors, i.e., the role of boundary conditions, for this relationship is especially valuable, because it can help organizations direct their efforts toward improving employees' workability, given their resilience.

With respect to factors that could be supportive for the resilience-workability relationship, COR theory proposes the presence of passageways, i.e., organizational conditions that may accelerate or suppress a change in resources (Hobfoll, 2001, 2011; Halbesleben et al., 2014). Such passageways can manifest themselves in the form of influence strategies, also labeled influence tactics, that are used by the leader to influence the attitude and behavior of employees (Yukl et al., 2005), such as pressure or rational persuasion. In terms of COR theory, influence tactics may encourage or thwart the conservation of resources by employees, thereby leading to either positive, or poor outcomes.

In prior studies, leadership influence tactics are usually assessed solely from an employee perspective (Yukl et al., 2005). When employees experience undesired pressure from leaders, they are likely to try to change this behavior either by speaking up (e.g., during yearly development and assessment talks) or by exerting less overt influence tactics themselves. A problem occurs when the leader does not recognize that he/she puts pressure on an employee. In this situation there is no opportunity to arrive at a resolution of the issue. By solely focusing on employee ratings of leadership influence strategies, studies have missed the opportunity to include an additional perspective on the used influence strategies, namely the perspective of the leader. It may be so that leaders and employees vastly differ in their perspective on the used influence strategy. Such a difference in perspective may have an important boundary effect on the resilience-workability relationship, because a leader, who does not recognize his/her influence strategy in the same way as is perceived by the employee, will not be open to changing his/her behavior. Therefore, it may not be so much the issue whether an employee experiences pressure from a leader, but more so if this leader does not realize that he/she puts pressure on the employee. Differences in perception between leaders and followers are therefore expected to influence the resilience-workability relationship of followers.

The aim of this study is to investigate the relationship between resilience and workability, as well as the extent in which this relationship is buffered or strengthened by differences in perception between leaders and followers about the degree in which a certain influence strategy (pressure or rational persuasion)

is used. To this end, this study uses a two-wave time-lagged study design with a multi-sourced sample of 146 leader-follower dyads. The present study aims to answer two main research questions: (1) to what extent is resilience related to workability, and (2) to what extent is the resilience-workability relationship affected by leader-follower perceptual differences in the use of influence tactics (i.e., pressure and rational persuasion).

This study presents one of the first empirical attempts to explore the boundary conditions that determine whether and to what extent resilient employee behavior is related to employee workability. In addition, the current study is one of the first that explores differences in perception between leaders and their followers about the tactics used by leaders. Therefore, our study harbors several theoretical contributions. First, it responds to calls for investigating the role of passageways (Halbesleben et al., 2014), which until now has received scant attention in the literature. By exploring the organizational conditions that may accelerate or hamper the conservation of resources by employees, a gap is filled in empirical studies that until now have mainly focused on studying how personal resources are invested to hedge against resource losses as well as overcoming them (Halbesleben et al., 2014). Second, the current study explores assessment differences between leaders and their followers regarding the degree in which certain influence tactics are used. Consequently, this study advances current knowledge about whether and how differences in perspective between leaders and followers may act as a passageway and hence function as an important boundary effect on the resilience-workability relationship. In this way, this study offers a nuanced understanding of the relationship between resilience and workability.

## 2. Literature review and hypothesis development

Conservation of Resources theory (COR; Hobfoll, 1989) is particularly relevant when studying the relationship between personal resources and workability. Employees use personal resources for self-regulation, for conducting social relations, and for carrying out work tasks (Hobfoll, 2011), in other words, they use personal resources to improve their workability. COR theory poses that individuals are motivated to shield their resources, to use them sparingly as not to deplete them, and to be constantly on the lookout for obtaining new and more resources (Halbesleben et al., 2014). It suggests that when individuals encounter challenges, for instance at work, they try to conserve their personal resources to protect themselves and to meet the demands of the situation at hand. In a work context, personal resources can be conceived of all personal assets that are of value to an employee, e.g., ability, self-esteem and self-efficacy (Hobfoll, 2011, p. 117). Resilience, i.e., having the capacity to be resilient, is also such a personal resource. It can be seen as a means of protecting other resources, and as a way of accumulating additional resources for the future.

## 2.1. Resilience and workability

Luthans et al. (2007) identified resilience as a ‘psychological capital’ resource (Upadaya et al., 2016). It may help employees to cope with job requirements and therefore support them to conserve resources. Resilient employees are able to recover from setbacks and even thrive in the face of adversity (Smith et al., 2008). Resilience can be nurtured and it can be gradually improved over time (Luthans, 2002; Xanthopoulou et al., 2009; Caniëls and Baaten, 2019), for instance by specifically designed interventions (Bardoel et al., 2014), such as developmental training targeted at the construction of social identities (Roberts and Wood, 2006; Lodi-Smith and Roberts, 2007).

Having the capacity to be resilient provides several advantages in a workplace setting (Kuntz et al., 2016; Caniëls and Hatak, 2019; Näswall et al., 2019). Being able to cope with failure and setbacks improves chances of employees for excelling in their work. Furthermore, resilient employees signal to their organization that they are committed to organizational goals even under conditions of stress and change (Coutu, 2002; Caniëls and Baaten, 2019). Personal resources, such as resilience, have been shown to be crucial for functioning at work (Luthans et al., 2007; Van Dam and Shannon, 2013). Moreover, prior research has positively linked resilience to job performance (Peterson et al., 2011), organizational commitment (Youssef and Luthans, 2007; Meneghel et al., 2016; Wang et al., 2017), thriving at work (Paterson et al., 2014), and overall well-being (Roche et al., 2014; Siu et al., 2015).

Resilience is also likely to be positively associated with the ability to work, i.e., workability (Ilmarinen et al., 2005; Semeijn et al., 2019), as prior studies have shown that resilience is positively associated with closely linked indicators, such as employability and vitality (Avey et al., 2009, 2011; Semeijn et al., 2019). Resilient employees feel confident that they can overcome difficult situations at work and therefore are likely to positively assess their ability to work.

*Hypothesis 1:* Resilience is positively associated with workability.

## 2.2. Influence strategies and leader-employee assessment differences

Leaders influence their followers to carry out their requests. It is essential for leaders to employ an array of influence tactics to ensure the performance of their followers (Yukl et al., 2008). Different tactics are suitable for different objectives. For example, influence tactics that relate to impression management are used by leaders to build and improve their relationship with their followers (e.g., Kumar and Beyerlein, 1991). In contrast, proactive influence tactics are used by leaders in an attempt to influence followers to undertake immediate action and tend to a certain request (Yukl et al., 2008). Exerting pressure and using rational

persuasion are two tactics that fall into this latter category. Leaders who employ pressure as an influence tactic, use persistent reminders, threats and/or insistent demands to influence their followers to carry out an immediate request. When rational persuasion is utilized, leaders make use of logical arguments and factual evidence to convince followers of the importance of carrying out the immediate request (Yukl et al., 2008).

When a tactic is used for a legitimate request and when the tactic is in line with a follower’s values and needs, it is likely that the tactic will be successful and the follower will carry out the request (Yukl et al., 2008). Therefore, tactics that appeal to rational arguments and evidence are more likely to receive compliance than tactics that make use of manipulation, coercion and pressure. To determine whether leadership influence tactics are successful, they are usually evaluated from the perspective of either the leader (Kacmar et al., 2013; Curtis, 2018) or the employee (e.g., Yukl et al., 2005; Clarke and Ward, 2006). However, when leaders are asked to assess their own influence tactics, it is likely that socially desirable ratings are provided. Following this reasoning, it seems more apt to evaluate how followers assess the influence tactics that they experience. Furthermore, an assessment of the leader’s preferred tactic by followers may be of practical use within a work context. In a workplace setting, followers have certain role expectations regarding their leader, i.e., beliefs about acts that leaders should or should not display (Katz and Kahn, 1966; Wong, 2019). Followers have been found to engage in upward influence behaviors when leaders’ behavior deviates from the followers’ beliefs about how they should be treated by their leader (Wong, 2019). Hence, it is to be expected that when an employee experiences negative tactics from a leader, such as pressure, employees will engage in influencing behavior to correct this deviation from desired leader behavior. In addition, the issue will be discussed during yearly development and assessment talks. Leaders may reflect upon their behavior and how it is perceived by their followers and consequently adapt it.

A problem occurs when leaders do not acknowledge or recognize that they put pressure on their employees. In this situation, a gap emerges between what leaders acknowledge that they are doing and what followers experience. Drawing on COR theory (Hobfoll, 2011) and especially on the concept of ‘resource caravan passageways’ (Hobfoll, 2011, 2012), we argue that leader-follower differences in the assessment of leader pressure may act as a resource passageway. The concept of resource passageways refers to organizational “environmental conditions that support, foster, enrich, and protect the resources of individuals, sections or segments of workers, and organizations in total, or that detract, undermine, obstruct, or impoverish people’s or group’s resource reservoirs” (Hobfoll, 2011, p. 119). We argue that leader-follower assessment differences of leader pressure may function as a resource passageway and exert an important boundary effect on the resilience-workability relationship. The assessment differences may suppress and deplete followers’ resources (i.e., resilience) and thwart the possibility to obtain new resources (i.e., improved workability).



In situations where leaders and employees do not differ in their perception of the used influence strategy we expect a positive relationship between resilience and workability. However, in situations where differences between leaders' and employees' perspectives are large, i.e., followers experience more pressure than leaders perceive that they exert, the positive relationship between resilience and workability will be buffered. This is because followers may feel that their fundamental norms of respect and understanding are violated (Kane and Montgomery, 1998), which depletes resources and thwarts the acquirement of resources.

Additionally, one could conceive of a situation where employees assess their leader as less pressuring than the leader assesses him/herself. In such cases, drawing on the principle of resources passageways, it is expected that the possibility to use followers' resources (resilience) for obtaining more resources (workability) is complemented, as followers do not experience thwarting by the leader's use of pressure. Hence, the positive resilience-workability relationship is strengthened. Taken altogether, the following is hypothesized:

*Hypothesis 2:* Leader-employee differences in the assessment of leader pressure moderates the positive relationship between resilience and workability in such a way that this relationship is buffered when followers experience more pressure than leaders perceive that they exert, and strengthened when follower ratings of leader pressure are lower than leader ratings.

Similarly, a gap between leaders' and followers' perceptions may occur when leaders rate themselves as more rationally persuasive than their followers perceive. Followers can influence their leaders' behavior by asking for more explanations, logical arguments and factual evidence to justify the request for certain tasks (Yukl, 2002). Furthermore, such situation may also be openly discussed during annual leader-follower development talks. Similarly to the fact that respectful leaders are considered to have high teachability (Owens et al., 2013), it is likely that leaders, who rate themselves as rational, are open to arguments and evidence from followers of the opposite. Therefore, these leaders may be likely to change their behavior over time. Yet, if a difference in perception persists, i.e., when the leader does not recognize or acknowledge (a lack in) their use of rational persuasion, we expect that this assessment gap may act as a resource passageway that negatively moderates the resilience-workability relationship. Resilient employees will be less inclined to invest their resources in improving their workability when they experience a gap between themselves and their leaders in the assessment of the use of rational persuasion by the leader.

In analogy with the situation in which pressure is being used, it may be the case that followers rate their leaders' use of rational persuasion more positively than the leader does him/herself. In line with the notion of resources passageways, it is expected that the possibility to use followers' resources (resilience) for obtaining more resources (workability) is complemented in these situations,

as followers experience reasonable and justified (well-argued) requests from their leaders. Therefore, the positive resilience-workability relationship will be reinforced. Taken altogether, the following is hypothesized:

*Hypothesis 3:* Leader-employee differences in the assessment of leader rational persuasion moderates the positive relationship between resilience and workability in such a way that this relationship is buffered when follower ratings of leaders' rational persuasion are lower than leader ratings, and strengthened when follower ratings are higher than leader ratings.

Figure 1 shows the conceptual model for this study.

## 3. Materials and methods

### 3.1. Sample

Data were collected via an online survey in two waves from 146 Dutch leader-follower dyads. In the first wave (W1), in the first wave (W1) data were gathered about the influence tactics used by the leader (leader-rated as well as employee-rated). In this wave, also self-reported data were collected from employees about their resilience. In the second wave (W2), data were gathered about the dependent variable, namely workability (employee-rated). The study was approved by the Ethics Committee of the researcher's university. Respondents provided informed consent and various procedures were employed to limit common method bias (ability to stop anytime, request for honest responses, etc.).

In total 222 leaders-follower dyads were invited to participate in the study. The scores of leaders and followers were matched by using tokens and pseudonimisation. After the second wave of data collection among leaders and followers the final sample consisted of 146 unique matched leader-follower pairs. In this dataset 54% of leaders and 44% of followers was male. On average leaders were 46.1 years old ( $SD=9.1$ ), and followers 41.6 years ( $SD=10.7$ ). Furthermore, 88% of leaders and 67% of followers had a bachelor degree or higher.

### 3.2. Measures

Study variables were assessed using validated scales from prior studies.

#### 3.2.1. Employee resilience

Resilience was measured by the nine-item resilience at work scale from Näswall et al. (2019). This scale is explicitly designed to measure resilience capacity in workplace settings (Näswall et al., 2019). Example items are: "I resolve crises competently at work" and "I effectively respond to feedback at work, even criticism." Following recommendations of Geldhof et al. (2014) and Cortina



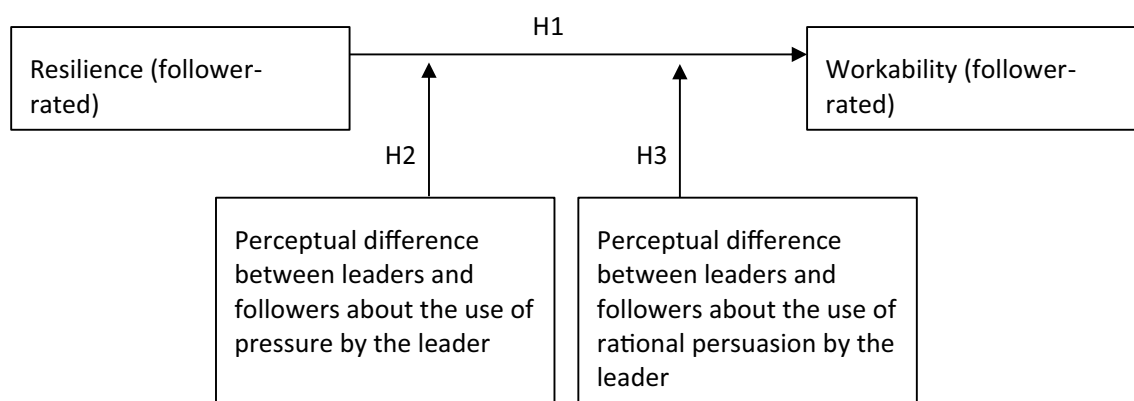


FIGURE 1  
Conceptual model.

et al. (2020), we used McDonald's (1999) omega ( $\omega$ ) to establish internal reliability of the scales, instead of the less accurate Cronbach's alpha. Drawbacks from Cronbach's alpha as compared to other indicators of reliability can be found, among others in Zinbarg et al. (2005), Revelle and Zinbarg (2009) and Cho and Kim (2015). The reliability analysis showed good internal reliability of the scale ( $\omega = 0.80$ ). Similar to Cronbach's alpha, McDonald's omega has a cutoff value of 0.7.

### 3.2.2. Influence tactics

The influence tactics pressure and rational persuasion were each assessed with a four-item scale developed by Yukl et al. (2008). The influence tactics were assessed by leaders as well as followers, i.e., both dyad partners. Leaders rated themselves with respect to their use of pressure and their use of rational persuasion and followers rated the extent in which they perceived pressure (and rational persuasion) from their leader. Two example items for follower-rated pressure are: "My leader repeatedly checks to see whether I have carried out a request" and "My leader tries to pressure me to carry out a request" ( $\omega = 0.69$ ). We employed a referent-shift method (Chan, 1998) to ask the same items to leaders: "I repeatedly check to see whether employee X has carried out a request" and "I try to pressure X to carry out a request" ( $\omega = 0.69$ ). Two example items for follower-rated rational persuasion are: "My leader explains clearly why a proposed change is necessary to accomplish task objectives," and "My leader uses facts and logic to make a persuasive case for a request or proposal" ( $\omega = 0.87$ ). Employing the referent-shift method leads to similar versions for the leader: "I explain clearly why a proposed change is necessary to accomplish task objectives" and "I use facts and logic to make a persuasive case for a request or proposal" ( $\omega = 0.83$ ). We constructed a new variable for the difference in leader-follower assessment of each influence tactic by subtracting the average follower rating from the average leader rating. Positive values therefore indicate that the leader rates him/herself higher on the use of a certain influence tactic than the follower.

### 3.2.3. Workability

Workability was measured with the one-item dimension of the validated shortened Dutch version of the Workability Index (Ilmarinen et al., 2005). The item requires respondents to rate their current workability on a 1–10 rating scale. The use of single-item measures has been extensively discussed in the literature (e.g., Allen et al., 2022; Matthews et al., 2022) and it has been established that single-item measures display ample validity when constructs are unidimensional, well-defined, and narrow in scope (Allen et al., 2022; Matthews et al., 2022), as is the case for workability.

### 3.2.4. Control variables

We controlled for demographic variables, including age, gender and education level as is the custom in studies about resilience and workability (e.g., Näswall et al., 2019). Age was measured in years. Gender was coded 0 for male and 1 for female. Education level was evaluated using six levels common to the Dutch educational system (1 = basic education; 2 = high school; 3 = applied education; 4 = higher applied education; 5 = university degree; 6 = PhD).

## 3.3. Analytical strategy

Analyses were performed using Jamovi open source software (The Jamovi Project, 2021), which uses R (R Core Team, 2021), as well as PROCESS for R (version 4.0.1). Collinearity statistics for the independent variables showed that all Variance Inflated Factors (VIFs) were below the recommended threshold of four (Hair et al., 2017), with the highest VIF being 1.06. Using a score-type variable for the leader-follower perception differences, limits the possibilities for testing convergent discriminant validity of the entire model. When assessing model fit by means of a Confirmatory Factor Analysis (CFA), including all items of resilience, leader-rated influence tactics and follower-rated influence tactics in a one-factor model generated the following fit

measures:  $\chi^2=985$ ;  $df=275$ ;  $RMSEA=0.096$ ;  $CFI=0.46$ ;  $TLI=0.41$ . The CFA for the five factor-model showed that all items loaded on the intended factors, as is reflected in the fit statistics:  $\chi^2=381$ ;  $df=265$ ;  $RMSEA=0.039$ ;  $CFI=0.91$ ;  $TLI=0.90$ ). Altogether, the CFAs indicated that the five-factor structure has a better fit than the alternative, one-factor model specification.

After performing a regression analysis, two moderation models were analyzed, using 10,000 bootstrap samples. Predictor variables were mean-centered before the analysis to enhance the interpretability of the moderation analyses. The first moderation model pertains to the moderation of the resilience-workability relationship by differences in assessment of leader pressure. The second moderation model applies the assessment of leader rational persuasion as a moderator in the resilience-workability relationship.

## 4. Results

The correlation matrix in [Table 1](#) summarizes means, standard deviations and correlations between the main variables in our study. [Table 1](#) shows that resilience at wave 1 (W1) is positively associated with workability at wave 2 (W2). Furthermore, the leader's use of rational persuasion in the perception of the follower is positively related to the leader's own rating of the degree to which this influence tactic is used, suggesting that leaders and followers align in their perspective. Contrastingly, the leader's own rating of the use of pressure is not related to the perception of the follower about the extent to which the leader uses this influence tactic. This finding suggests that leaders and followers may differ in their assessment of the leader's use of pressure. Interestingly, the mean of leader-rated use of pressure is higher than the mean ratings made by followers, suggesting that on average followers perceive less pressure than leaders perceive to exercise.

The correlations between the study variables and the demographic control variables provide the following insights. The education level of the follower is positively and significantly related to the use of persuasion of the leader ( $r=0.18$ ). This relationship could signal that highly educated followers are more likely to be encountered with rational persuasion than lower educated followers. Yet, the coefficient is rather small (well below 0.3, which is a commonly used threshold, e.g., [Caniëls et al., 2022](#)). Furthermore, [Table 1](#) shows that age and gender of the follower are significantly associated with the perceptual difference between leaders and followers about the use of pressure (DPRES). Given the fact that DPRES concerns the discrepancy in perception between leader and follower it is difficult to assess whose gender/age (that of the follower or that of the leader) is showing the association. When observing the follower ratings and leader ratings (columns 5 and 6 in [Table 1](#)), no significant association between age/gender and the use of pressure can be identified. Taken together with the argument for parsimonious study designs and exclusion of impotent control variables ([Becker, 2005](#); [Bernerth and Aguinis, 2016](#)), these controls were left out of

further analysis to increase its power. Results from the regression and moderation analyses are shown in [Table 2](#). As expected, resilience is shown to be positively and significantly related to workability, supporting hypothesis 1. The results further indicate a significant interaction between resilience and a leader-follower perceptual difference about the use of pressure, which is supportive of hypothesis 2. The interaction between resilience and a leader-follower perceptual difference about the use of rational persuasion is not significant. Hence, hypothesis 3 is not supported.

To analyse the significant moderation effect of perceptual differences about the use of pressure, a simple slope analysis was performed. Following the procedure suggested by [Aiken and West \(1991\)](#), simple slopes were tested for high (one standard deviation above the mean), moderate (mean) and low (one standard deviation below the mean) levels of the moderator. The significant interaction was plotted in [Figure 2](#) using [The Jamovi Project \(2021\)](#). [Figure 2](#) shows that the green (high moderator level;  $b=0.07$ ) line is less steep than the red (average moderator level;  $b=0.69$ ), indicating that high perceptual differences between leaders and followers concerning the leader's use of pressure undermines the resilience-workability relationship. Additionally, the blue line is steeper ( $b=1.31$ ) than the red line ( $b=0.69$ ), indicating that low perceptual differences between leaders and followers concerning the leader's use of pressure strengthens the resilience-workability relationship. The slopes of the blue and red lines significantly differ from zero. The slope of the green line does not significantly differ from zero. This pattern of results is in line with what was expected in hypothesis 2 and suggests the presence of a resource passageway.

## 5. Discussion

Most studies have explored leadership as an essential supportive (or hindering) factor that shapes the performance of employees. The present study assessed a dyadic perspective on the use of influence tactics by the leader. By investigating this issue, this study is one of the first to explore the boundary conditions that determine whether and how resilient behavior of employees is related to their workability. We found that leader-follower differences in perception about the use of pressure as an influence tactic moderates the resilience-workability relationship of followers. Where on average resilient employees possess resources that are associated with a high workability, this positive relationship is buffered when followers experience more pressure from their leader than the leader is thinking that he/she exerts on the follower. We did not find support for a similar effect with regard to rational persuasion.

The findings of this study have several theoretical and practical implications. First, our study contributes to COR theory by investigating a relatively less examined element of COR theory, namely the role of resource passageways ([Halbesleben et al., 2014](#)). Resource passageways are shaped by organizational circumstances that may stimulate the creation and maintenance of resources when

TABLE 1 Correlation matrix.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Workability (follower-rated; W2)	7.82	1.3	—													
2. Resilience (follower-rated; W1)	4.14	0.46	0.21***	(0.80)												
3. Perceptual difference about the use of pressure (DPRES)	0.38	0.69	0.08	0.17*	—											
4. Perceptual difference about the use of rational persuasion (DRATP)	0.03	0.78	0.01	−0.15	0.15	—										
5. Use of pressure (leader-rated, W1)	2.02	0.53	0.02	0.06	0.70***	0.12	(0.69)									
6. Use of pressure (follower-rated, W1)	1.65	0.49	−0.04	−0.14	−0.64***	−0.08	0.11	(0.69)								
7. Use of rational persuasion (leader-rated, W1)	4.00	0.6	−0.05	0.13	0.11	0.57***	0.10	−0.04	(0.83)							
8. Use of rational persuasion (follower-rated, W1)	3.95	0.68	−0.07	0.31***	−0.07	−0.68***	−0.04	0.06	0.22**	(0.87)						
9. Gender (leader)	0.46	0.5	−0.04	0.02	−0.04	−0.10	−0.15	−0.08	−0.13	−0.01	—					
10. Gender (follower)	0.56	0.5	−0.10	0.14*	−0.04	0.03	−0.03	−0.01	0.02	0.02	0.28***	—				
11. Education level (leader)	4.36	0.86	0.06	0.02	−0.05	−0.06	−0.03	0.03	0.14	0.16	0.06	0.08	—			
12. Education level (follower)	3.93	0.93	0.07	0.04	−0.07	0.15	−0.10	−0.05	0.18*	−0.03	−0.03	−0.02	0.14*	—		
13. Age (leader)	46.1	9.11	0.04	−0.06	0.06	0.14	−0.04	−0.07	0.04	−0.11	−0.09	0.06	0.03	0.11	—	
14. Age (follower)	41.6	10.7	0.02	−0.12	0.24**	0.08	0.15	−0.14	0.08	−0.03	−0.04	−0.10	0.02	−0.12	0.25***	—

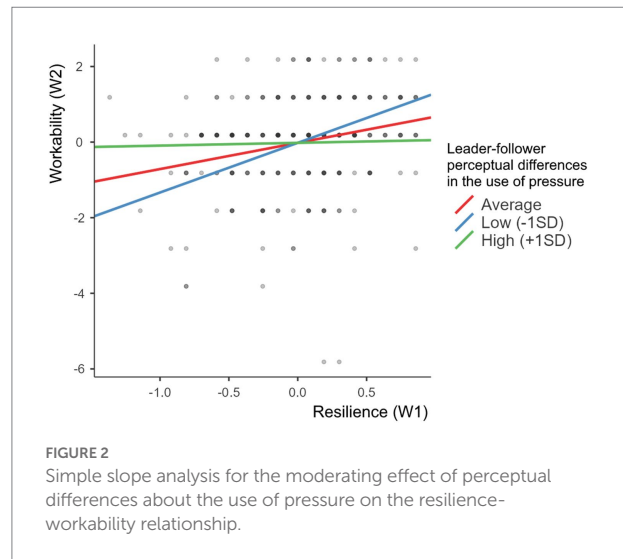
\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; SD denotes the standard deviation; McDonald's omega is displayed between brackets on the diagonal.

TABLE 2 Moderation analysis with workability as dependent variable (employee-rated; W2;  $n=146$ ).

	Regression model	Moderation Model 1 Pressure	Moderation Model 2 Rational Persuasion
Intercept	5.024	7.840	7.787
Resilience (Employee-rated; W1)	0.662*	0.694**	0.675**
Perceptual difference about the use of pressure (DPRES)	0.075	0.112	
Perceptual difference about the use of rational persuasion (DRATP)	0.068		0.069
Interaction (Resilience * DPRES)		-0.908*	
Interaction (Resilience * DRATP)			-0.153
$R^2$	0.053	0.083	0.053
$F$	2.63	4.29	2.63

\*\* $p < 0.01$ ; \* $p < 0.05$ .

they are favorable or may deplete resources when they are stacked against employees (Hobfoll, 2014). In this study, leader-follower assessment differences regarding the leader's use of pressure as an influence tactic have been found to hamper the conservation of resources (specifically, resilience) by followers. The assessment difference adds an extra load on followers, who try to conserve their scarce resources, and such differences buffer a positive resilience-workability relationship. In other words, assessment differences concerning the use of pressure suppress the utilization of resilience by followers and its passage to workability. As predicted by COR theory, and consistent with the notion of resource passageways (Halbesleben et al., 2014), resource gains from resilience in the form of increased workability are overshadowed by the larger influence of resource loss as a consequence of a pressuring leader who does not fully recognize his/her pressuring influence. Evidence for this effect is indicated by the way in which the red line in Figure 2 transforms into the green line and becomes less steep when followers rate the utilization of pressure higher than their leaders. These results tie in with prior studies about the boundary condition asserted by a safety climate and studies on how resources function



(e.g., Loh et al., 2018). The findings are also in line with leadership research that explores the importance of follower perceptions of interpersonal leadership (Aslam et al., 2021) and the leader-member exchange relationship (for a review, see Epitropaki and Martin, 2016) in accelerating (or hindering) employees' investment of energy and resources in performance behaviors. When employees entertain positive perceptions of interpersonal leadership and of their personal leader-member exchange relationship, they develop a sense of psychological safety that is conducive to an initiative climate, i.e., a climate in which employees are self-starting, oriented at improvements, persistent and long-term-focused (Aslam et al., 2021).

Second, this study advances current insights into the impact of differences in perspective between leaders and followers about the degree in which certain influence tactics are used. We found no effect of leader-follower assessment differences regarding rational persuasion, which may be explained by the notion that rational persuasion appeals to the ratio of followers, whereas pressure may have an effect on a more subconscious level. Leaders who use rational persuasion to a larger extent than they acknowledge are at the root of a leader-follower assessment difference, but the findings indicate that this difference does not influence the resilience-workability relationship. In contrast, influencing followers by pressuring them depletes their resources and leader-follower assessment differences in the use of pressure counteracts the resource gain process that on average exists between resilience and workability. When followers feel pressure (unacknowledged by their leader), they hold close to their resources (resilience) and do not invest them into workability. Apparently, perceptual differences about pressure are more damaging to resource development than perceptual differences about persuasion. Unacknowledged pressure of the leader can induce feelings of hopelessness in the follower, as the situation is not likely to change any time soon. This realization may therefore have a resource depleting effect. Studies about destructive leadership

(Trépanier et al., 2013) and dark triad character traits of leaders (Volmer et al., 2016) have shown how pressure from leaders, especially when it cannot be addressed, undermines followers' motivation and drains their personal resources and can even jeopardize their health (Kile, 1990). In contrast, unacknowledged (lack of) the use of persuasion as an influence tactic by leaders may feel different to followers, as leaders who claim to be rational may do their best in explaining their motivations for their task requests to followers. By asking for more clarification and underlying reasons for the task request, followers may satisfy their need for arguments to justify the request for certain tasks (Yukl, 2002). In other words, followers have the means to address the perceived lack of using persuasion by their leaders. Perceptual gaps between leaders and followers about the leaders' use of rational persuasion can therefore be overcome.

## 5.1. Practical implications

The study's findings suggest that leader-follower assessment differences with regard to the leader's use of pressure served as a resource passageway, draining resources, resulting in a buffered relation between followers' resilience and workability. This study's results suggest that organizations can improve the resilience-workability relationship by curbing leader-follower assessment differences of influence tactics (specifically, the utilization of pressure by the leader). Organizations are advised to undertake efforts to improve the self-awareness of leaders. Here could lie a prominent role for human resource management practices, as targeted trainings may be beneficial in this respect. It has been shown that training leaders in self-awareness is positively associated with follower-rated transformational leadership (Cerni et al., 2010). Therefore, self-awareness trainings are expected to diminish the gap between leaders' and followers' perception of leaders' utilization of pressure, which may in turn lift its buffering effect on the followers' resilience-workability relationship.

Furthermore, the study provided evidence of a positive association between resilience and workability of employees. Therefore, organizations may want to direct resources toward improving employee resilience. Previous studies have posed several concrete ways in which resilience among workers can be stimulated (Bardoel et al., 2014; Caniëls and Hatak, 2019). Human resource practices that are oriented at personal development and growth can be offered to employees in order to strengthen their resilience and thereby their workability. For example, specifically designed interventions may encourage and foster resilience qualities among employees (Bardoel et al., 2014). In addition, organizations can provide adequate tools to buffer the depletion of resources as much as possible. Not only self-awareness trainings for leaders that diminish perception gaps can help in this respect, but also organizational practices that curtail the depletion of resources in general. For example, it has been shown that when

employees are given a degree of control over their work that matches their needs, this job control acts as a buffer against depletion of resources (Parker et al., 2010).

## 5.2. Limitations and future research

Several limitations have to be taken into account when interpreting this study. Firstly, we adopted a two-wave design to test a moderation model. Although a two-wave study is preferred over a cross-sectional design, we can merely offer evidence of causality, but we cannot provide absolute proof. Future studies may want to test the robustness of our proposed model by correcting for auto-correlations in the dependent variable.

Secondly, although evaluating leader-follower perception differences in the leader's use of influence tactics is new and original, we were limited in that we tested only two influence tactics, namely pressure and rational persuasion. Yukl et al. (2008) have identified a wide range of possible tactics that can be used in the workplace. Future studies may broaden the set of influence tactics under study. Even though studies are known to use subsets of influence tactics (e.g., Sparrowe et al., 2006), it may be especially interesting for future research to design studies that incorporate all tactics.

Thirdly, as was pointed out by one of the anonymous reviewers, Hobfoll et al. (2018) proposes that resource spirals are more rigid than loss spirals, i.e., the progression on a loss spiral is more swift than the progression on a resource spiral. The current study did only explore whether a resource passageway could be established at all. Future studies may have *a priori* hypotheses about the relative strength of a loss spiral versus a resource/gain spiral. Testing such hypotheses would require multiple (more than two) measurements of this study's variables.

Lastly, although multiple sources (leaders and followers) were used for this study, the antecedent and outcome variables were rated by followers, while only moderating variables were rated by both, followers and leaders. This procedure may have introduced common method bias to the study. Given that resilience and workability are difficult to assess by others than oneself, because external raters often fall back on general impressions (Lance et al., 1994), the use of self-reports in such cases is generally warranted (Conway and Lance, 2010). Furthermore, we followed recommendations of Podsakoff et al. (2012) about curbing method biases through survey design, by measuring antecedent and outcome variables at different points in time. Therefore, given the nature of the study variables, as well as the multiwave design of the study, risks of common method bias are low. Nevertheless, future studies may pursue alternative research designs to further curtail the risk of bias. Relatedly, due to the fact that the study used multiple waves (wave 1 and wave 2) and multiple sources (leaders and followers), the final size of the sample is quite small ( $n = 146$ ), which may have consequences for the accuracy and reliability of the estimates (Shadish et al., 2002). This is the price paid for the rigorous study design that allows for a time lag



between the measurement of the dependent and independent variables, thereby following Podsakoff et al.'s (2003) recommendations for limiting the risk on method biases through study design. Future studies are advised to check the robustness of this study's model in larger samples.

Notwithstanding these limitations, the present study and its findings has advanced current insights about how the resilience-workability relationship can be influenced by leader-follower differences in assessment of the leader's use of influence tactics.

## Data availability statement

The datasets presented in this article are not readily available because respondents have not consented to sharing the data. Requests to access the datasets should be directed to MC, [marjolein.caniels@ou.nl](mailto:marjolein.caniels@ou.nl).

## Ethics statement

The studies involving human participants were reviewed and approved by CETO (Commissie Ethische Toetsing) of the Open Universiteit Open Universiteit, Heerlen, Netherlands. The patients/participants provided their written informed consent to participate in this study.

## References

- Aiken, L. S., and West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, London: Sage.
- Allen, M. S., Iliescu, D., and Greiff, S. (2022). Single item measures in psychological science. *Eur. J. Psychol. Assess.* 38, 1–5. doi: 10.1027/1015-5759/a000699
- Aslam, M. Z., Fateh, A., Omar, S., and Nazri, M. (2021). The role of initiative climate as a resource caravan passageway in developing proactive service performance. *Asia Pac. J. Bus. Adm.* 14, 691–705. doi: 10.1108/APJBA-09-2021-0454
- Avey, J. B., Luthans, F., and Jensen, S. M. (2009). Psychological capital: a positive resource for combating employee stress and turnover. *Hum. Resour. Manag.* 48, 677–693. doi: 10.1002/hrm.20294
- Avey, J. B., Reichard, R. J., Luthans, F., and Mhatre, K. M. (2011). Meta-analysis of the impact of positive psychological capital on employees' attitudes, behaviors, and performance. *Hum. Resour. Dev. Q.* 22, 127–152. doi: 10.1002/hrdq.20070
- Bardoel, E. A., Pettit, T. M., De Cieri, H., and McMillan, L. (2014). Employee resilience: an emerging challenge for HRM. *Asia Pac. J. Hum. Resour.* 52, 279–297. doi: 10.1111/1744-7941.12033
- Becker, T. E. (2005). Potential problems in statistical control of variables in organizational research. *Organ. Res. Methods* 8, 274–289. doi: 10.1177/1094428105278021
- Bernerth, J. B., and Aguinis, H. (2016). A critical review and best-practice recommendations for control variable usage. *Pers. Psychol.* 69, 229–283. doi: 10.1111/peps.12103
- Caniëls, M. C. J., and Baaten, S. M. (2019). How a learning-oriented organizational climate is linked to different proactive behaviors: the role of employee resilience. *Soc. Indic. Res.* 143, 561–577. doi: 10.1007/s11205-018-1996-y
- Caniëls, M. C. J., and Hatak, I. (2019). Employee resilience: considering both the social side and the economic side of leader-follower exchanges in conjunction with the dark side of followers' personality. *Int. J. Human Resour. Manag.* 33, 297–328. doi: 10.1080/09585192.2019.1695648
- Caniëls, M. C. J., Nikolova, I., Hatak, I., and de Weerd-Nederhof, P. C. (2022). Antecedents of COVID-19 rumination: a three-wave study. *Scand. J. Psychol.* 63, 476–483. doi: 10.1111/SJOP.12832
- Cerni, T., Curtis, G. J., and Colmar, S. H. (2010). Increasing transformational leadership by developing leaders' information-processing systems. *J. Leadersh. Stud.* 4, 51–65. doi: 10.1002/jls.20177
- Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: a typology of composition models. *J. Appl. Psychol.* 83, 234–246. doi: 10.1037/0021-9010.83.2.234
- Cho, E., and Kim, S. (2015). Cronbach's coefficient alpha: well known but poorly understood. *Organ. Res. Methods* 18, 207–230. doi: 10.1177/1094428114555994
- Clarke, S., and Ward, K. (2006). The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk Anal.* 26, 1175–1185. doi: 10.1111/j.1539-6924.2006.00824.x
- Conway, J. M., and Lance, C. E. (2010). What reviewers should expect from authors regarding common method bias in organizational research. *J. Bus. Psychol.* 25, 325–334. doi: 10.1007/s10869-010-9181-6
- Cortina, J. M., Sheng, Z., Keener, S. K., Keeler, K. R., Grubb, L. K., Schmitt, N., et al. (2020). From alpha to omega and beyond! A look at the past, present, and (possible) future of psychometric soundness in the journal of applied psychology. *J. Appl. Psychol.* 105, 1351–1381. doi: 10.1037/apl0000815
- Coutu, D. L. (2002). How resilience works. *Harv. Bus. Rev.* 80, 46–50.
- Curtis, G. J. (2018). Connecting influence tactics with full-range leadership styles. *Leadersh. Organ. Dev. J.* 39, 2–13. doi: 10.1108/LODJ-09-2016-0221
- Epitropaki, O., and Martin, R. (2016). "LMX and work attitudes: is there anything left unsaid or unexamined?" in *The Oxford Handbook of Leader-Member Exchange*. eds. T. N. Bauer and B. E. Erdogan (New York, NY: Oxford University Press), 157–174.
- Geldhof, G. J., Preacher, K. J., and Zyphur, M. J. (2014). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychol. Methods* 19, 72–91. doi: 10.1037/a0032138
- Gómez-Molinero, R., Ruiz-González, P., Zayas, A., and Gil, R. (2019). Resilience and workability among breast cancer survivors. *INFAD (Barcelona)* 4, 37–44. doi: 10.17060/jiodaep.2019.n1.v4.1503

## Author contributions

MC gathered the data, performed the analyses, and wrote the paper.

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## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Hair, J., Hollingsworth, C. L., Randolph, A. B., and Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Ind. Manag. Data Syst.* 117, 442–458. doi: 10.1108/IMDS-04-2016-0130
- Halbesleben, J. R., Neveu, J. P., Paustian-Underdahl, S. C., and Westman, M. (2014). Getting to the 'COR': understanding the role of resources in conservation of resources theory. *J. Manag.* 40, 1334–1364. doi: 10.1177/0149206314527130
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. doi: 10.1037/0003-066X.44.3.513
- Hobfoll, S. E. (2001). The influence of culture, community, and the nested self in the stress process: Advancing conservation of resources theory. *Appl. Psychol. Int. Rev.* 50, 337–370.
- Hobfoll, S. E. (2011). Conservation of resource caravans and engaged settings. *J. Occup. Organ. Psychol.* 84, 116–122. doi: 10.1111/j.2044-8325.2010.02016.x
- Hobfoll, S. E. (2012). Conservation of resources and disaster in cultural context: the caravans and passageways for resources. *Psychiatry* 75, 227–232. doi: 10.1521/psyc.2012.75.3.227
- Hobfoll, S. E. (2014). Resource caravans and resource caravan passageways: A new paradigm for trauma responding. *Intervention (Amstelveen, Netherlands)* 12, 21–32. doi: 10.1097/WTF.0000000000000067
- Hobfoll, S. E., Halbesleben, J., Neveu, J.-P., and Westman, M. (2018). Conservation of resources in the organizational context: the reality of resources and their consequences. *Annu. Rev. Organ. Psychol. Organ. Behav.* 5, 103–128.
- Ilmarinen, J., Tuomi, K., and Seitsamo, J. (2005). New dimensions of work ability. *Int. Congr. Ser.* 1280, 3–7. doi: 10.1016/j.ics.2005.02.060
- Kacmar, K. M., Carlson, D. S., and Harris, K. J. (2013). Interactive effect of leaders' influence tactics and ethical leadership on work effort and helping behavior. *J. Soc. Psychol.* 153, 577–597. doi: 10.1080/00224545.2013.798248
- Kane, K., and Montgomery, K. (1998). A framework for understanding dysempowerment in organizations. *Hum. Resour. Manag.* 37, 263–275. doi: 10.1002/(SICI)1099-050X(199823/24)37:3/4<263::AID-HRM8>3.0.CO;2-U
- Katz, D., and Kahn, R. L. (1966). *The Social Psychology of Organizations*. New York, NY: Wiley.
- Kile, S. M. (1990). *Helsefarleg Leierskap (Health Endangering Leadership)*; Oslo, Norway: Hjemmets Bokforlag.
- Kumar, K., and Beyerlein, M. (1991). Construction and validation of an instrument for measuring ingratiation behaviors in organizational settings. *J. Appl. Psychol.* 76, 619–627. doi: 10.1037/0021-9010.76.5.619
- Kuntz, J. C., Näswall, K., and Malinen, S. (2016). Resilient employees in resilient organizations: flourishing beyond adversity. *Indus. Organ. Psychol. Perspect. Sci. Pract.* 9, 456–462. doi: 10.1017/iop.2016.39
- Lance, C. E., LaPointe, J. A., and Fiscaro, S. A. (1994). Test of three causal models of halo rater error. *Organ. Behav. Hum. Decis. Process.* 57, 83–96. doi: 10.1006/obhd.1994.1005
- Lodi-Smith, J., and Roberts, B. W. (2007). Social investment and personality: a meta-analysis of the relationship of personality traits to investment in work, family, religion, and volunteerism. *Personal. Soc. Psychol. Rev.* 11, 68–86. doi: 10.1177/1088868306294590
- Loh, M. Y., Idris, M. A., Dollard, M. F., and Isahak, M. (2018). Psychosocial safety climate as a moderator of the moderators: contextualizing JDR models and emotional demands effects. *J. Occup. Organ. Psychol.* 91, 620–644. doi: 10.1111/joop.12211
- Luthans, F. (2002). Positive organizational behavior: developing and managing psychological strengths. *Acad. Manag. Perspect.* 16, 57–72. doi: 10.5465/ame.2002.6640181
- Luthans, F., Avolio, B. J., Avey, J. B., and Norman, S. M. (2007). Positive psychological capital: Measurement and relationship with performance and satisfaction. *Pers. Psychol.* 60, 541–572. doi: 10.1111/j.1744-6570.2007.00083.x
- Matthews, R. A., Pineault, L., and Hong, Y. (2022). Normalizing the use of single-item measures. *J. Bus. Psychol.* 37, 639–673. doi: 10.1007/s10869-022-09813-3
- McDonald, R. P. (1999). *Test Theory: A Unified Treatment*. Mahwah, NJ: Erlbaum.
- Meneghel, I., Salanova, M., and Martínez, I. M. (2016). Feeling good makes us stronger. *J. Happiness Stud.* 17, 239–255. doi: 10.1007/s10902-014-9592-6
- Näswall, K., Malinen, S., Kuntz, J., and Hodliffe, M. (2019). Employee resilience: development and validation of a measure. *J. Manag. Psychol.* 34, 353–367. doi: 10.1108/JMP-02-2018-0102
- Owens, B. P., Johnson, M. D., and Mitchell, T. R. (2013). Expressed humility in organizations: implications for performance, teams, and leadership. *Organ. Sci.* 24, 1517–1538. doi: 10.1287/orsc.1120.0795
- Papazoglou, K., and Andersen, J. P. (2014). A guide to utilizing police training as a tool to promote resilience and improve health outcomes among police officers. *Traumatology* 20, 103–111. doi: 10.1037/h0099394
- Parker, S. L., Jimmieson, N. L., and Amiot, C. E. (2010). Self-determination as a moderator of demands and control: implications for employee strain and engagement. *J. Vocat. Behav.* 76, 52–67. doi: 10.1016/j.jvb.2009.06.010
- Paterson, T. A., Luthans, F., and Jeung, W. (2014). Thriving at work: impact of psychological capital and supervisor support. *J. Organ. Behav.* 35, 434–446. doi: 10.1002/job.1907
- Peterson, S. J., Luthans, F., Avolio, B. J., Walumbwa, F. O., and Zhang, Z. (2011). Psychological capital and employee performance: a latent growth modeling approach. *Pers. Psychol.* 64, 427–450. doi: 10.1111/j.1744-6570.2011.01215.x
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Podsakoff, P. M., MacKenzie, S. B., and Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annu. Rev. Psychol.* 63, 539–569. doi: 10.1146/annurev-psych-120710-100452
- R Core Team (2021). R: A Language and Environment for Statistical Computing. (version 4.0) [computer software]. Available at: <https://cran.r-project.org> (Accessed December 22, 2022).
- Revelle, W., and Zinbarg, R. E. (2009). Coefficients alpha, Beta, omega, and the glb: comments on Sijsma. *Psychometrika* 74, 145–154. doi: 10.1007/s11336-008-9102-z
- Roberts, B. W., and Wood, D. (2006). "Personality development in the context of the neo-Socioanalytic model of personality," in *Handbook of Personality Development*. eds. D. K. Mroczek and T. D. Little (Mahwah, NJ: Lawrence Erlbaum Associates Publishers), 11–39.
- Roche, M., Haar, J. M., and Luthans, F. (2014). The role of mindfulness and psychological capital on the well-being of leaders. *J. Occup. Health Psychol.* 19, 476–489. doi: 10.1037/a0037183
- Semeijn, J. H., Caniëls, M. C. J., and Kooistra, D. (2019). Cross-lagged effects of resilience and indicators of sustainable employability: a study among Dutch police officers. Policing: an. *Int. J.* 42, 961–975. doi: 10.1108/PIJPSM-01-2019-0003
- Shadish, W. R., Cook, T. D., and Campbell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston, MA: Houghton Mifflin Company
- Siu, O. L., Cheung, F., and Lui, S. (2015). Linking positive emotions to work well-being and turnover intention among Hong Kong police officers: the role of psychological capital. *J. Happiness Stud.* 16, 367–380. doi: 10.1007/s10902-014-9513-8
- Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., and Bernard, P. (2008). The brief resilience scale: assessing the ability to bounce back. *Int. J. Behav. Med.* 15, 194–200. doi: 10.1080/1070550080222972
- Sparrowe, R. T., Soetjito, B. W., and Kraimer, M. L. (2006). Do leaders' influence tactics relate to members' helping behavior? It depends on the quality of the relationship. *Acad. Manag. J.* 49, 1194–1208. doi: 10.5465/AMJ.2006.23478645
- The Jamovi Project (2021). Jamovi. (version 2.2) [computer software]. Available at: <https://www.jamovi.org> (Accessed December 22, 2022).
- Trépanier, S., Fernet, C., and Austin, S. (2013). Workplace bullying and psychological health at work: the mediating role of satisfaction of needs for autonomy, competence and relatedness. *Work Stress.* 27, 123–140. doi: 10.1080/02678373.2013.782158
- Upadaya, K., Vartiainen, M., and Salmela-Aro, K. (2016). From job demands and resources to work engagement, burnout, life satisfaction, depressive symptoms, and occupational health. *Burn. Res.* 3, 101–108. doi: 10.1016/j.burn.2016.10.001
- Van den Berg, T. I., Elders, L. A., de Zwart, B. C., and Burdorf, A. (2009). The effects of work-related and individual factors on the work ability index: a systematic review. *Occup. Environ. Med.* 66, 211–220. doi: 10.1136/oem.2008.039883
- Van Dam, P., and Shannon, E. A. (2013). Developing positive leadership in health and human services: Original research. *SA J. Ind. Psychol.* 39, 1–11.
- Volmer, J., Koch, I. K., and Göritz, A. S. (2016). The bright and dark sides of leaders' dark triad traits: effects on subordinates' career success and well-being. *Pers. Individ. Differ.* 101, 413–418. doi: 10.1016/j.paid.2016.06.046
- Wang, Z., Li, C., and Li, X. (2017). Resilience, leadership and work engagement: the mediating role of positive affect. *Soc. Indic. Res.* 132, 699–708. doi: 10.1007/s11205-016-1306-5/10.1177/0149206307305562
- Wong, S. I. (2019). Influencing upward: Subordinates' responses to leaders' (un) awareness of their empowerment expectations. *Int. J. Hum. Resour. Manag.* 30, 1604–1634. doi: 10.1080/09585192.2017.1299194
- Xanthopoulou, D., Bakker, A. B., Demerouti, E., and Schaufeli, W. B. (2009). Reciprocal relationships between job resources, personal resources, and work engagement. *J. Vocat. Behav.* 74, 235–244. doi: 10.1016/j.jvb.2008.11.003

Youssef, C. M., and Luthans, F. (2007). Positive organizational behavior in the workplace. *J. Manag.* 33, 774–800. doi: 10.1177/0149206307305562

Yukl, G. (2002). *Leadership in Organizations (5th Edn)*. Upper Saddle River, NJ: Prentice-Hall.

Yukl, G., Chavez, C., and Seifert, C. F. (2005). Assessing the construct validity and utility of two new influence tactics. *J. Organ. Behav.* 26, 705–725. doi: 10.1002/job.335

Yukl, G., Seifert, C. F., and Chavez, C. (2008). Validation of the extended influence behavior questionnaire. *Leadersh. Q.* 19, 609–621. doi: 10.1016/j.leaqua.2008.07.006

Zinbarg, R. E., Revelle, W., Yovel, I., and Li, W. (2005). Cronbach's alpha, Revelle's, and McDonald's omega H: their relations with each other and two alternative conceptualizations of reliability. *Psychometrika* 70, 123–133. doi: 10.1007/s11336-003-0974-7



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# Workplace ostracism and employee wellbeing: A conservation of resource perspective

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**Introduction:** As a common phenomenon of workplace ostracism in corporate management, it is urgent to clarify how it affects employee well-being.

**Methods:** Based on Conservation of Resource Theory, this study investigates the mechanisms of workplace ostracism on employee well-being and examines the mediating role of emotional exhaustion and the moderating role of team forgiveness climate by surveying 282 employees from 68 companies in mainland China.

**Results:** The results show that (1) workplace ostracism negatively affects employee well-being; (2) emotional exhaustion plays a mediating role between workplace ostracism and employee well-being; (3) team forgiveness climate weakens the negative effect of workplace ostracism on emotional exhaustion and negatively moderates the indirect effect of workplace ostracism on employee well-being through emotional exhaustion.

**Discussion:** It tries to provide theoretical basis and practical guidance for eliminating the negative effects of workplace ostracism and focusing on employee well-being.

## KEYWORDS

workplace ostracism, forgiveness climate, emotional exhaustion, employee wellbeing, conservation of resource theory (COR)

## 1. Introduction

Workplace ostracism is prevalent in management practice. In the United States, a survey of 262 workplace employees revealed that nearly 70% of employees felt they had been ostracized by their leaders or co-workers at work (1). Similarly, in China, a month-long survey of more than 10,000 employees conducted by Zhaopin Ltd., a workplace research company, revealed that nearly half of employees believe they are ostracized at work (2). The phenomenon that individuals perceive being neglected, excluded, or rejected by others in the workplace is becoming an increasingly common and serious problem, with damaging consequences for victims (3). In the Chinese context, workplace ostracism had a negative impact on victims' physical and psychological health (4), work attitude (3), workplace behavior (5), work performance (6), and innovation (7), and the impact intensity decreases successively (8). As China's economy takes off and material living standards improve, people are becoming more and more conscious of their physical and psychological health and wellbeing experiences. The term "wellbeing" has gradually appeared in organization management (9) as a relatively broad

concept that includes three aspects: work, psychology, and life (10). For employees, wellbeing is closely related to individual work engagement (11), life satisfaction (12), and occupational health (13). For enterprises, employees with a sense of wellbeing are more likely to achieve high levels of work performance, which is conducive to improving enterprise efficiency (14). In China, where the “people-oriented” management mode is advocated, paying attention to employees’ physical and psychological health and improving their wellbeing are conducive to a win-win situation for both employees and the company (15, 16). However, workplace ostracism, as a widespread and relatively new phenomenon, is a difficult issue for organizations to solve, whether it damages employee wellbeing or how it affects their wellbeing.

Ostracism, the act of being neglected or excluded, significantly influences behavior toward others (17). The workplace is a social setting where ostracism occurs at a high frequency. Workplace ostracism is the degree to which employees feel ignored or excluded by other members of the workplace (3). Workplace ostracism will significantly increase employees’ psychological stress, lead to health problems, and even trigger workplace deviant behaviors that can impair the normal operation of the organization (18). Given the prevalence of workplace ostracism and its serious harmful effects on employees and organizations, and the influence of Chinese “people-oriented” management mode, the focus is on the physical and psychological health of employees. This study aims to investigate the mechanism of workplace ostracism on employee wellbeing.

Workplace ostracism, as a stressful situation for employees, can be understood to some extent as a threat of resource loss. However, the conservation of resource theory (COR) initially emerged as a stress theory, emphasizing the cultivation, retention, and maintenance of resources (19). The conservation of resource theory suggests that individuals have the incentive to retain existing resources and acquire new ones and also take the initiative to create resource surpluses to offset the potential loss of resources in the future (19). As a potential threat of resource loss, workplace ostracism tends to trigger tension and stress in individuals (19, 20). At the same time, workplace ostracism, as a stressful situation that generates the threat of resource loss and resource loss, brings greater physical and psychological stress to the ostracized person, leading to tension and anxiety, generating emotional exhaustion, which in turn destroys their good experiences in work and life and affects employee wellbeing.

Although workplace ostracism will trigger negative emotions and experiences, its effects will also be influenced by situational factors. Employees’ emotions, psychological states, and workplace behaviors are interfered with by the team climate (21, 22). Team forgiveness climate as an organizational phenomenon is manifested by team members’ empathy and benevolence for the faults or failures of others (23). It

can be interpreted as a shared perception of team support, encouragement, and expectations in the face of conflict or failure (24). The care and understanding given to employees by the team forgiveness climate, as a gaining resource, help to alleviate and compensate for the loss of resources caused by employees being excluded or isolated.

Therefore, in order to make up for the research gap by focusing on employee wellbeing from negative perspectives, based on the aforementioned analysis, this study investigates the impact of workplace ostracism on employee wellbeing in the context of Chinese organizational workplaces by using the conservation of resource theory as the basis for a survey of teams and employees in mainland Chinese companies. At the same time, employees’ emotional exhaustion is considered a resource variable of individual traits, and the mediating role of emotional exhaustion between workplace ostracism and employees’ wellbeing is discussed. It attempts to reveal the specific mechanism of how workplace ostracism affects employee wellbeing from the perspective of psychological traits. Moreover, considering that team climate has an intervening effect on employees’ psychology and behavior in the organization, team forgiveness climate is used as a contextual variable in this study to discuss the boundary conditions of workplace ostracism on employee wellbeing, to expand the understanding of the impact of workplace ostracism and its mechanism of action, and to provide inspiration and reference to the corresponding management practices.

## 2. Theory and hypothesis

### 2.1. Workplace ostracism and employee wellbeing

Employee wellbeing refers to employees’ evaluation of the overall quality of their career and work experience (25). Zheng et al. divide wellbeing into three dimensions (10): work, psychological, and life wellbeing, which more comprehensively reflect the wellbeing status of individuals.

As a common social phenomenon, workplace ostracism behaviors include silent treatment, neglect, and avoidance of contact (18). Workplace ostracism is a specific form of ostracism, a phenomenon in which individuals perceive that they are neglected or rejected by others in the workplace, a kind of emotional office abuse (3, 26). When employees suffer from ostracism, it will cause them to suffer from self-esteem, generate negative emotions, reduce work efficiency (27, 28), and hinder the generation of wellbeing (29). First, when employees perceive ostracism or isolation in the team, interpersonal stress will be generated, which will affect employees’ engagement and satisfaction with their work and reduce their wellbeing at work. Second, ostracism will cause employees’ anger, anxiety, and even negative psychological feelings, such as



self-doubt and self-denial, leading to excessive consumption of their psychological resources and ultimately reducing their psychological wellbeing (30). Third, as producers of “emotional office abuse,” ostracized employees are perceived as “outsiders” and have certain prejudices (31). On the one hand, ostracized employees have the feeling of “not fitting in,” which increases the burden of getting along with colleagues. On the other hand, it is difficult for the ostracized employees to obtain care and help from the organization members in their work and life, which reduces their wellbeing in work, psychology, and life and negatively affects employees’ sense of happiness. Finally, workplace ostracism is often associated with punitive measures, implying employees have done something wrong, thus, reducing employees’ organizational commitment, causing the ostracized individuals to be less engaged in their work (32, 33), undermining employees’ good experiences at work, in life, etc., and ultimately inhibiting employee wellbeing (18, 34). At the same time, according to the belongingness theory, workplace ostracism makes it difficult for employees to belong to the work team, which affects employees’ psychology, behavior, and work-related effects (18, 35, 36) and also affects employees’ sense of wellbeing (37, 38). Therefore, Hypothesis 1 is proposed:

Hypothesis 1: Workplace ostracism negatively affects employee wellbeing.

## 2.2. The mediating role of emotional exhaustion

Emotional exhaustion refers to an individual’s loss of interest and enthusiasm for people, things, and objects around, and a feeling of physical and psychological exhaustion and energy depletion, reflecting the individual’s negative emotional experience and state, and is often regarded as a resource shortage (39, 40). According to the conservation of resource theory, the loss of resources puts more pressure on the individual and the individual has to invest more resources to offset further resource losses (41). Once a loss of resources has occurred, it may lead to a continuous loss, resulting in a spiral of negative effects (42, 43).

Workplace ostracism will cause the depletion of employees’ emotional and psychological resources, which will lead to emotional exhaustion (44, 45). First, according to the conservation of resource theory, individuals have the motivation to protect, maintain, and obtain their own resources and become stressed and exhausted when their resources are reduced or threatened. If an individual’s depleted resources are not replenished in a timely manner, it can easily lead to emotional exhaustion (46). Second, when employees suffer from workplace ostracism, they are cut off from their emotional connections with other employees. Individuals need social interactions as a way to communicate emotionally to strengthen their emotional resources and maintain physical and psychological health (47).

When the need for shared emotions is not met, emotional resources are lost and, thus, suffer emotional exhaustion (35). Third, ostracism is a major challenge for individuals to hold resources and can reduce the resources held by individuals (48). On the one hand, individuals will consume their psychological resources in the process of handling and coping with ostracism. On the other hand, in their daily work, employees need to contact each other in order to obtain external resources, and it is difficult for individuals who suffer from ostracism to replenish their resources from others, so they can only deplete their own resources. Subsequently, their own resources become less, and they may become stressed, anxious, and exhausted. Finally, being ostracized means that individuals lack reliable interpersonal networks, making it difficult for employees to trust members of the organization and lack a sense of security. In this low trust and insecure workplace environment, individuals who suffer from ostracism will take a more cautious stance to maintain relationships with surrounding employees, which will consume more of their own resources and increase the self-depletion of resources, leading to emotional exhaustion in the long run.

Emotional exhaustion, a typical manifestation of psychological overwork, can further lead to a lack of emotional and psychological resources and reduce employees’ sense of wellbeing. On the one hand, according to the affective event theory, negative emotional events will affect individuals’ emotional responses, and at the same time, individuals’ emotional responses will further influence their attitudes and behaviors (49, 50). On the other hand, emotionally depleted employees are more likely to show dissatisfaction and aversion to their jobs and lives, resulting in turnover intention and lower life satisfaction (45). Emotional exhaustion reflects individual psychological feelings and health status and is a negative indicator of employee wellbeing (51). When employees perceive workplace ostracism, as a negative emotional event, based on the social exchange theory, it triggers a depletion of their emotional resources and ultimately leads to a decrease in wellbeing (26, 36). Therefore, this study infers that the higher the level of workplace ostracism an individual suffers, the higher degree of emotional exhaustion, which in turn will affect the individual’s wellbeing and inhibit employee wellbeing. Therefore, Hypothesis 2 is put forward as follows:

Hypothesis 2: Emotional exhaustion mediates the relationship between workplace ostracism and employee wellbeing.

## 2.3. The moderating role of forgiveness climate

Forgiveness is an individual’s conscious effort to relieve resentment and abandon potential retaliation in the face

of offense or aggression (52). With the intensification of social competition, various conflicts burst out (53). In the workplace, employees have conflicts over job resources and promotion opportunities. At this point, if the organization fails to develop an effective forgiveness climate, employees will inevitably waste resources and time in responding to conflict, failing to engage in their work and affecting the output of work performance. Team forgiveness climate refers to the perception of team support when employees show kindness and altruism in the face of conflict and failure, which is mainly reflected in the team's tolerance of fault or negligent behavior (24).

Team climate serves as an important situational variable when working in the workplace. When employees suffer from ostracism, their psychological resources will be lost. At this time, the team's forgiveness climate can alleviate the loss of psychological resources when employees cope with ostracism. According to the resource conservation theory (54), the forgiveness climate of the team, as a resource supplement, helps to reduce the generation of emotional exhaustion (55). First, after a forgiveness climate is formed in the team, team members are more likely to maintain optimistic and positive emotions (56), instead of complaining or blaming others. At this point, even if the employee suffers from workplace ostracism, it will counteract the negative emotions and thus will not easily cause emotional exhaustion. In addition, the forgiveness climate of the team can improve the interpersonal relationship between team members, making them friendly and trusting, which is conducive to cooperation and mutual assistance among the team members (57). At this time, even if employees suffer from rejection and emotional resources are destroyed, the existence of such a trust-friendly climate will alleviate or offset the generation of negative emotions (58). Finally, in view of the social exchange theory, when a forgiveness climate releases a signal similar to the failure of tolerance, team members show more communication and cooperation in return for the team's tolerance, resulting in more active behaviors and positive expressions (59). Even when employees suffer from ostracism, they will try to minimize the generation of negative emotions in order to repay the team's tolerance so as not to affect their work engagement. Therefore, this study infers that when individuals feel a climate of forgiveness, those who suffer from workplace ostracism will suppress the generation of emotional exhaustion. Thus, Hypothesis 3 is supported:

**Hypothesis 3:** Forgiveness climate plays a negative moderating role in the relationship between workplace ostracism and emotional exhaustion. That is, the higher the level of forgiveness climate perceived by employees, the weaker the positive effect of workplace ostracism on emotional exhaustion. Conversely, the effect is stronger.

## 2.4. Mediation model with moderation

Integrating Hypotheses 2 and 3, this study proposes a mediated model with moderation. It can alleviate the emotional exhaustion caused by workplace ostracism and restrain the decrease in employee wellbeing, that is, a forgiveness climate will suppress the negative effects of workplace ostracism on employee wellbeing through emotional exhaustion. In view of this, Hypothesis 4 is proposed:

**Hypothesis 4:** The forgiveness climate negatively moderates the negative effect of workplace ostracism on employee wellbeing through emotional exhaustion. The higher the level of forgiveness climate perceived by employees is, the weaker this indirect effect is. On the contrary, this indirect effect is stronger.

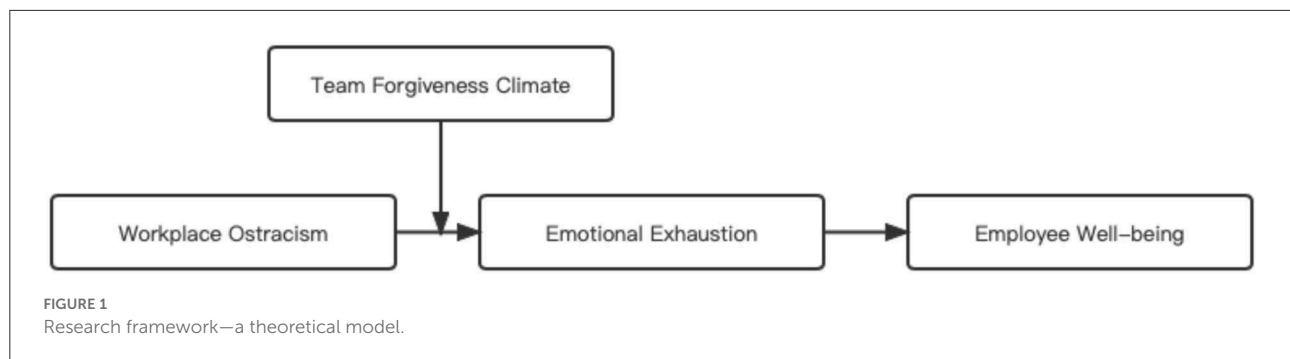
Thus, emotional exhaustion is introduced as the mediating variable and forgiveness climate as the moderating variable. According to the logical relationship, four hypotheses are put forward to build a theoretical model to study the impact of workplace ostracism on employee wellbeing. The research framework of this article is shown in [Figure 1](#).

## 3. Research methods and tools

### 3.1. Research subjects and collection procedures

Before the survey, the participating employees were communicated and informed that there were no right or wrong answers for all respondents, and the anonymity and confidentiality of the questionnaire were promised. To reduce common method bias, the paired sample of employees and leaders was adopted in this study. Also, to avoid common method bias, the same group of participants was given questionnaires at three time points. Each time interval was 1 month with the entire survey lasting 3 months (June–August 2021). First, the HR department randomly selects the department supervisors who participate in the survey, and the supervisors randomly select 3–6 direct subordinates; then, the supervisors' questionnaires are matched and numbered with the employees' questionnaires. At the first time point, the supervisor questionnaire for forgiveness climate and employee questionnaire 1 for workplace ostracism were distributed; employee questionnaire 2 about employee emotional exhaustion was distributed at the second time point, and employee questionnaire 3 was distributed at the third time point about employee wellbeing.

After the investigation is completed, the last four digits of the phone number of "leader-employee" will be used as the matching basis. In this research, a total of 80 supervisor questionnaires and 350 employee questionnaires were distributed, of which 68



and 282 were collected, respectively, after eliminating invalid and unmatched ones with an effective recovery rate of 80.57%. Employee sample characteristics are as follows: There were 139 male employees (49.3%), 143 female employees (50.7%), 62 unmarried employees (22%), and 220 married employees (78%). The average education level is college, the average age is 38.83 years old, the average working years is 4.97 years, and the average working hours per week is 49.83 h.

## 3.2. Measuring tools

To ensure the reliability and validity of the questionnaire, established scales were used for reference in this study. The English scales were accurately translated into Chinese in terms of the standard translation and back-translation procedure (60) before investigation and research and were repeatedly checked before distribution. A 5-point Likert scale (1–5 in the questionnaire indicates “strongly disagree” to “strongly agree”) was used throughout the study.

### 3.2.1. Workplace ostracism

A questionnaire was applied to measure the degree of workplace ostracism perceived by employees with 10 items in total according to the scale compiled by Ferris et al. (3). Examples of questions are “Your greetings have gone unanswered at work” and “You noticed others would not look at you at work.” The scale has a Cronbach’s alpha coefficient of 0.906 in this study.

### 3.2.2. Emotional exhaustion

A 3-item scale developed by Boswell et al. (39) was used. Examples of questions are “I feel emotionally drained from my work” and “I feel exhausted when I think about having to face another day on the job.” This scale has a Cronbach’s alpha coefficient of 0.762 in this study.

### 3.2.3. Forgiveness climate

There are four questions with reference to Cox’s (52) forgiveness climate scale. Examples of questions are “We can forgive the faults and mistakes of team members” and “we don’t hold grudges in a team.” This scale has a Cronbach’s alpha coefficient of 0.952 in this study.

### 3.2.4. Employee wellbeing

The wellbeing scale with 18 items was compiled by Zheng et al. (10), covering life wellbeing, work wellbeing, and psychological wellbeing. Examples of questions are “Most aspects of my life are very close to my ideal,” “I always find ways to enrich my work” and “As years went by, I feel that I have grown a lot.” This scale has a Cronbach’s alpha coefficient of 0.958 in this study.

### 3.2.5. Control variables

Based on previous studies, gender, age, and education have been found to influence employee wellbeing (10). In addition, employees’ weekly working hours and length of service also make a difference in their perceptions of wellbeing (61, 62). To more accurately validate the model, gender, age, education, length of service and the weekly working hour was measured as control variables in this study.

## 3.3. Analysis tools

In this study, SPSS 21.0 was employed for Harman’s one-way test, descriptive statistics, correlation analysis, and multiple regression analysis, and Amos 21.0 was used for the confirmatory factor analysis. For testing the mediating effects, the three-step method of Baron and Kenny (63) was used and combined with the Bootstrap technique (using the PROCESS program) (64) to estimate confidence intervals for mediating effects. In testing for mediators with moderation, this study tested the significance of the values and differences of indirect effects under high and low moderating variables relied on

TABLE 1 Results of confirmatory factor analysis ( $N = 282$ ).

Model	$\chi^2$	df	$\Delta\chi^2$	RMSEA	SRMR	CFI	TLI
Four-factor model (hypothesis)	691.58	554		0.03	0.04	0.98	0.98
Three-factor model (A+B)	890.81	557	199.23***	0.05	0.07	0.94	0.94
Two-factor model (A+B+D)	1,904.41	559	1,212.83***	0.09	0.11	0.77	0.78
One-factor model (A+B+C+D)	3,064.72	560	2,373.14***	0.13	0.17	0.56	0.59

A, workplace ostracism; B, emotional exhaustion; C, forgiveness climate; D, employee wellbeing; “+” indicating integration.

TABLE 2 Mean values, standard deviations, and correlation coefficients of variables ( $N = 282$ ).

Variables	Mean Values	Standard deviation	1	2	3	4	5	6	7	8
1 Gender	0.51	0.5								
2 Age	38.83	8.15	0.07							
3 Education	14.7	1.99	−0.06	0.70***						
4 Length of service	4.97	2.67	0.09	0.41***	−0.34***					
5 Weekly working hour	49.83	6.32	0.11	0.16**	−0.09	0.24***				
6 Workplace ostracism	2.84	0.95	0.01*	0.19**	−0.19**	0.11	0.02			
7 Emotional exhaustion	2.87	1.06	0.06	−0.13*	0.1	−0.09	−0.02	0.27***		
8 Forgiveness climate	4.14	0.96	0.04	−0.01	−0.01	−0.07	−0.04	−0.02	0.08	
9 Employee wellbeing	3.29	0.96	−0.04	−0.01	0.08	0.06	0.01	−0.36***	−0.31***	0.01

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , and \* $p < 0.05$ .

Edwards and Lambert's (65) study and integrated with the bootstrap technique.

## 4. Research results

### 4.1. Common method deviation test

In this research investigation, the multi-stage fill-in approach, suggested by Podsakoff et al. (66), was followed to control for possible common method bias from the methodological level (66). At the data level, Harman's one-way test of the collected data revealed that the percentage of explained variance by the first factor was 34.38%, which is <40% criterion (66). In addition, as can be seen in Table 1, the fitting results of the confirmatory factor analysis of the one-factor model also failed the test ( $\chi^2 = 3,064.72$ ,  $df=560$ ,  $RMSEA = 0.13$ ,  $SRMR = 0.17$ ,  $CFI = 0.56$ , and  $TLI = 0.59$ ). Therefore, there is no serious common method bias among the variables in this study.

### 4.2. Confirmatory factor analysis

In this study, the following fit index was selected to judge the fit of the model, including the chi-square difference must reach a significant level, the root means square error of approximation (RMSEA) must be < 0.08, and the comparative fit index (CFI)

and Tucker–Lewis index (TLI) must be > 0.9. A series of competing models were compared in this study, and the results of the analysis are shown in Table 1. As can be seen in Table 1, the model fit of the four-factor model ( $\chi^2 = 691.58$ ,  $df = 554$ ,  $RMSEA = 0.03$ ,  $SRMR = 0.04$ ,  $CFI = 0.98$ , and  $TLI = 0.98$ ) was better than other competing models in this study. Moreover, all the fit indicators of the four-factor model passed the test. In the view of above, all the variables in this study were found to be distinguishable.

### 4.3. Correlation analysis

The results of the correlation analysis between control variables and variables are shown in Table 2. As can be seen in Table 2, there is a significant negative relationship between workplace ostracism and employee wellbeing ( $r = -0.36$ ,  $p < 0.001$ ), which provides preliminary support for exploring the negative prediction of workplace ostracism on employee wellbeing.

### 4.4. Hypothesis testing results

#### 4.4.1. Test results of the main effect

According to Model 5 in Table 3, workplace ostracism has a significant negative relationship with employee

TABLE 3 Hypothesis testing model.

Variables	Emotional exhaustion			Employee wellbeing			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<b>Control variable</b>							
Gender	0.07	0.07	0.07	−0.04	−0.04	−0.03	−0.03
Age	−0.11	−0.14	−0.13	0.05	0.09	0.06	0.06
Education	0.02	0.06	0.05	0.15	0.1	0.12	0.11
Length of service	−0.04	−0.05	−0.05	0.1	0.11	0.1	0.1
Weekly working hour	0	0.01	−0.01	−0.01	−0.01	−0.01	−0.01
<b>Independent variable</b>							
Workplace ostracism		0.32***	0.31***		−0.37***	−0.29***	−0.29***
<b>Mediating variable</b>							
Emotional exhaustion						−0.23***	−0.24***
<b>Moderating variable</b>							
Forgiveness climate			0.1				0.04
<b>Interaction items</b>							
Workplace ostracism* Forgiveness climate			−0.12*				−0.05*
R <sup>2</sup>	0.02	0.12	0.14	0.02	0.15	0.19	0.19
F	1.33	29.70***	12.19***	1.03	40.93***	29.16***	14.78***

\*\*\*p < 0.001, \*\*p < 0.01, and \*p < 0.05.

TABLE 4 Bootstrap test for mediating effects.

Mediating effect	Effect value	Standard error	95% of confidence interval	
			Lower confidence limit	Upper confidence limit
Indirect effect	−0.07	0.02	−0.12	−0.03
Direct effect	−0.30	0.06	−0.41	−0.18

Bootstrap sample size N = 5,000.

wellbeing ( $\beta = -0.37$ ,  $p < 0.001$ ). Hypothesis 1 is supported.

#### 4.4.2. Test results of mediating effect

As shown by Models 2, 6 in Table 3, workplace ostracism presents a significant positive relationship with emotional exhaustion ( $\beta = 0.32$ ,  $p < 0.001$ ) and emotional exhaustion showed a significant negative relationship with employee wellbeing ( $\beta = -0.23$ ,  $p < 0.001$ ), verifying the indirect effect of workplace ostracism on employee wellbeing through emotional exhaustion. To clarify this indirect effect again, the Bootstrap method test was used in this study (64). The Bootstrap method test for the mediating effect is shown in Table 4, where both the direct and indirect effects of workplace ostracism and employee wellbeing do not include zero at the 95% confidence interval. Therefore, it can be confirmed that emotional exhaustion in the relationship between workplace

ostracism and employee wellbeing played a partially mediating role in the relationship between workplace ostracism and employee wellbeing. Hypothesis 2 is supported.

#### 4.4.3. Test results of moderating effects

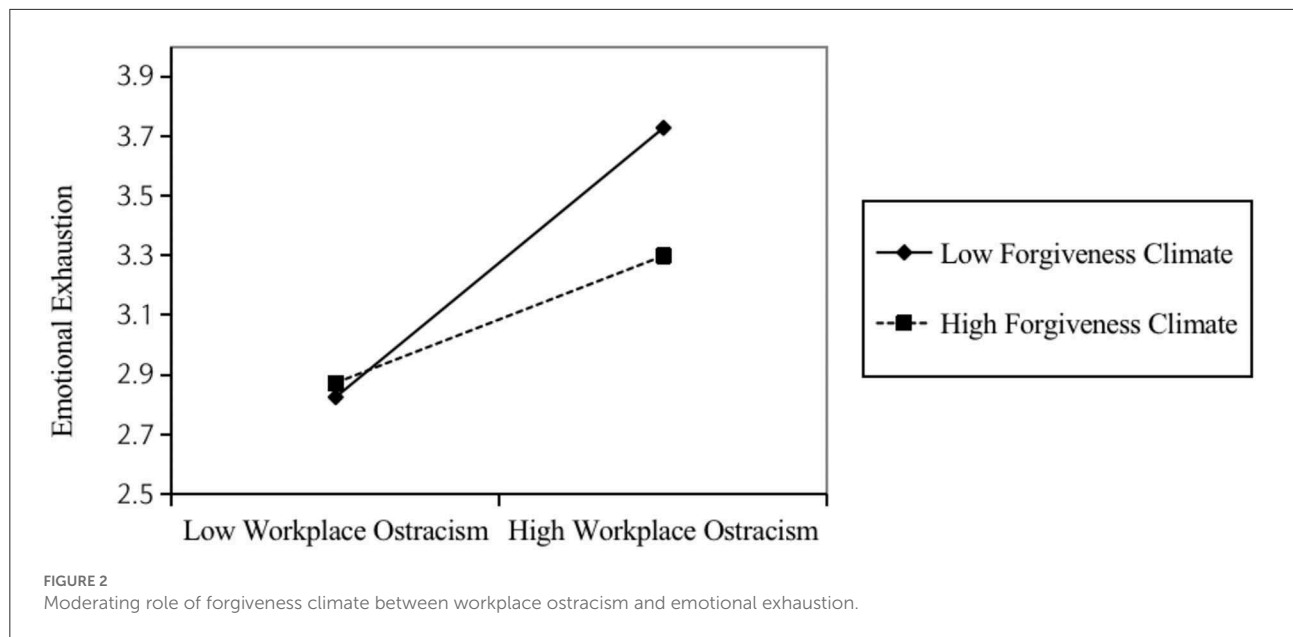
Verifying the moderating effect of forgiveness climate. As shown by Model 3 in Table 3, the interaction term between workplace ostracism and forgiveness climate displayed a significant negative relationship with emotional exhaustion ( $\beta = -0.12$ ,  $p < 0.05$ ). Also, the Bootstrap method test for the moderating effect is shown in Table 5, at a confidence interval of 95%, where the indirect effect of workplace ostracism on emotional exhaustion is higher in a low degree of forgiveness climate (with effect value of 0.48) and lower in a high degree of forgiveness climate (with effect value of 0.24). To further clarify this moderating effect, the study was determined by using the method provided by Aiken et al. (67) to regulate the



TABLE 5 The bootstrap test of the moderating effect with forgiveness climate.

Moderating effect	Effect value	Standard error	95% of confidence interval	
			Lower confidence limit	Upper confidence limit
Low (−1SD)	0.48	0.09	0.30	0.65
Medium	0.35	0.06	0.22	0.48
High (+1SD)	0.24	0.09	0.07	0.41

Bootstrap sample size N = 5,000.



high and low levels of the moderating variables. According to Figure 2, the positive relationship between workplace ostracism and emotional exhaustion is weaker at higher levels of the forgiveness climate. Hypothesis 3 is, thus, supported.

#### 4.4.4. Test results of mediating effects with moderation

This study aims to verify whether a forgiveness climate moderates the indirect effect of workplace ostracism on employee wellbeing through emotional exhaustion. This study also employed the Bootstrap method to examine the effect values of indirect effects at high levels vs. low levels of moderating variables (65). Table 6 illustrates that in a high degree of forgiveness climate, the indirect effect of workplace ostracism on employee wellbeing through emotional exhaustion is  $-0.05$ , whose value is  $[-0.09, -0.01]$  at a 95% confidence interval. Under the condition of a low level of forgiveness climate, the indirect effect of workplace ostracism on employee wellbeing through emotional exhaustion is  $-0.10$ , with the value of  $[-0.15, -0.05]$  at a 95% confidence interval. In conclusion, the higher the degree of forgiveness climate, the weaker the indirect effect of

workplace ostracism on employee wellbeing through emotional exhaustion. Hypothesis 4 is, thus, supported.

## 5. Conclusion

From the perspective of resource conservation, this study uses matched data from supervisors and subordinates, adopts a multi-stage research method, introduces emotional exhaustion as a mediating variable and forgiveness climate as a moderating variable, and deeply analyzes the mechanism of the effect of workplace ostracism on employee wellbeing. This study not only expands the research in the field of workplace ostracism but also clarifies the causes of employee wellbeing.

## 6. Discussion

### 6.1. Theoretical implications

First, this study takes the perspective of resource consumption and uses the conservation of resource theory

TABLE 6 Bootstrap test for mediating effects with moderation.

Independent variable	Moderating variable (forgiveness climate)	Indirect effect	Standard error	95% of confidence interval	
				Lower confidence limit	Upper confidence limit
Workplace ostracism	Low (−1SD)	−0.10	0.03	−0.15	−0.05
	Medium	−0.07	0.02	−0.12	−0.03
	High (+1SD)	−0.05	0.02	−0.09	−0.01

Bootstrap sample size N = 5,000.

to explain the effects of workplace ostracism. It confirms that emotional exhaustion plays a role in bridging workplace ostracism and employee wellbeing, provides a new theoretical perspective and interpreting path to explain how workplace ostracism affects employee wellbeing, and expands a new angle to study employee wellbeing (68, 69). Meanwhile, workplace ostracism is seen as a stressor that depletes employees' emotional resources and negatively affects their attitudes and behaviors (8).

Second, this study examines the borderline role of workplace ostracism in affecting employee wellbeing. The forgiveness climate acts as a negative moderator between workplace ostracism and emotional exhaustion. The perception of the team forgiveness climate by employees is regarded as a resource supplement, which can alleviate the negative impact caused by ostracism (70). This conclusion has profound implications for understanding workplace ostracism and emotional exhaustion.

Finally, this study focuses on employee wellbeing. The relationship between the role of workplace ostracism on employee wellbeing is examined in terms of three aspects of employees' work, psychology, and life wellbeing. Also, this study verifies that when employees perceive ostracism, there is a loss of psychological resources that causes emotional exhaustion (48, 71), which reveals the mechanism of how negative workplace behaviors affect employee wellbeing (72) and enriches the research on negative workplace behaviors and wellbeing (73).

## 6.2. Practical implications

Since workplace ostracism affects employee wellbeing, managers should minimize or avoid ostracism in the workplace. For example, companies can reduce the incidence of ostracism by encouraging employees to use face-to-face communication, strengthening the care for employees through multiple ways, encouraging employees to participate in social activities, increasing communication opportunities between colleagues, improving emotional communication, promoting mutual understanding, and reduce the possibility of ostracism.

In addition, workplace ostracism consumes employees' emotional resources and causes emotional exhaustion. The organization should provide employees with more organizational support, such as a good communication

environment and a cordial organizational atmosphere, which makes employees develop positive emotions toward work and helps them regain resources to overcome the negative effects of ostracism. At the same time, the organization can establish a psychological counseling mechanism for employees to reduce the level of emotional exhaustion and provide opportunities to replenish resources in an attempt to eliminate negative emotions.

Organizational culture has an inhibiting effect on team atmosphere. Therefore, the organization should create a healthy culture, construct a team climate of fairness, forgiveness, tolerance, and understanding, and develop an atmosphere of openness and trust among colleagues or between superiors and subordinates, to curb the occurrence of workplace ostracism at the source (74, 75). Certainly, if workplace ostracism has already occurred in an organization, this climate of forgiveness and trust can serve as a complementary resource to reduce the harmful effects of workplace ostracism.

## 7. Limitations and future research directions

The limitations of this study are as follows:

First, the paired data from leaders and employees were adopted in this study which can effectively reduce the influence of common method bias and make the results more credible. However, these are self-assessed questionnaires, and it is suggested that mutual valuation will be used to obtain survey data subsequently.

Second, the sample data of this study are all obtained from developed regions in mainland China, and whether the conclusions of this study are applicable to other regions and industries still needs further research.

Third, most of the scales used in this study were developed from the Western organizational background and have good reliability and validity. However, China believes in Confucianism and Zhong Yong Thinking (76). Therefore, it is suggested that future researchers can develop scales according to Chinese cultural background.

Fourth, this study uses organizational climate as a situational factor, but employee wellbeing is also influenced by personal

traits and leadership (77–79). Therefore, it is suggested that future research could try to use personal traits and leadership as situational factors to more clearly reveal the impact of workplace ostracism on employee wellbeing.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## References

1. Fox S, Stallworth LE. Racial/ethnic bullying: exploring links between bullying and racism in the US workplace. *J Vocat Behav.* (2005) 66:438–56. doi: 10.1016/j.jvb.2004.01.002
2. Wu Z, Liu J, Hui C. Workplace ostracism and organizational citizenship behavior: the roles of organizational identification and collectivism. *Nankai Bus Rev.* (2010) 13:36–44. doi: 10.3969/j.issn.1008-3448.2010.03.006
3. Ferris DL, Brown DJ, Berry JW, Lian H. The development and validation of the workplace ostracism scale. *J Appl Psychol.* (2008) 93:1348–66. doi: 10.1037/a0012743
4. Hitlan RT, Clifton RJ, and DeSoto MC. Perceived exclusion in the workplace: the moderating effects of gender on work-related attitudes and psychological health. *N Am J Psychol.* (2006) 8:217–36.
5. Hitlan RT, Noel J. The influence of workplace exclusion and personality on counterproductive work behaviours: an interactionist perspective. *Eur J Work Organ Psychol.* (2009) 18:477–502. doi: 10.1080/13594320903025028
6. Steinbauer R, Renn RW, Chen HS, Rhew N. Workplace ostracism, self-regulation, and job performance: moderating role of intrinsic work motivation. *J Soc Psychol.* (2018) 158:767–83. doi: 10.1080/00224545.2018.1424110
7. Kwan HK, Zhang X, Liu J, Lee C. Workplace ostracism and employee creativity: an integrative approach incorporating pragmatic and engagement roles. *J Appl Psychol.* (2018) 103:1358–66. doi: 10.1037/apl0000320
8. Bedi A. No herd for black sheep: a meta-analytic review of the predictors and outcomes of workplace ostracism. *Appl Psychol.* (2021) 70:861–904. doi: 10.1111/apps.12238
9. Tedone AM. Keeping up with work email after hours and employee wellbeing: examining relationships during and prior to the COVID-19 pandemic. *Occup Health Sci.* (2022) 6:51–72. doi: 10.1007/s41542-021-00107-3
10. Zheng X, Zhu W, Zhao H, Zhang C. Employee well-being in organizations: theoretical model, scale development, and cross-cultural validation. *J Organ Behav.* (2015) 36:621–44. doi: 10.1002/job.1990
11. Schaufeli WB, Taris TW, Van Rhenen W. Workaholism, burnout, and work engagement: three of a kind or three different kinds of employee well-being? *Appl Psychol.* (2008) 57:173–203. doi: 10.1111/j.1464-0597.2007.00285.x
12. Moore ME, Konrad AM, Yang Y, Ng ES, Doherty AJ. The vocational well-being of workers with childhood onset of disability: life satisfaction and perceived workplace discrimination. *J Vocat Behav.* (2011) 79:681–98. doi: 10.1016/j.jvb.2011.03.019
13. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st century workplace. *J Occup Organ Psychol.* (2001) 74:489–509. doi: 10.1348/096317901167497
14. Nielsen K, Nielsen MB, Ogbonnaya C, Käsälä M, Saari E, Isaksson K. Workplace resources to improve both employee well-being and performance: a systematic review and meta-analysis. *Work Stress.* (2017) 31:101–20. doi: 10.1080/02678373.2017.1304463
15. Baran M, Sypniewska B. The significance of people-oriented management and participation for mentoring in organizations. *J Posit Manag.* (2017) 8:14–30. doi: 10.12775/JPM.2017.128
16. Subramony M, Golubovskaya M, Keating B, Solnet D, Field J, Witheriff M. The influence of pandemic-related workplace safety practices on frontline service employee well-being outcomes. *J Bus Res.* (2022) 149:363–74. doi: 10.1016/j.jbusres.2022.05.040
17. Gerber J, Wheeler L. On being rejected: a meta-analysis of experimental research on rejection. *Perspect Psychol Sci.* (2009) 4:468–88. doi: 10.1111/j.1745-6924.2009.01158.x
18. Howard MC, Cogswell JE, Smith MB. The antecedents and outcomes of workplace ostracism: a meta-analysis. *J Appl Psychol.* (2020) 105:577–96. doi: 10.1037/apl0000453
19. Hobfoll SE. Conservation of resources: a new attempt at conceptualizing stress. *Am Psychol.* (1989) 44:513–24. doi: 10.1037/0003-066X.44.3.513
20. Hobfoll SE, Halbesleben J, Neveu JP, Westman M. Conservation of resources in the organizational context: the reality of resources and their consequences. *Annu Rev Organ Psychol Organ Behav.* (2018) 5:103–28. doi: 10.1146/annurev-orgpsych-032117-104640
21. James LR, Choi CC, Ko CHE, McNeil PK, Minton MK, Wright MA, et al. Organizational and psychological climate: a review of theory and research. *Eur J Work Organ Psychol.* (2008) 17:5–32. doi: 10.1080/13594320701662550
22. Chiang JT, Chen XB, Liu H, Akutsu S, Wang Z. We have emotions but can't show them! Authoritarian leadership, emotion suppression climate, and team performance. *Hum Relat.* (2021) 74:1082–111. doi: 10.1177/0018726720908649
23. Cox S. *A Forgiving Workplace: an Investigation of Forgiveness Climate, Individual Differences and Workplace Outcomes.* Ruston, LA: LA Tech University (2008).
24. Fehr R, Gelfand MJ. The forgiving organization: a multilevel model of forgiveness at work. *Acad Manage Rev.* (2012) 37:664–88. doi: 10.5465/amr.2010.0497
25. Warr P. *Work, Unemployment, and Mental Health.* Oxford: Oxford University Press (1987).
26. Liu H, Xia H. Workplace ostracism: a review and directions for future research. *J Hum Resour Sustain Stud.* (2016) 4:197–201. doi: 10.4236/jhrss.2016.43022
27. Feng L, Li J, Feng T, Jiang W. Workplace ostracism and job performance: meaning at work and family support as moderators. *Soc Behav Pers.* (2019) 47:1–13. doi: 10.2224/sbp.8244
28. Kuo CC, Wu CY. Workplace ostracism and job performance: the moderated mediation model of organization-based self-esteem and performance goal orientation. *Career Dev Int.* (2022) 27:260–73. doi: 10.1108/CDI-02-2021-0035
29. Robinson SL, O'Reilly J, Wang W. Invisible at work: an integrated model of workplace ostracism. *J Manag.* (2013) 39:203–31. doi: 10.1177/0149206312466141

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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30. Tan N, Yam KC, Zhang P, Brown DJ. Are you gossiping about me? The costs and benefits of high workplace gossip prevalence. *J Bus Psychol.* (2021) 36:417–34. doi: 10.1007/s10869-020-09683-7
31. Tassiello V, Lombardi S, Costabile M. Are we truly wicked when gossiping at work? The role of valence, interpersonal closeness and social awareness. *J Bus Psychol.* (2018) 84:141–9. doi: 10.1016/j.jbusres.2017.11.013
32. Ferris DL, Lian H, Brown DJ, Morrison R. Ostracism, self-esteem, and job performance: When do we self-verify and when do we self-enhance? *Acad Manag J.* (2015) 58:279–97. doi: 10.5465/amj.2011.0347
33. Zhu H, Lyu Y, Deng X, Ye Y. Workplace ostracism and proactive customer service performance: a conservation of resources perspective. *Int J Hosp Manag.* (2017) 64:62–72. doi: 10.1016/j.ijhm.2017.04.004
34. Jiang Y, Poon KT. Stuck in companionless days, end up in sleepless nights: relationships between ostracism, rumination, insomnia, and subjective well-being. *Curr Psychol.* (2021). doi: 10.1007/s12144-021-01474-4
35. Wu LZ, Yim FHK, Kwan HK, Zhang X. Coping with workplace ostracism: the roles of ingratiation and political skill in employee psychological distress. *J Manag Stud.* (2012) 49:178–99. doi: 10.1111/j.1467-6486.2011.01017.x
36. Imran MK, Fatima T, Sarwar A, Iqbal SMJ. Will I speak up or remain silent? Workplace ostracism and employee performance based on self-control perspective. *J Soc Psychol.* (2021). doi: 10.1080/00224545.2021.1967843
37. Mao Y, Liu Y, Jiang C, Zhang ID. Why am I ostracized and how would I react?—a review of workplace ostracism research. *Asia Pac J Manag.* (2018) 35:745–67. doi: 10.1007/s10490-017-9538-8
38. Fatima T, Bilal AR, Imran MK, Sarwar A. Manifestations of workplace ostracism: an insight into academics' psychological well-being. *South Asian J Bus Stud.* (2021). doi: 10.1108/SAJBS-03-2019-0053
39. Boswell WR, Olson-Buchanan JB, LePine MA. Relations between stress and work outcomes: the role of felt challenge, job control, and psychological strain. *J Vocat Behav.* (2004) 64:165–81. doi: 10.1016/S0001-8791(03)00049-6
40. Watkins MB, Ren R, Umphress EE, Boswell WR, Triana MDC, Zardkoohi A. Compassion organizing: employees' satisfaction with corporate philanthropic disaster response and reduced job strain. *J Occup Organ Psychol.* (2015) 88:436–58. doi: 10.1111/joop.12088
41. Halbesleben JR, Neveu JP, Paustian-Underdahl SC, Westman M. Getting to the "COR": understanding the role of resources in conservation of resources theory. *J Manag.* (2014) 40:1334–64. doi: 10.1177/0149206314527130
42. Sun LY, Pan W. HR practices perceptions, emotional exhaustion, and work outcomes: a conservation-of-resources theory in the Chinese context. *Hum Resour Dev Q.* (2008) 19:55–74. doi: 10.1002/hrdq.1225
43. Whitman MV, Halbesleben JR, Holmes IVO. Abusive supervision and feedback avoidance: The mediating role of emotional exhaustion. *J Organ Behav.* (2014) 35:38–53. doi: 10.1002/job.1852
44. Jahanzeb S, and Fatima T. How workplace ostracism influences interpersonal deviance: the mediating role of defensive silence and emotional exhaustion. *J Bus Psychol.* (2018) 33:779–91. doi: 10.1007/s10869-017-9525-6
45. Chen Y, Li S. Relationship between workplace ostracism and unsafe behaviors: the mediating effect of psychological detachment and emotional exhaustion. *Psychol Rep.* (2020) 123:488–516. doi: 10.1177/0033294118813892
46. Hobfoll SE. The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Appl Psychol.* (2001) 50:337–421. doi: 10.1111/1464-0597.00062
47. Heaphy ED, Dutton JE. Positive social interactions and the human body at work: linking organizations and physiology. *Acad Manage Rev.* (2008) 33:137–62. doi: 10.5465/amr.2008.27749365
48. Xia A, Wang B, Song B, Zhang W, Qian J. How and when workplace ostracism influences task performance: through the lens of conservation of resource theory. *Hum Resour Manag J.* (2019) 29:353–70. doi: 10.1111/1748-8583.12226
49. Weiss HM, Cropanzano R. Affective events theory. *Res Organ Behav.* (1996) 18:1–74.
50. Ashkanasy NM, Ayoko OB, Jehn KA. Understanding the physical environment of work and employee behavior: an affective events perspective. *J Organ Behav.* (2014) 35:1169–84. doi: 10.1002/job.1973
51. Kausto J, Elo AL, Lipponen J, Elovainio M. Moderating effects of job insecurity in the relationships between procedural justice and employee well-being: gender differences. *Eur J Work Organ Psychol.* (2005) 14:431–52. doi: 10.1080/13594320500349813
52. Cox SS. An investigation of forgiveness climate and workplace outcomes. In *Academy of Management Proceedings*. Briarcliff Manor, NY: Academy of Management (2011).
53. Gilbert P. Evolution and social anxiety: the role of attraction, social competition, and social hierarchies. *Psychiatr Clin.* (2001) 24:723–51. doi: 10.1016/S0193-953X(05)70260-4
54. Hobfoll SE, Johnson RJ, Ennis N, Jackson AP. Resource loss, resource gain, and emotional outcomes among inner city women. *J Pers Soc Psychol.* (2003) 84:632–43. doi: 10.1037/0022-3514.84.3.632
55. Karremans JC, Van Lange PA, Holland RW. Forgiveness and its associations with prosocial thinking, feeling, and doing beyond the relationship with the offender. *Pers Soc Psychol Bull.* (2005) 31:1315–26. doi: 10.1177/0146167205274892
56. Costa SP, Neves P. Forgiving is good for health and performance: how forgiveness helps individuals cope with the psychological contract breach. *J Vocat Behav.* (2017) 100:124–36. doi: 10.1016/j.jvb.2017.03.005
57. Khan MS, Elahi NS, Abid G. Workplace incivility and job satisfaction: mediation of subjective well-being and moderation of forgiveness climate in health care sector. *Eur J Investig Health Psychol Educ.* (2021) 11:1107–19. doi: 10.3390/ejihpe11040082
58. Aquino K, Grover SL, Goldman B, Folger R. When push doesn't come to shove: Interpersonal forgiveness in workplace relationships. *J Manag Inq.* (2003) 12:209–16. doi: 10.1177/1056492603256337
59. Bandura A. Social cognitive theory: an agentic perspective. *Asian J Soc Psychol.* (1999) 2:21–41. doi: 10.1111/1467-839X.00024
60. Brislin RW. The wording and translation of research instruments. In: Lonner WJ and Berry JW, editors. *Field Methods in Cross-Cultural Research*. Sage Publications, Inc (1986). p. 137–64.
61. Dimotakis N, Scott BA, Koopman J. An experience sampling investigation of workplace interactions, affective states, and employee well-being. *J Organ Behav.* (2011) 32:572–88. doi: 10.1002/job.722
62. Wright TA, Huang CC. The many benefits of employee well-being in organizational research. *J Organ Behav.* (2012) 33:1188–92. doi: 10.1002/job.1828
63. Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* (1986) 51:1173–82. doi: 10.1037/0022-3514.51.6.1173
64. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Publications (2017).
65. Edwards JR, Lambert LS. Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychol Methods.* (2007) 12:1–22. doi: 10.1037/1082-989X.12.1.1
66. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol.* (2003) 88:879–903. doi: 10.1037/0021-9010.88.5.879
67. Aiken LS, West SG, Reno RR. *Multiple Regression: Testing and Interpreting Interactions*. Sage (1991).
68. Zhang S, Shi Q. The relationship between subjective well-being and workplace ostracism: the moderating role of emotional intelligence. *J Organ Chang Manag.* (2017) 30:978–88. doi: 10.1108/JOCM-07-2016-0139
69. Rasool SF, Wang M, Tang M, Saeed A, Iqbal J. How toxic workplace environment affects the employee engagement: the mediating role of organizational support and employee wellbeing. *Int J Environ Res Public Health.* (2021) 18:2294. doi: 10.3390/ijerph18052294
70. Salvador R. Perceived forgiveness climate and punishment of ethical misconduct. *Management Decision.* (2019) 58:797–811. doi: 10.1108/MD-06-2018-0650
71. Jahanzeb S, Fatima T, Malik MAR. Supervisor ostracism and defensive silence: a differential needs approach. *Eur J Work Organ Psychol.* (2018) 27:430–40. doi: 10.1080/1359432X.2018.1465411
72. Xing L, Sun JM, Jepsen D. Feeling shame in the workplace: examining negative feedback as an antecedent and performance and well-being as consequences. *J Organ Behav.* (2021) 42:1244–60. doi: 10.1002/job.2553
73. Panaccio A, Vandenberghe C. Perceived organizational support, organizational commitment and psychological well-being: a longitudinal study. *J Vocat Behav.* (2009) 75:224–36. doi: 10.1016/j.jvb.2009.06.002
74. Butler JK. Trust expectations, information sharing, climate of trust, and negotiation effectiveness and efficiency. *Group Organ Manag.* (1999) 24:217–38. doi: 10.1177/1059601199242005
75. Jiang L, Probst TM. Do your employees (collectively) trust you? The importance of trust climate beyond individual trust. *Scand J Manag.* (2015) 31:526–35. doi: 10.1016/j.scaman.2015.09.003

76. Ning B, Omar R, Ye Y, Ting H, and Ning M. (2021). The role of Zhong-Yong thinking in business and management research: a review and future research agenda. *Asia Pacific Business Review* 27:150–179. doi: 10.1080/13602381.2021.1857956
77. DeNeve KM, Cooper H. The happy personality: a meta-analysis of 137 personality traits and subjective well-being. *Psychol Bull.* (1998) 124:197–229. doi: 10.1037/0033-2909.124.2.197
78. Reb J, Narayanan J, Chaturvedi S. Leading mindfully: two studies on the influence of supervisor trait mindfulness on employee well-being and performance. *Mindfulness.* (2014) 5:36–45. doi: 10.1007/s12671-012-0144-z
79. Chughtai A, Byrne M, Flood B. Linking ethical leadership to employee well-being: the role of trust in supervisor. *J Bus Ethics.* (2015) 128:653–63. doi: 10.1007/s10551-014-2126-7





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# Patient satisfaction with nurses' care is positively related to the nurse–patient relationship in Chinese hospitals: A multicentre study

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**Background:** The nurse–patient relationship and nursing care satisfaction are important factors that represent whether patients experience the care they expect from nurses. However, research is lacking on the relationship between nursing staff and patients, and the correlation between nursing care satisfaction and relationship care in China. Therefore, this study aimed to explore the correlation between the nurse–patient relationship and patients' satisfaction with nursing care, to form a basis for corresponding intervention measures.

**Methods:** A total of 29,108 patients from 107 hospitals in 30 provinces/municipalities in China completed a general information questionnaire, the Nursing Care Satisfaction Scale, and Relational Care Scale.

**Results:** The average nurse–patient relational care scale score was  $4.38 \pm 0.57$ , and the average patients' satisfaction with nursing care scale score was  $5.40 \pm 0.86$ . Nursing care satisfaction score was significantly related to differences among patients in different age, gender, marital status, education level, occupation, residence, family per capita monthly income, type of medical insurance, medical department, and regional patient characteristics. The correlation analysis showed that the total nurse–patient relational care score and its three dimensions of caring, trust, and professional ethics correlated positively with nursing care satisfaction scores. The multiple linear regression analysis showed that patients' age, marital status, region, department, income, type of medical insurance and the caring, trust, and professional ethics dimensions of relational care predicted nursing care satisfaction.

**Conclusion:** Enhancing nurse–patient relational care improves nursing care satisfaction, reduces nurse–patient disputes, promotes early rehabilitation of patients, and ensures patient safety.

## KEYWORDS

Chinese, hospital patients, patient satisfaction, nurse–patient care, nurse–patient relationship

# 1. Introduction

Humanistic care is the core and essence of nursing, which includes the care provided by nurses to patients, nursing managers to nurses, mutual care between nurses, and the self-care of nurses (1–4). Advocating humanistic care in nursing helps build a harmonious nurse–patient relationship, improve the quality of nursing services and patients’ satisfaction, and enhance nurses’ professional recognition (5–8). The nurse–patient relationship and nursing care satisfaction are important factors that refer to whether patients experience the care they expect from nurses (9, 10). The content of caring research is very broad, as foreign and domestic research mainly involves the following aspects: the nature of care, care in clinical nursing, care behavior evaluation of nursing staff and patients, care ability evaluation, care efficiency evaluation, organizational care atmosphere evaluation, and patients’ experience of care (11, 12). However, there is a lack of research on the relationship between nursing staff and patients, and the correlation between nursing care satisfaction and relational care. An extensive literature search revealed a scarcity of research on the above topics at present and most were single-center studies with small sample sizes (13–15). Acknowledging the above, numerous humanistic nursing training programs have gradually been carried out in China. What is more noteworthy is that the Humanistic Care Professional Committee of Chinese Association for Life Care issued the Humanistic Care Management Specification for Ward Nursing in April 2022, which further provides concrete and feasible guidelines for humanistic care services in China’s hospitals (16). Based on the above research background, we conducted a cross-sectional survey *via* the Humanistic Care Professional Committee of Chinese Association for Life Care to understand the current situation and risk factors relating to humanistic care in Chinese hospitals at all levels, so as to provide a basis for the solid practice of humanistic care in medical institutions. This study also analyzed the correlation between the relationship between the nurse–patient relationship and patients’ nursing caring satisfaction, so as to provide a basis for the establishment of a relationship care system between nurses and patients, and achieve the aim of improving nursing care satisfaction among patients.

# 2. Methods

## 2.1. Survey participants

Ethical approval for this study was obtained through our university’s Research Ethics Board (2022-S161). The data for this study were obtained from the database established by the expert consensus of the “Norms of Practice of Humanistic Care in Hospital Nursing” and the group standard application unit of the “Norms of Humanistic Care Management in Ward Nursing” of the Humanistic Care Professional Committee of Chinese Association for Life Care. Considering the regional distribution, multi-stage stratified sampling was used to recruit participants from July 1 to August 15, 2022. In the first stage, four regions, namely northeast, east, central, and west, were selected, as well as provinces or autonomous regions and municipalities. In the second stage, hospitals of Grade II and above in each province were taken as units (according to the survey, the managers of the surveyed hospitals were members of the National

Humanistic Nursing Special Committee). In the third stage, the managers of the hospitals who were selected during the second stage were selected as units, and 107 hospitals nationwide were included. The following patient inclusion criteria were used: (1) All participants were outpatients or stable inpatients; (2) All participants were aged above 18 years old or their legal guardians were older than 18 years old; (3) Study participants or their legal guardians provided informed written consent. The following exclusion criteria were used: (1) Patients unable to complete the cognitive assessments required for the trial; (2) Patients without smartphones or who cannot answer the questionnaire using a smartphone. Informed consent was obtained from all respondents. We determined that the sample size should be at least 5–10 times the questionnaire’s total number of 35 items. A sample of 350 was determined as the total needed, and a 10% loss rate was taken into account. Therefore, we planned to recruit at least 385 patients in each hospital. The actual number of patients who were investigated in this study was 31,095 from 107 hospitals in China, of which 29,108 valid questionnaires were returned.

## 2.2. Survey tools

### 2.2.1. General information questionnaire

The researchers developed the design and included the patients’ hospital, gender, age, marriage, education level, place of residence, medical insurance type, family monthly income, department visited, region, and whether surgery was performed.

### 2.2.2. Nursing care satisfaction scale

The scale designed by the Nursing Care Quality Control Committee of Houston Health Care System (17) was used. This scale consists of 20 items and covers 12 aspects, including nursing coordination, nursing ability, teaching/learning ability, emotional support, respect for individuality, physical comfort, availability, helping/trusting relationship, patient/family involvement, physical environment, spiritual environment, and outcome. The patients’ satisfaction with the humanistic care of nurses was investigated, and the patients were asked to evaluate the care they received during their last hospitalization. For each item, “never,” “rarely,” “sometimes,” “often,” “most of the time,” and “always” were scored from 1 to 6 points, giving a total score of 120. The higher the score, the higher the patient’s satisfaction with the nurses’ care. The Cronbach’s  $\alpha$  coefficient of this scale in this study was 0.98, showing good reliability.

### 2.2.3. Relational Care Scale

This scale was originally developed by Ray and Turkel in 2001 according to the grounded theory and then verified and improved through a series of qualitative and quantitative studies that demonstrated good reliability and validity in foreign countries (18). The patient version consists of 15 items that could be divided into the following three dimensions: work ethics, trust, and care. Each item was scored from 1 to 5 points from “strongly disagree” to “strongly agree.” The total score is 75 points. The higher the score, the better the nurse–patient relationship. This study was the first to use the scale in China, and the reliability of the scale was good. The Cronbach’s  $\alpha$  coefficient of the overall scale was 0.98, and the Cronbach’s  $\alpha$

coefficients of trust, care, and professional ethics were 0.97, 0.98, and 0.95, respectively.

## 2.3. Data collection method

The survey was conducted by scanning the two-dimensional code on the network platform *via* the Humanistic Nursing Professional Committee of China Life Care Association. After obtaining the consent of the nursing department and secretary of each hospital, the investigation team first gave the questionnaire to the head nurse of the investigation department of different hospitals and departments across the country and explained the purpose of the questionnaire. The head nurse of the department is responsible for organizing the patients in the department to ensure that they scan the two-dimensional code and fill in the questionnaire. Each patient could participate only once. All items could only be submitted after completion, and the questionnaire was filled out anonymously and independently. Data entry was done by two researchers alone, who checked the original questionnaire data after input to guarantee the accuracy of the data. Missing data or poor-quality questionnaires were eliminated. There were a total of 31,095 questionnaires in this survey, of which 29,108 valid questionnaires were recalled, with an effective completion rate of 93.6%.

## 2.4. Statistical methods

The questionnaire results were input into Excel to create the original database. After removing invalid questionnaires, the data were imported into SPSS 25.0 for statistical analysis. The two-person cross-check method was used to reduce errors and ensure the accuracy of the data inputted. Pearson correlation analysis was used to analyse the correlations between the variables. A hierarchical linear regression equation was used to analyse the effect of relational care on satisfaction with nurses' care.  $P < 0.05$  was considered statistically significant.

## 3. Results

A total of 29,108 valid questionnaires were collected from 30 provinces in China. There were 1,910 (6.6%) participants in Northeast China, 5,700 (19.6%) in East China, 15,911 (54.7%) in Central China, and 5,587 (19.2%) in West China.

### 3.1. Current situation of patients' satisfaction with nursing care

The average score of nurse–patient relational care was  $4.38 \pm 0.57$ , and the average score of patients' satisfaction with nursing care was  $5.40 \pm 0.86$ . The average scores of 12 aspects of nursing relationship satisfaction ranged from 5.11 to 5.49. Among them, patients' satisfaction with nursing ability ( $5.49 \pm 0.89$ ) and emotional support ( $5.47 \pm 0.88$ ) were higher, while patients' satisfaction with family participation ( $5.11 \pm 1.28$ ) and spiritual environment ( $5.35 \pm 1.04$ ) were lower.

### 3.2. Comparison of differences in the nursing care satisfaction scores of subjects with different demographic characteristics

There were statistical differences in the nursing care satisfaction of different patients in terms of gender, age, marital status, education level, residence, family monthly income, department of treatment, type of medical insurance and region. However, there were no statistical differences regarding whether the patients underwent an operation. Briefly, male patients, older patients, married patients, patients without tertiary education, urban patients, patients with high income, surgical patients, high Medicare patients, and patients in Northeast China reported higher satisfaction with nursing care. See [Table 1](#) for more details.

### 3.3. Correlation analysis of relational care, scores of each dimension, and nursing care satisfaction

The total mean score of relational care and its dimensions were positively correlated with total satisfaction with nursing care ( $r = 0.35\text{--}0.37$ ,  $p < 0.01$ ), and the trust dimension showed the lowest coefficient ( $r = 0.35$ ). In contrast, the care dimension and relationship care were tied for the highest coefficient as shown in [Table 2](#).

### 3.4. Hierarchical linear regression analysis of the effect of relational care on nursing care satisfaction

First, gender, age, marital status, education level, place of residence, family monthly income, department of medical treatment, type of medical insurance, and region were used as the control variables, relational care was taken as the independent variable, and care satisfaction was taken as the dependent variable in the hierarchical linear regression analysis. The specific variables are shown in [Table 3](#). The analysis found that age, region, and the caring, trust, and professional ethics dimensions of relational care were the relevant factors predicting nursing care satisfaction ( $p < 0.05$ ). Therefore, to simplify the regression equation, age and region were included as control variables, and other irrelevant variables were removed. The results of the hierarchical linear regression showed that after controlling for age and region, the dimensions of caring, trust, and professional ethics of relational care significantly predicted nursing care satisfaction, as shown in [Table 4](#).

## 4. Discussion

### 4.1. Patients' satisfaction with nursing care is at an intermediate level

The survey results of 29,108 patients showed that the average patients' satisfaction with nursing care score was  $5.40 \pm 0.86$ , which was above the medium level, similar to the research results of Jia et al. (19). Several studies have shown that benevolence, altruism, and dedication are the main concepts of religious traditions (20). Liu's

TABLE 1 Comparison of nursing care satisfaction scores of subjects with different demographic characteristics.

Project	Grouping	Numbers	Score ( $\bar{x} \pm s$ )	Statistics	<i>p</i>
Gender	Male	12,049	5.43 $\pm$ 0.85	4.77 <sup>a</sup>	<0.001
	Female	17,059	5.38 $\pm$ 0.87		
Age	18–34	8,334	5.34 $\pm$ 0.91	44.46 <sup>b</sup>	<0.001
	35–39	13,247	5.41 $\pm$ 0.84		
	$\geq 60$	7,527	5.47 $\pm$ 0.82		
Marriage	Unmarried	24,066	5.36 $\pm$ 0.90	9.20 <sup>b</sup>	<0.001
	Married	4,001	5.41 $\pm$ 0.85		
	Other	1,041	5.33 $\pm$ 0.94		
Level of education	Primary school the following	4,334	5.42 $\pm$ 0.86	3.15 <sup>b</sup>	0.013
	Junior high school	7,128	5.42 $\pm$ 0.85		
	High school/technical secondary school	5,601	5.40 $\pm$ 0.87		
	College	4,765	5.37 $\pm$ 0.88		
	Bachelor degree or above	7,280	5.40 $\pm$ 0.86		
Location	City	15,769	5.43 $\pm$ 0.85	17.67 <sup>b</sup>	<0.001
	Towns	5,983	5.39 $\pm$ 0.88		
	Rural	7,356	5.36 $\pm$ 0.87		
Per capita monthly household income (Yuan)	<3,000	7,958	5.36 $\pm$ 0.88	10.65 <sup>b</sup>	<0.001
	3,000–<5,000	9,771	5.40 $\pm$ 0.86		
	5,000–<8,000	6,132	5.44 $\pm$ 0.83		
	>8,000	5,247	5.42 $\pm$ 0.86		
Department	Internal medicine	13,989	5.41 $\pm$ 0.85	18.03 <sup>b</sup>	<0.001
	Surgical	9,252	5.45 $\pm$ 0.83		
	The department of obstetrics and gynecology	2,953	5.32 $\pm$ 0.92		
	Pediatric	919	5.30 $\pm$ 0.93		
	The critical	731	5.25 $\pm$ 0.90		
	Outpatient service	605	5.27 $\pm$ 0.94		
	Other	659	5.48 $\pm$ 0.85		
Health care type	Health care in cities and towns	16,022	5.42 $\pm$ 0.85	14.95 <sup>b</sup>	<0.001
	The city health care	6,915	5.42 $\pm$ 0.84		
	Provincial health care	1,986	5.46 $\pm$ 0.80		
	Commercial insurance	255	5.35 $\pm$ 0.86		
	At public expense	439	5.41 $\pm$ 0.86		
	At his own expense	3,077	5.27 $\pm$ 0.95		
	Other	414	5.35 $\pm$ 0.90		
Area	Northeast	1,910	5.50 $\pm$ 0.83	50.03 <sup>b</sup>	<0.001
	East	5,700	5.43 $\pm$ 0.85		
	Middle	15,911	5.42 $\pm$ 0.84		
	West	5,587	5.28 $\pm$ 0.93		
Operation	Yes	17,607	5.40 $\pm$ 0.86	–2.36 <sup>a</sup>	0.18
	No	11,501	5.42 $\pm$ 0.85		

<sup>a</sup>t-value.<sup>b</sup>F-value.

**TABLE 2** Correlation between relational care, scores of each dimension and nursing care satisfaction ( $n = 29,108$ ).

Variable	1	2	3	4	5
1 Trust	1				
2 Care	0.94	1			
3 The professional ethics	0.93	0.96	1		
4 Relationship of care	0.97	0.99	0.98	1	
5 Satisfaction with nursing care	0.35	0.37	0.36	0.37	1

All  $P < 0.01$ .**TABLE 3** Value assignment of each variable.

Variable	Assignment way
Gender	Male = 0; female = 1
Age	18–34 = 1; 35–59 = 2; $\geq 60$ = 3
Marriage	Married = 1; unmarried = 2; other = 3
Level of education	Primary school and below = 1; junior high school = 2; high school/technical secondary school = 3; college = 4; bachelor degree or above = 5
Location	City = 1; towns = 2; rural = 3
Monthly household income	$< 3,000$ = 1; $3,000 - < 5,000$ = 2; $5,000 - < 8,000$ = 3; $\geq 8,000$ = 4
Department	Internal medicine = 1; surgical = 2; obstetrics and gynecology = 3; pediatric = 4; emergency and critical care unit = 5; outpatient service = 6; other = 7
Health care type	Health care in cities and towns = 1; the city health care = 2; provincial health care = 3; commercial insurance = 4; at public expense = 5; own expense = 6; other = 7
Area	Northeast = 1; east = 2; in the middle = 3; in the west = 4
Operation	Yes = 1; no = 0

research found that inpatients believed that the strongest care support was the humanitarian care provided by nursing staff (21). This study showed that patients had the highest satisfaction with nursing ability and emotional support, while they had low satisfaction scores with family involvement and spiritual environment. This indicates that patients are satisfied with nurses' professional knowledge and skills, and emotional support provided, and feel safe in their care. However, patients hope that their families can participate in the treatment and nursing. Existing studies have pointed out that the humanistic care ability of clinical nurses is at a relatively low level overall (22, 23). As nurses are busy with clinical treatment, nursing managers pay more attention to the improvement of clinical operation skills, and there is a lack of humanistic care education for clinical nurses (24). Therefore, it is necessary to strengthen nursing staff's keen observation skills. Moreover, patients will undergo physical and psychological changes after illness. In addition to receiving medical treatment and nursing operations, they require emotional support and spiritual comfort from nursing staff. It is very easy for nursing staff to assess the psychological state of patients because they have more contact with them. Nursing staff should therefore help patients increase their self-confidence to overcome illness and provide them with professional and emotionally supportive holistic care.

## 4.2. Scores of nursing care satisfaction in relation to different demographic characteristics

Age, gender, marital status, education level, place of residence, region, family monthly income, type of medical insurance, and department were associated with differences in nursing care satisfaction scores. Patients older than or equal to 60 years old had higher scores, which indicates that patients of this age have lower requirements than younger patients, so they are more satisfied with the evolving humanistic care of nurses. The results of this survey showed that the caring ability of nurses improved with age and experience. Milutinović et al. performed a survey on nursing satisfaction among inpatients in Serbia and found that age influenced nursing satisfaction, which is consistent with the findings of this study (25). Previous study has found that clinical nurses over 35 years old have the highest humanistic care ability, and as they shoulder the social responsibility of caring for the elderly and raising children, so they have more experience in caring for their relatives. Therefore, they are more likely to empathize with patients and give them more care. However, nurses under the age of 35 do not have as much social experience and lack nursing experience, communication skills, and professional knowledge, which affects their caring ability and perception to different degrees (26). Therefore, it is necessary to further improve the humanistic caring ability of nurses under the age of 35. A nurse's responsibility is closely related to their professional qualification and ability. Senior nurses are more likely to build good relationships with patients because of their deep knowledge and vast experience. In contrast, junior nurses lack clinical nursing experience because of their shorter job tenure and so have difficulty in establishing good relationships with patients (27). These findings are consistent with the results of Simmons' finding that humanistic care ability increases with work experience (28). This suggests that humanistic nursing care education should focus on nurses with junior seniority and a professional title (27). Therefore, more management and family support are needed for nurses who are younger than 35. Moreover, male patients were significantly more satisfied with their care than females, which may be because women are more sensitive compared to men. Regarding marital status, those who were married had the highest satisfaction scores. Studies in China show (29) that married couples are happier than unmarried couples. Separated and divorced people had lower happiness scores, and those who are widowed had the lowest. In terms of residence, patients from urban areas scored higher than those from rural areas. In terms of income, those with a middle income scored higher. Regarding education, those below junior high school scored higher, and those with a low education level were more likely to be satisfied. In terms of the type of medical insurance, patients with provincial and municipal medical insurance had higher scores for nursing care satisfaction, while patients without insurance had the lowest scores. When patients without insurance have to pay for services, they become more critical or demanding about the service they receive. In terms of departments, other departments had the highest score, followed by surgery. Patients in surgery have faster recovery times and shorter hospital stays. During treatment, patients pay more attention to their own diseases and are easily satisfied with the humanistic nursing care. Studies in different countries and regions have shown that clinical nurses in intensive care units and emergency departments are more likely to demonstrate altruism



TABLE 4 Hierarchical linear regression analysis of nursing relationship satisfaction ( $n = 29,108$ ).

Layered	The independent variables	Regression coefficient	Standard error	Standard regression coefficient	<i>t</i>	<i>p</i>
The first layer	(Constant)	5.47	0.02	—	234.96	<0.001
	Age	0.06	0.01	0.05	9.25	<0.001
	Location	−0.07	0.01	−0.06	−10.28	<0.001
The second layer	(Constant)	3.04	0.04	—	71.43	<0.001
	Age	0.03	0.01	0.03	5.38	<0.001
	Location	−0.03	0.01	−0.03	−5.80	<0.001
	Care	0.35	0.03	0.24	10.88	<0.001
	Trust	0.13	0.02	0.09	5.45	<0.001
	The professional ethics	0.07	0.03	0.05	2.14	0.032

The first layer,  $R^2 = 0.007$ ,  $F = 97.148$ ,  $P < 0.001$ ; second layer,  $R^2 = 0.139$ ,  $\Delta R^2 = 0.132$ ,  $F = 943.143$ ,  $P < 0.001$ .

(27–30) because they have a higher level of humanistic care compared with clinical nurses in other departments and pay more attention to the health needs of different patients. However, due to the critical condition of patients in the acute and intensive care units, there are few opportunities to communicate with nurses, and physical pain is difficult to communicate with them. Therefore, even if the nurses have a strong caring ability and pay attention to humanistic care, some specific departments will occasionally be associated with lower nursing satisfaction score. In contrast to inpatients who are more concerned about the quality of humanistic care services, outpatients are often only concerned about the hardware facilities and so on. In conclusion, we should particularly focus on women, single, divorced, or widowed patients, as well as outpatients and patients in intensive care unit, emergency, gynecological, and pediatric departments. These populations warrant further humanistic care services.

### 4.3. Nurse–patient relationship predicts patients' satisfaction with nurses

The results showed that the nurse–patient care relationship was positively correlated with nursing care satisfaction ( $r = 0.37$ ,  $p < 0.001$ ). The results of the hierarchical linear regression analysis showed that after controlling for the demographic variables, the caring, trust, and professional ethics dimensions of relational care were the factors predicting nursing satisfaction. The interaction between the patient and nursing staff, eye contact, and respect for the patient's choice can cultivate trust between the nurse and patient, as patients prefer the nurse to treat them as a person rather than a disease. This kind of good care relationship will inevitably affect patients' satisfaction with nurses' care. However, because nursing care satisfaction is a part of patient satisfaction and affected by many factors, the relevant factors explained only 37% of the variance. Hu (31) suggested that the humanistic care ability of nurses can be increased by improving the nursing humanistic care education and evaluation system, creating a harmonious working atmosphere, improving work–family support for nurses, optimizing the allocation of human resources, and accelerating the construction of intelligent nursing. A good working atmosphere is conducive to improving the satisfaction of nursing staff and making them

happier and more patient when treating patients. Managers should consider the work quality, nursing service, professional assessment, and other conditions of nursing staff in terms of performance pay and implement humanistic management methods. This will enhance collaboration and trust between care leadership and immediate bedside staff to create a culture of care that improves the support, communication, and opportunities for shared decision-making. Establishing a good humanistic care atmosphere will trigger a positive professional identity and improve nurses' enthusiasm for work (32).

## 5. Conclusion

This study investigated the correlation between patients' satisfaction with nursing care and the nurse–patient care relationship in Chinese hospitals through a multicentre survey. Patients' satisfaction with nursing care in Chinese hospitals was positively correlated with the nurse–patient care relationship and these results may provide guidelines for the establishment of relationship care systems. However, patient care satisfaction is related to any group or individual that affects the process and outcome of medical activities. These factors include governments, hospitals, and patients themselves. Nurse–patient relationship care is only one factor influencing patients' nursing care satisfaction. To build a strong nurse–patient relationship and improve nursing care satisfaction, it is necessary to establish a nursing care educational system in hospitals and so increase humanistic care knowledge training. Since 2019, Liu has led experts in the field of humanistic nursing to formulate the expert consensus on “Norms of Practice of Humanistic Care in Hospital Nursing” and the group standard of “Norms of Humanistic Care Management in Ward Nursing” (33–36). Moreover, the Chinese Journal of Hospital Management and the National Standard Network formally published and selected 107 hospitals around China to start the application of “consensus” and “standards.” They also created training criteria for the humanistic nursing care in 107 hospitals, and provided a basis and reference for the next step of a cross-sectional survey for humanistic care intervention. However, this study has several limitations. For example, this study only focused on some departments in the hospital. Future studies will need to include

other departments, such as the orthopedics, cardiovascular, and tumor departments.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Ethical approval for this study was obtained through our university's Research Ethics Board (2022-S161).

## Author contributions

SG, YC, XH, and YL: study conception and design. SG, YC, and HC: acquisition of data. QZ, XH, and BS: analysis and interpretation of data. YL and BS: critical revision. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Clark C. Watson's human caring theory: Pertinent transpersonal and humanities concepts for educators. *Humanities*. (2016) 5:21. doi: 10.3390/h5020021
- Watson J. The theory of human caring: Retrospective and prospective. *Nurs Sci Q*. (1997) 10:49–52. doi: 10.1177/089431849701000114
- Watson J, Smith MC. Caring science and the science of unitary human beings: A trans-theoretical discourse for nursing knowledge development. *J Adv Nurs*. (2002) 37:452–61. doi: 10.1046/j.1365-2648.2002.02112.x
- Wallis M. Caring and evidence-based practice: The human side of critical care nursing. *Intensive Crit Care Nurs*. (2005) 21:265–7. doi: 10.1016/j.iccn.2005.06.003
- Chen R, Yilan L. Research status of humanistic care curriculum in nursing. *Chin J Nursing*. (2014) 49:1249–53. doi: 10.3761/j.issn.0254-1769.2014.10.021
- Gunawan J, Aungsueroch Y, Watson J, Marzilli C. Nursing administration: Watson's theory of human caring. *Nurs Sci Q*. (2022) 35:235–43. doi: 10.1177/08943184211070582
- Turkel M C, Watson J, Giovannoni J. Caring science or science of caring. *Nurs Sci Q*. (2018) 31:66–71. doi: 10.1177/0894318417741116
- Karlsson M, Pennbrant S. Ideas of caring in nursing practice. *Nurs Philos*. (2020) 21:e12325. doi: 10.1111/nup.12325
- McNicholas A, McCall A, Werner A, Wounderly R, Marinchak E, Jones P. Improving patient experience through nursing satisfaction. *J Trauma Nurs*. (2017) 24:371–5. doi: 10.1097/JTN.0000000000000328
- O'Connell B, Young J, Twigg D. Patient satisfaction with nursing care: A measurement conundrum. *Int J Nurs Pract*. (1999) 5:72–7. doi: 10.1046/j.1440-172x.1999.00158.x
- Teskereci G, Yangin H, Kulakac Ö. Effects of a nursing care program based on the theory of human caring on women diagnosed with gynecologic cancer: A pilot study from Turkey. *J Psychosoc Oncol*. (2022) 40:45–61. doi: 10.1080/07347332.2021.1878317
- Arsalan-Özkan O, Okumuş H, Buldukoglu K. A randomized controlled trial of the effects of nursing care based on Watson's Theory of Human Caring on distress, self-efficacy and adjustment in infertile women. *J Adv Nurs*. (2014) 70:1801–12. doi: 10.1111/jan.12338
- De Barbieri I, Sisti D, Di Falco A, Galeazzo M, Amatori S, Rocchi MBL, et al. Relationship-based care model in paediatrics: A randomized controlled trial to implement the parents' perception of the quality of nursing care. *J Adv Nurs*. (2020) 76:3597–608. doi: 10.1111/jan.14585
- Fitzpatrick JJ. Relationship based care and the psychiatric mental health nurse. *Arch Psychiatr Nurs*. (2014) 28:223. doi: 10.1016/j.apnu.2014.05.006
- Reilly J, Krause K, Zande CV, Knutzen B. Implementing relationship-based care as a professional practice model: Promoting nurses' understanding and confidence to apply in practice. *Creat Nurs*. (2019) 25:e36–43. doi: 10.1891/1078-4535.25.4.e36
- Chinese Association for Life Care. *Humanistic Care Management Specification for Ward Nursing*. (2022). Available online at: <http://www.ttbz.org.cn/StandardManagement/Detail/63451> (accessed June 23, 2022).
- Sherwood G. Methodist health care system nurse caring instrument. In: KL Sitzman, J Watson, editors, *Assessing and Measuring Caring in Nursing and Health Sciences*, 3rd ed. New York, NY: Springer Publishing Company. (2019). p. 207–11. doi: 10.1891/9780826195425.0018
- Ray M, Turkel C. Relational caring questionnaires. In: KL Sitzman, J Watson, editors, *Assessing and Measuring Caring in Nursing and Health Sciences*, 3rd ed. New York, NY: Springer Publishing Company. (2019). p. 213–34.
- Jia W, Yuan X, Jia M. Zhuhai hospital humanistic care satisfaction survey research. *J Health Res*. (2010) 30:230–3. doi: 10.19890/j.carolcarrollnkiissn1674-6449.2010.03.021
- Zhao X. *The Relationship Between Psychological Capital, Organizational Climate and Humanistic Care Ability of Clinical Nurses*. Tianjin: Tianjin University of Traditional Chinese Medicine (2019).

21. Liu Y, Wang G, Ren X, Luo Q, Chen D, Zhao G. Investigation on the evaluation of nursing behavior of inpatients. *Chin J Nursing*. (2012) 37:245–7. Available online at: <https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFD2002&filename=ZHHL200204003&uniplatform=NZKPT&v=5r0ROTSx0d0YB1xujMr1LrN83Yk43g8NEGe7dlrebrHZWDqBMXU6s0W8cdPfGkkC>
22. Fan L, Liang G, Guang Q, Wang Q. Research progress of humanistic care ability of clinical nurses. *Nurs Res*. (2015) 16:1929–32.
23. Guo Y, Qiu Y. Current situation and influencing factors of nurses' caring ability. *J Nurs Admin*. (2013) 13:541–2. doi: 10.3969/j.issn.1009-6493.2015.16.003
24. Tong SY. American higher nursing education standards. *Nurs Res*. (2000) 14:183–4. Available online at: <https://kns.cnki.net/KXReader/Detail?invoice=utS2qOQTWNqsrIzsekjUsH3TixjWyckEDQyjq%2FiCUvldTvHVHHZPoKL0bvGsyrrp8Qh6Yf4%2Bb4Jt2VEvP5z0t4WTg2JabwNr%2B0yTtbUrZ4XfVhVtk4EvkQhmKlxb5PTn1KqErtX2PdeFzN1OLPj1iFRG5526T8r62VMNjewFDVt4%3D&DBCODE=CJFD&FileName=SXHZ200004036&TABLEName=cjfd2000&nonce=5DCB25E3500E4ED8981C78A7D7E06A8F&uid=&TIMESTAMP=1672928409478>
25. Milutinović D, Simin D, Brkić N, Brkić S. The patient satisfaction with nursing care quality: The psychometric study of the Serbian version of PSNCQ questionnaire. *Scand J Caring Sci*. (2012) 26:598–606. doi: 10.1111/j.1471-6712.2012.00969.x
26. Chi L. Relationship between marriage and happiness of Chinese people: Factual description and theoretical test. *J Cap Normal Univ*. (2016) 145–56. Available online at: [https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2016&filename=SDSD201601019&uniplatform=NZKPT&v=LHkMWo9UUfQfd63-a7GiMGaD5WJOLaLl9qEHbpbEPm\\_6Wo3\\_Yf8BJMOa-o2Kp7ya](https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2016&filename=SDSD201601019&uniplatform=NZKPT&v=LHkMWo9UUfQfd63-a7GiMGaD5WJOLaLl9qEHbpbEPm_6Wo3_Yf8BJMOa-o2Kp7ya)
27. Xue C, Liu Y, Xu J, Hu D, Xiong L, Lu C, et al. Investigation and analysis of humanistic care ability of nurses in basic hospitals of medical alliance. *J Nurs*. (2019) 34:43–6. doi: 10.3870/j.issn.1001-4152.2019.14.043
28. Simmons PR, Cavanaugh SH. Relationships among student and graduate caring ability and professional school climate. *J Prof Nurs*. (2000) 16:76–83. doi: 10.1016/S8755-7223(00)80019-8
29. Veloza-Gomez M, Munoz de Rodriguez L, Guevara-Armenta C, Mesa-Rodriguez S. The importance of spiritual care in holistic nursing practice. *J Holist Nurs*. (2017) 35:118–31. doi: 10.1177/0898010115626777
30. da Silva RC, Ferreira MA. The practice of intensive care nursing: Alliance among technique, technology and humanization. *Rev Esc Enferm USP*. (2013) 47:1325–32. doi: 10.1590/S0080-623420130000600011
31. Hu Y, Ge G, Zou G, Guo S, Li L. Zhengzhou city humanistic care nursing ability present situation and influence factors. *J Health Psychol*. (2022) 30:1326–31. doi: 10.13342/j.carolcarrollnkiCJHP.2022.09.010
32. Lanjing C, Yinju D, Cai W. Correlation analysis between humanistic care atmosphere and work engagement of 218 ICU nurses. *J Nurs*. (2019) 26:57–9. doi: 10.16460/j.issn1008-9969.2019.09.057
33. Hu Y, Huo J, Zou G, Ge G, Hou S, Li L, et al. Nurses work family support and humanistic care ability of correlation study. *J Nurs Sci*. (2022) 5:45–7. doi: 10.3870/j.issn.1001-4152.2022.05.045
34. Humanistic Nursing Professional Committee of China Life Care Association. Humanistic care hospital nursing practice specification expert consensus. *Chin J Hosp Manag*. (2021) 10:843–7. doi: 10.3760/cma.j.c.n111325-20210129-00092
35. Liu Y, Guan C, Hu D, Huang L, Huang H, Hu Y. Hospital nursing humanities standardization management and effective. *Chin J Hosp Manag*. (2016) 32:226–9. doi: 10.3760/cma.j.issn.1000-6672.2016.03.017
36. Humanistic Nursing Professional Committee of China Life Care Association. *Humanistic Care Ward Nursing Management Standard Specification Groups*. (2021). Available online at: <http://www.ttbz.org.cn/Home/Show/40217> (accessed April 8, 2022).



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# The integrated effects of leader–member exchange social comparison on job performance and OCB in the Chinese context

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Although it has been long recognized that leader–member exchange social comparison (LMXSC) has critical implications for employee productivity, little attention has been given to systematically exploring the effects of LMXSC on employee performance in a specific cultural context. Integrating social exchange theory with social comparison theory, we examine a dual process model to explain how and when LMXSC affects employee performance outcomes in the Chinese context. Results based on multiphase, multisource data from China revealed that the mediating roles of employees' perceived obligation toward the leader and self-esteem are examined simultaneously in the relationship between LMXSC and job performance and organizational citizenship behavior (OCB). Additionally, guanxi strengthens the connection between LMXSC and perceived obligation, while Zhongyong thinking erodes the connection between LMXSC and self-esteem. Taken together, these findings enhance our understanding of LMXSC in China.

## KEYWORDS

leader–member exchange social comparison, guanxi, Zhongyong thinking, job performance, organizational citizenship behavior

## 1. Introduction

In the workplace, we seem unable to stop comparing ourselves to peers in various aspects, such as performance, salary (Kim et al., 2018), stress, health (Yang et al., 2021), status (Reh et al., 2022), and especially the leader–employee relationship. Without a doubt, leaders hold the keys to the huge resources that determine whether employees successfully complete their tasks and advance in their careers, and their access to these resources is largely contingent on their relationship with the leader (Moser et al., 2022). According to a survey in 2022, a startling 79% of employees will quit after obtaining insufficient appreciation from their superiors or establishing positive work relationships with them (Apollo Technical, 2022). Consequently, leader–member exchange social comparison (LMXSC) defined by Vidhyarthi et al. (2010) as employees' evaluations of their own leader–member exchange (LMX) relative to that of their peers has been one of the most important topics in the leader–employee relationship field over the years. LMXSC acknowledges that each leader–follower dyadic relationship is nested inside multiple leader–follower relationships (Martin et al., 2018), and that the comparison in terms of LMXs across employees significantly leads to their attitudinal and behavioral outcomes. To get a better understanding of the current of LMXSC research, we conducted a systematic review of the LMXSC literature and identified 23 relevant studies, as shown in Table 1. The existing research suggests that LMXSC plays a vital role in explaining, for example, employees'

TABLE 1 Existing research on LMXSC as an antecedent.

Authors (year)	Samples	Theories	Mediators	Moderators	Outcomes
Vidyarthi et al. (2010)	India	/	/	/	Job performance; OCB
Tse et al. (2013)	China	Balance theory	A's Contempt for B	Social comparison orientation; Coworker A's LMX	Perception of help
Chan (2015)	/	Social influence theory	/	Politically skill	Ingratiation
Huang et al. (2015)	China	/	Procedural justice; Interpersonal justice	Organizational embodiment	Organizational deviance; Supervisor-directed deviance
Ott-Holland (2015)	United States	Attribution theory; Core affect theory	/	Interpersonal justice; Locus of causality for relationship building with one's supervisor	Positive emotion; Negative emotion
Matta (2016)	United States	Social comparison emotions	/	Self-other overlap	Emotions
Vidyarthi et al. (2016)	India	Social comparison theory	/	Team orientation; Task interdependence.	Performance
Kim H. L. R. et al. (2017)	/	Impression management research	Coworker exchange	LMX; Equity sensitivity	Interpersonal citizenship behavior
Valdiviezo (2017)	United States	Social comparison theory; Attachment theory	Job embeddedness	/	Psychological ownership; Job satisfaction
Tse et al. (2018)	United States	Social comparison theory	Hostility toward to coworker	Procedural justice climate	Harmful behavior toward the coworker
Arain et al. (2019)	Kingdom of Saudi Arabia	/	/	/	Promotive voice; Prohibitive voice
Lee et al. (2019)	United States; China	Social exchange theory	Felt obligation	Psychological entitlement; Job performance	Job performance; Organizational commitment
Choi et al. (2020)	South Korea	The equality principles	Procedural justice climate; Relational conflict	/	Team performance; Individual performance
Flores et al. (2020)	/	Social cognitive theory; Social comparison theory	Self-efficacy	Ethical leadership	Job performance; OCB
Lapointe et al. (2020)	Canada	Social exchange theory	Organizational commitment	Perceived supervisor collective self-concept; Employee relational self-concept; Perceived supervisor relational self-concept	Task proficiency; Task adaptivity and proactivity
Korman et al. (2020)	United States	Social comparison theory	Hubristic pride	/	Coworker-direct social undermining
Sharma et al. (2020)	India	Social comparison theory	Envy	Aggression-preventive supervisor behavior	Uncivil behavior
Weng et al. (2020)	China	Social comparison theory	Envy toward coworkers	Cooperative goal interdependence; Competitive goal interdependence	Knowledge hiding behavior
Chen and Zhang (2021)	China	Group engagement model	Procedural justice	LMX; Group-level LMX differentiation	/
Pan et al. (2021)	China	Social comparison theory; EASI theory	Benign envy; Malicious envy	Perceived hubristic pride; Perceived authentic pride	Learning behavior; Social undermining
Shalendra and Kang (2021)	/	Social comparison theory	Employee-organization relationship	Supervisor's organizational embodiment	Voice behavior
Lee et al. (2022)	United States	Social comparison theory	Psychological capital	/	Malicious envy; Benign envy
Liu et al. (2022)	China	Social identity theory	Perceived outsider status of the target	Trait self-control	Deviant behavior



job performance, organizational citizenship behavior (OCB), knowledge hiding behavior, and organizational commitment (Weng et al., 2020; Jahantab et al., 2021; Afshan et al., 2022). Although it has been known for a long time that LMXSC has significant consequences for employee productivity, most studies rely on only one theoretical perspective to understand its influences (Korman et al., 2020; Lapointe et al., 2020; Liu et al., 2022), which are largely limited to our systematically examining why and how LMXSC shapes employee job performance and OCB (Harris et al., 2014). In addition, most research on LMXSC have been conducted in western context (Lapointe et al., 2020), leaving it unclear if LMXSC has a comparable role in predicting the organizational behaviors of Chinese employees. Cultural factors may drive employees from diverse cultural backgrounds to adopt varying opinions towards LMXSC and thus moderate the relationship between LMXSC and outcomes (Rockstuhl et al., 2012). Thus, findings originating from western contexts may not necessarily be applicable to other cultural situations, or further findings may be uncovered in an eastern cultural context.

To fill in these theoretical gaps in the current LMXSC research, we build an integrated theoretical framework for how and when LMXSC works in the Chinese context to affect employee outcomes. Specifically, we combine LMXSC research with the two most relevant theories, namely social exchange theory and social comparison theory. Social exchange theory asserts that employee performance is contingent upon reciprocal obligations stemming from the employee's relationship with their leader (Cropanzano and Mitchell, 2005), whereas social comparison theory explains why social comparison processes within focal individuals in terms of leader-employee relationships are central to individual outcomes (Festinger, 1954). Both theories lay the foundation for the formulation and development of the LMXSC concept (Vidhyarthi et al., 2010). This relevant and common theoretical foundation enables us to present a unified or integrated perspective for elucidating the process by which LMXSC translates into employee job performance and OCB.

Drawing upon social exchange theory, followers with good-quality LMX tend to obtain various resources provided by their leaders and thus have a strong motivation to improve their in- and out-role performance as a form of reciprocating their leaders' payout (Erdogan and Liden, 2002). If employees have a high LMXSC, they seem to be more inclined to feel obligated to their leaders, which will affect their job performance and OCB (Hooper and Martin, 2008). Moreover, literature on social exchange posits that situational characteristics shape individuals' feelings of obligation requested by the leader-employee relationship (Hollander, 1980). In China, the overlap between work and social relations is significantly more pervasive, and *guanxi*, an indigenous Chinese concept, describes "an informal, particularistic personal connection between two individuals who are bound by an implicit psychological contract to follow the social norm of *guanxi*" (Chen and Chen, 2004, p: 306). Supervisor-subordinate *guanxi* (hereinafter referred to as *guanxi*) specially refers to an employee's personal, non-work relationships with a leader (Chen et al., 2013), which involve mutual commitment, loyalty, and trust. We argue that if employees with high LMXSC also have *guanxi* with their leaders, they will perceive an obligation to repay the resources from their leaders, thus strengthening the positive relationship between LMXSC and perceived obligation toward leaders.

On the other hand, drawing upon social comparison theory, individuals undertake social comparison processes in which they evaluate themselves by considering "information about one or more other people

in relation to the self" (Wood, 1996, p: 520–521). Accordingly, those with a high LMXSC who compare themselves to their less fortunate coworkers are likely to create a positive self-image, while those with a low LMXSC tend to develop a negative self-image after comparing themselves to those in a better LMX position (Tse et al., 2018). As a fundamental self-image-related evaluation, self-esteem is defined as a person's self-perception of his or her own value, worth, or competence (Pyszczynski et al., 2004). We argue that LMXSC has a positive relationship with employee self-esteem and leads to employees acting in a way congruent with their competence and value, such as by exhibiting high work performance and OCB. However, the positive effect of LMXSC on self-esteem may be mitigated if the employee has a high degree of Zhongyong thinking, a unique and significant mode of thinking in traditional Chinese culture (Wei et al., 2020). Zhongyong is the core content of Confucian thought, which has dominated Chinese society since ancient times and had a tremendous impact on the Chinese people (Yang et al., 2016). Zhong signifies center, the mean, and balance, neither leaning to one side nor the other, while Yong denotes ordinarieness, universality, and harmony (Chiu, 2000; Kim et al., 2006). Individuals with high Zhongyong thinking can think of others as well as themselves (Yang et al., 2016) and tend to stand in the middle of the LMX rank. Their positive or unfavorable comparisons to others on LMXs become less prominent, hence diminishing the positive association between LMXSC and self-esteem.

Overall, our research has several important theoretical implications for the existing literature. First, we provide an integrated theoretical framework to unfold the effects of LMXSC on job performance and OCB by drawing from the social exchange and social comparison theories. Second, it represents a first step towards comprehending the roles of *guanxi* and Zhongyong thinking in the relationship between LMXSC and job performance and OCB in the Chinese cultural context. Such an examination largely enhances our knowledge of LMXSC in the Chinese context. Third, by demonstrating that Zhongyong thinking adversely affects the association between LMXSC and self-esteem, we are able to recognize that LMXSC is not always effective for all employees, and even superior LMX over their colleagues may become a burden for certain employees.

Next, this article is structured into three major sections. First, the present study expands on a clear theoretical framework based on social exchange theory and social comparison theory to hypothesize how and when LMXSC impacts employee job performance and OCB along two paths. Second, the present study uses a multi-source and multi-time field study to evaluate our theoretical model in the Chinese workplace. Third, theoretical and practical implications of LMXSC are discussed.

## 2. Theory and hypothesis

### 2.1. Social exchange path: LMXSC, perceived obligation, job performance, and OCB

Social exchange theory is a typical theoretical paradigm for explaining supervisor-subordinate interaction (Kim S. L. et al., 2017). The central tenet of social exchange theory is that resources are transferred through a reciprocal process in which one party wishes to return (an eye for an eye) the positive (or negative) behavior of another party (Gergen, 1969). In addition, the quality of the reciprocal process is largely determined by the relationship between the giver and the receiver (Blau, 1964). In a team, leaders differentiate in their treatment of followers, resulting in LMXs ranging from low to high between the leader and each employee (Sparrowe and Liden, 1997). Low-quality LMX relationships encompass mostly

economic exchanges, which means formal, role-defined interactions and contractual exchanges between leaders and followers, whereas high-quality LMX relationships are based on social exchanges, which are typified by liking, trust, support, and respect (Cogliser et al., 2009). In general, employees with high LMX tend to respond to the preferential treatment received from the leader by meeting the leader's expectations or increasing the leader's interest, a process known as reciprocation (Uhl-Bien and Maslyn, 2003). However, a good-quality LMX relationship in the context of other high-quality relationships erodes its significance and may become inadequate to elicit strong feelings of obligation.

As previously mentioned, LMXSC depicts an employee's subjective judgments of their own relative LMX position in comparison to their coworkers (Choi et al., 2020); a high level of LMXSC indicates that the employee has a better LMX connection with the leader than coworkers. LMXSC denotes a very valued connection, suggesting that the leader will commit more resources to this relationship than to others (Lee et al., 2019). That is, LMXSC can help to recognize the surrounding context of an employee's LMX, where multiple LMX relationships exist between a leader and their followers, and determine to whether or not his or her LMX holds value (Pan et al., 2021). If followers with a high LMXSC have become the leader's favorites, meaning they have received more instrumental resources and support from their leaders, such as information, learning opportunities, good evaluations, or promotion, than their coworkers (Thomas et al., 2013). In addition, they also get more affective support, like, and trust from their leader than other coworkers (Marescaux et al., 2021). According to social exchange theory, scarcity, such as when you have something that most others do not, enhances the value of any deal (Blau, 1964). Clearly, a high LMXSC consists of a variety of resources that each employee would deem important and aspire to obtain in their organization. In this case, according to the logic of social exchange, employees with a high LMXSC would feel more obligated to respond to their leaders because they know that their leaders treat them better than other coworkers, giving them access to vital and exclusive resources (Singh and Vidyarthi, 2018). Lee et al. (2019) found that LMXSC is positively related to felt obligation.

Moreover, when employees feel obligated to their leaders, they will demonstrate positive work behaviors (Dulebohn et al., 2012) in order to satisfy their leaders' expectations. Work performance is one of the most important factors determining the overall success of an organization; as a result, it has evolved into the primary focus of leaders (Rich et al., 2010). Work performance is increasingly seen as including concepts such as "job performance," defined as outputs explicitly required by a job role, and "OCB," defined as discretionary behaviors that advance the interests of organizations (Organ, 1988). We contend that there are two primary ways for employees to complete their duties in order to reciprocate their leader: job performance and OCB. Previous research has documented that employees would positively finish their job duties or work hard to fulfill their sense of obligation (Basit, 2017). Wong et al. (2022) found that employees' feeling of obligation toward LMX leads to improvements in their job performance. Kim et al. (2010) found that LMX leads to a higher OCB. Overall, we propose that:

*H1: Perceived obligation positively mediates the relationship between LMXSC and (a) job performance, and (b) OCB.*

## 2.2. The moderating role of guanxi

As stated earlier, LMXSC instills in employees a feeling of obligation towards the leader. In this section, we investigate which situations

LMXSC will have a greater or lesser effect on perceived obligation using the social exchange perspective. In particular, we argue that guanxi makes the link between LMXSC and perceived obligations stronger. Guanxi is the core concept for comprehending Chinese social structure and interpersonal interaction among Chinese, who are primarily relationship-oriented (Chen and Chen, 2004). That is, guanxi is widespread and all-encompassing in Chinese society and is seen as a major factor in influencing how Chinese interact with and treat others (Wang et al., 2005). The concept of guanxi originates from Confucianism, which has identified the five most fundamental relationships between people: monarch, father and son, couple, brother, and friend (Haibo, 2020), namely the "five lun." Five lun desires that all parties in a particular relationship express and behave in accordance with their social roles. In Chinese companies, supervisor-subordinate guanxi is an informal and personal relationship characterized by personal contact, emotional engagement, and mutual support beyond the workplace (Zhang et al., 2016). Guanxi develops mostly *via* non-work-related social contacts, such as having dinner, giving gifts, and helping, and emphasizes the principle of communal sharing between parties (i.e., the development of significant personal obligations based on specific or emotional ties; Zhang et al., 2015). In contrast, LMX originates from work-related interactions that are confined to the workplace, include only work-related exchanges, and emphasize the equity-matching principle (i.e., the fair exchange between performance and rewards for leaders and employees; Martin et al., 2005). We argue that there are three reasons to explain why guanxi may be a potential moderator in the relationship between LMXSC and perceived obligation.

First, LMXSC is based on relationships and activities defined by formal, role-based interactions in the workplace, while guanxi is a sort of informal relationship that occurs in the personal lives of employees (Zhang et al., 2015). Employees who have a high LMXSC as well as guanxi with leaders are more likely to form social exchange relationships in their work interactions as well as personal close relationships that include various emotional support in the life domain (Han and Altman, 2009). In different domains, we argue that two key forms of the employees' relationship ties—organizational ties to the leaders and life ties to the leaders—can create a large and rich social network for the employees and enable them to meet the leaders' needs and goals to maintain these stable ties with leaders who provide them with important information, social support, and interesting assignments (Balkundi and Kilduff, 2006). A growing number of studies have shown that the more extensive and intimate a person's social network, the more reciprocal obligations that individual embedded in the social network should fulfill (Lin and Lo, 2015).

Second, guanxi is founded on affection and a feeling of reciprocal responsibility (Thibaut and Kelley, 1959), emphasizing emotional commitment and a desire to look out for one another. Nonetheless, LMXSC, which is derived from LMX, incorporates social and economic exchanges, emphasizing formal role duties and a feeling of indebtedness (Lee et al., 2019). Zhang et al. (2016) proposed that LMX is limited in cognition-based support between two parties, which is mostly reliant on the calculation of give and return, and that two parties prefer to maintain a balance of give and take. Accordingly, LMXSC reflects that employees get better or worse LMXs compared with other coworkers (Weng et al., 2020). In contrast, guanxi is a parochial and emotive bond founded on a shared understanding between individuals (Li, 2007). Guanxi is affection-based support between two parties; when employees have strong guanxi with the leader, they can identify the leader's desires when determining their future activities (Zhang et al., 2016). Thus, those high

in guanxi and LMXSC feel a double (cognitive and emotional) obligation to repay their leader.

Third, the communal sharing principle makes people in guanxi perceive a greater obligation to reciprocate, although they would get fewer rewards and benefits (Miao et al., 2020). The equity matching principle requires employees in LMX or LMXSC to repay based on what they receive from leaders. Guanxi is clearly long-term oriented and is based on total commitment and trust (Aryee et al., 2002). More importantly, guanxi manifests itself as being other-oriented, and this other-oriented characteristic causes people to not only have enough understanding of and concern for the other's interests but also to not care if they give more or get less (Chen and Chen, 2004). Thus, we propose:

*H2: Guanxi positively moderates the relationship between LMXSC and perceived obligation.*

### 2.3. Social comparison path: LMXSC, self-esteem, job performance and OCB

Social comparison theory proposes that social comparison is a basic aspect of human social existence (Buunk and Gibbons, 2007), that individuals frequently compare themselves to others in order to learn more about themselves, and that the outcomes of these comparisons influence their future behaviors. Employees have a natural tendency to compare themselves to peers who are repeatedly exposed same or comparable leaders, events, practices, and experiences (Kim et al., 2010). In the workplace, leaders tend to distinguish their treatment of their followers, which builds social exchange ties (high LMX) with certain ingroup followers and economic exchange ties (low LMX) with other outgroup followers (Henderson et al., 2009). This kind of LMX differentiation leads employees to participate in social comparisons with their coworkers in order to ascertain their LMX rank, and thus, Vidyarthi et al. (2010) refer to this process as LMXSC.

We argue that LMXSC evaluations are a significant factor in the development of self-esteem. Self-esteem, defined as the extent to which an individual believes he or she is competent, important, and worthy (Bandura, 1986), is a vital element of self-evaluation that influences individual behavior. Self-esteem can be derived through social comparisons that convey self-relevant information (Wheeler and Miyake, 1992). According to the direction of social comparison, it may be categorized as either upward comparison (i.e., comparing oneself to others who are better off; Festinger, 1954) or downward comparison (i.e., comparing with others who are worse off; Hakmiller, 1966). Furthermore, people who are in downward comparisons have a positive self-image, while people who are in upward comparisons have a negative self-image (Maslach, 1993). Similarly, employees with a high LMXSC prefer to engage in downward comparisons, and their dominant LMX position gives them a sense of self-worth and competence, resulting in a strong feeling of self-esteem. Conversely, employees with a low LMXSC tend to make upward comparisons, and their inferior LMX status causes them to believe they lack abilities, significance, and worth (Araín et al., 2017). In addition, the symbolic interactionist approach indicates that a person's self-concept is rooted in interpersonal connections (Mead, 1934), and that our self-perceptions are significantly influenced by how others perceive and see us (e.g., the looking-glass self; Cooley, 1972). For example, Leary et al. (1995) argued that self-esteem level is the result of being liked or

disliked by others. Ferris et al. (2015) also found that when employees are disliked by others, they will have a low level of self-esteem. A high LMXSC ranking indicates that the targeted employees are the leaders' favorites and get special attention, trust, or favor, while a low LMXSC indicates the likelihood that a person has already been excluded from the support and attention of a leader. Overall, LMXSC may positively lead to self-esteem.

Moreover, we argue that self-esteem is positively expected to relate to job performance and OCB. As noted previously, employees with low self-esteem are more likely to see themselves as failures and underperform in comparison to others (Rosenberg, 1965), while employees with high self-esteem see themselves as capable and valuable. According to the self-verification theory, people act in line with their self-evaluation (Korman, 1976). Therefore, employees with a high degree of self-esteem should be more confident and motivated to demonstrate outstanding job performance and even participate in OCB. Research has consistently shown that there is a positive relationship between self-esteem and job performance (e.g., Strauss, 2005). Ma et al. (2021) found that employees with high self-esteem are more likely to participate in OCBs that go beyond formal job obligations, such as maintaining exceptional role performance and assisting others. However, low-self-esteem employees should be less likely to participate in job performance and OCB to demonstrate that they do not have enough abilities or much capability, or to demonstrate to others that they are failures (Avey et al., 2011). Thus, we propose that

*H3: Self-esteem positively mediates the relationship between LMXSC and (a) job performance, and (b) OCB.*

### 2.4. The moderating role of Zhongyong thinking

According to the social comparison theory, not everyone would experience the same consequences of social comparison when confronted with the same a comparable social comparison scenario (Lyubomirsky and Ross, 1997). Individual characteristics impact how individuals respond to the outcomes of social comparisons (Sedikides and Brewer, 2001). Specifically, White and Lehman (2005) claim that people from diverse cultural origins have distinct social comparison outcomes. In general, individuals from Eastern and Western cultural contexts vary in how they make sense of objects, people, events, and surroundings (Markus and Kitayama, 1991). According to Chang and Yang (2014), one of the fundamental ways that Chinese people think is through the lens of Zhongyong, which is concerned with the ways in which Chinese people see things, other people, and the world around them (Pierce and Aguinis, 2013). Chinese individuals prefer to avoid extreme perspectives on the environment, place themselves in the middle of any given ranking system, and make judgments and take actions in a moderate manner (Wei et al., 2020). Zhongyong maintains that an individual's feelings, thoughts, and actions should never be experienced or expressed outside of the bounds of moderation, that is, neither in an excessive amount nor in an inadequate amount (Ji and Chan, 2017). Wu and Lin (2005) proposed that people with Zhongyong thinking can think in multiple dimensions, such as time, space, and roles, can recognize the dialectical relationship between contradictory elements (e.g., everything has both a dark and a light side); and can connect objects, people, and the environment from a holistic perspective.



Zhongyong thinking influences how employees view and respond to LMXSC. First, employees with high Zhongyong thinking tend to be more perspective-taking and see the world from others' viewpoints (Wei and Wang, 2020). In this case, high-level LMXSC members who make downward comparisons may consider and share the thoughts and sensations of their less fortunate coworkers, thereby weakening their sense of relative superiority (Yu and Yang, 2022). Second, employees with Zhongyong thinking might analyze LMXSC from a long-term vantage point (Chou et al., 2014), indicating that they are less prone to be misled by the relatively high LMX standing at present. In fact, the present high LMXSC is not fixed in stone, and the current high LMXSC does not guarantee that it will be maintained in the future. When employees with Zhongyong thinking are able to recognize this point, the benefits associated with having a high LMXSC in the social comparison process are diminished for those employees. As a result, possessing a high LMXSC ranking could no longer serve as a motivating factor for those employees to develop their self-esteem. Conversely, when low LMXSC members with high Zhongyong thinking engage in upward comparisons, they may put themselves in the shoes of better-off coworkers and think that their status level (i.e., high LMXSC) is attainable for them in the future (Buunk and Ybema, 1997). Third, the connotation of integration in Zhongyong thinking motivates employees to develop cooperative beliefs rather than competitive beliefs (He and Li, 2021). A competitive belief makes employees more likely to feel alienated from the team, leading them to care more about the outcomes of social comparison, thereby highlighting the effects of LMXSC (Garcia et al., 2013). That is, competitive belief emphasizes the contrast effects of social comparison, making LMXSC more important in the process of developing individual self-esteem (Morse and Gergen, 1970). Cooperative mindset causes employees to diminish the disparities between themselves and their low LMXSC coworkers and to view their superior ranks in terms of LMXs as common and reachable by their coworkers, thereby lowering their self-esteem (Buunk et al., 1990). Finally, Zhongyong thinking personnel would understand that an excess of any good thing is ultimately undesirable (Pierce and Aguinis, 2013). Zhongyong thinking highlights universal advocacy for proportionality over extremity (Wei et al., 2020). In such a context, low LMXSC members with high Zhongyong thinking might perceive the current low LMXSC as no bad thing, while high LMXSC members with high Zhongyong thinking might perceive the current high LMXSC as no good thing. Thus, the positive effect of LMXSC on self-esteem is diminished by Zhongyong thinking. Overall, we propose our hypothesis:

*H4: Zhongyong thinking negatively moderates the relationship between LMXSC and self-esteem.*

## 3. Methods

### 3.1. Participants and procedure

China is now the biggest domestic tourism market, the largest international tourism consumer, and the fourth largest tourist destination in the world. The hotel industry is an essential pillar sector in China and plays an important role in the national economy's growth. Although research efforts have been more focused on the impacts of LMXSC, the question of whether LMXSC is beneficial to the hotel business remains

unanswered. The hotel sector, which is characterized by interpersonal interaction, is an appropriate setting for analyzing the comparison of interpersonal relationships such as LMXSC. Therefore, the context of our current investigation focuses on the Chinese hotel industry.

We collected multisource data across three time points from 10 hotel organizations located in China. We obtained a strong endorsement of our work from the human resources departments of these organizations. This study project included employees from different departments, and we made sure to ask them if they were interested in doing our survey before inviting them. We provided all participants with a thorough explanation of how we protected their anonymity by never disclosing their personal information in exchange for their voluntary participation. We used identifying numbers to match the survey answers of employees and their supervisors across all three waves.

Each of the three waves was separated by 2 weeks. During Wave 1, questionnaires were administered to 478 subordinates. Respondents were asked to provide demographic information and their perceptions about LMXSC, LMX, guanxi, and Zhongyong thinking. A total of 446 usable responses were obtained, representing a response rate of 93.31%. Two weeks later, we delivered Wave 2 surveys to 446 employees, asking them to rate their perceived obligation and self-esteem, and we received 415 valid replies, for a response rate of 93.05%. Two weeks after Wave 2, we distributed Wave 3 questionnaires to supervisors (who supervised the 415 subordinates) and asked them to rate the work performance and OCB of their subordinates. 370 valid responses were identified, resulting in a response rate of 89.16%. Finally, we got 370 dyads of data.

The employee sample was 60% female; employees averaged 29.04 years of age ( $SD=6.56$ ) and reported working an average of 53.24 months ( $SD=60.73$ ) in their organizations. In terms of marital status, 61.4% of them were married. In terms of education, the sample included those with a junior high school diploma or less (3.2%), technical secondary school (11.6%), high school (6.2%), junior college (31.6%), a bachelor's degree (42.4%), and a postgraduate degree (4.2%).

## 3.2. Measures

Unless otherwise specified, all measures were scored using a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). In order to convert English scales to Chinese scales, translation and back-translation were utilized (Brislin, 1980).

### 3.2.1. LMXSC

Employees were assessed for LMXSC with Vidyarthi et al. (2016) 6-item measure. Included in the sample items was "I have a better relationship with my manager than most others in my work group" (Cronbach's  $\alpha=0.938$ ).

### 3.2.2. Perceived obligation

Perceived obligation was measured using the seven-item scale created by Eisenberger et al. (2001). An example item was, "I feel a personal obligation to do whatever I can to help my leader achieve his/her goals" (Cronbach's  $\alpha=0.940$ ).

### 3.2.3. Self-esteem

Rosenberg (1965) 10-item self-esteem scale was used. Sample items include, "On the whole, I am satisfied with myself" (Cronbach's  $\alpha=0.939$ ).

### 3.2.4. Guanxi

Guanxi was used with six items developed by Law et al. (2000). Sample items include, “I always actively share with my supervisor about my thoughts, problems, needs and feelings” (Cronbach’s  $\alpha=0.894$ ).

### 3.2.5. Zhongyong thinking

Zhongyong thinking was measured using 13 items developed by Taiwanese scholars Wu and Lin (2005). The measurement used a 5-point Likert-type scale (1=strongly disagree, 5=strongly agree) to rate Zhongyong thinking. An example item was, “I will take into account the conflicting views from each other in discussion” (Cronbach’s  $\alpha=0.948$ ).

### 3.2.6. Job performance

Because our samples are from hotels and we utilize service performance to gauge their job performance. Job performance was assessed using a seven-item measure by Liao and Chuang (2004). An example item was, “being friendly and helpful to customers” (Cronbach’s  $\alpha=0.901$ ).

### 3.2.7. OCB

OCB was assessed using a fourteen-item developed by Williams and Anderson (1991). Sample items include, “I help others who have heavy workloads” and “I conserve and protects organizational property” (Cronbach’s  $\alpha=0.953$ ).

### 3.2.8. Control variables

We controlled for followers’ gender (0 = male; 1 = female), age (in years), organizational tenure (in months), marital status (1 = single; 2 = married), and education (1 = junior high school or below; 2 = technical secondary school; 3 = high school; 4 = junior college; 5 = bachelor’s degree; 6 = master’s degree or above) because employees’ demographic variables may impact their attitudes as well as their performance (Lam et al., 2015). We also controlled for LMX because it is one of the most closely related constructs to LMXSC. We measured LMX with a 10-item scale developed by Liden et al. (1993). Sample items are “I know where I stand with my supervisor” and “My supervisor recognizes my potential” (Cronbach’s  $\alpha=0.902$ ).

## 4. Results

### 4.1. Descriptive statistics

The mean, standard deviation, and correlations among our variables are shown in Table 2. LMXSC is positively related to perceived obligation ( $r=0.255, p<0.01$ ), self-esteem ( $r=0.254, p<0.01$ ), job performance ( $r=0.324, p<0.01$ ), and OCB ( $r=0.184, p<0.01$ ). Perceived obligation is positively related to job performance ( $r=0.270, p<0.01$ ), and OCB ( $r=0.340, p<0.01$ ). Self-esteem is positively related to job performance ( $r=0.239, p<0.01$ ), and OCB ( $r=0.261, p<0.01$ ).

### 4.2. Common method bias

Harman’s one-factor test was used to test the common method bias (Chang et al., 2020). The results showed that the largest, extracted component accounts for only 20.386% of the total variance. In addition, confirmatory factor analyses were conducted. Fit indices were compared

between two measurement models: (1) a model with a common method factor and (2) a model without a common method factor. The fit indices did not improve significantly ( $\Delta CFI=0.000$ ,  $\Delta TLI=0.001$ ,  $\Delta RMSEA=0.000$ ,  $\Delta SRMR=0.005$ , respectively). Overall, these findings demonstrated that the likelihood of common method bias is, in fact, low.

### 4.3. Confirmatory factor analyses

We conducted a set of confirmatory factor analyses to examine whether our measures (i.e., LMXSC, perceived obligation, self-esteem, guanxi, Zhongyong thinking, job performance and OCB) captured distinctive constructs (see Table 3). Results suggested that the theorized seven-factor model [ $\chi^2(1864)=3341.931$ ,  $CFI=0.919$ ,  $TLI=0.915$ ,  $RMSEA=0.046$ ,  $SRMR=0.044$ ] fit the data better than six alternative models, demonstrating that these variables were distinct.

### 4.4. Tests of the hypotheses

We used the PROCESS macro (Model 4) to test the mediating effects of perceived obligation and self-esteem. Table 4 revealed that, after accounting for all control variables, LMXSC had a significant and positive effect on perceived obligation ( $b=0.237, p<0.01$ ), self-esteem ( $b=0.212, p<0.01$ ) and job performance ( $b=0.251, p<0.01$ ). Perceived obligation had a significant and positive effect on job performance ( $b=0.161, p<0.01$ ) and OCB ( $b=0.257, p<0.01$ ). Self-esteem had a significant and positive effect on job performance ( $b=0.145, p<0.05$ ) and OCB ( $b=0.177, p<0.01$ ). In addition, results revealed that the indirect effect of LMXSC on job performance *via* perceived obligation was significant, estimate = 0.038, 95% CI = [0.008, 0.087]. Likewise, the indirect effect of LMXSC on OCB *via* perceived obligation was significant, estimate = 0.061, 95% CI = [0.023, 0.116]. Thus, H1a and H1b were supported. The indirect effect of LMXSC on job performance *via* self-esteem was significant, estimate = 0.031, 95% CI = [0.002, 0.072]. Likewise, the indirect effect of LMXSC on OCB *via* self-esteem was significant, estimate = 0.037, 95% CI = [0.010, 0.087]. Thus, H3a and H3b were supported.

In addition, we tested the moderated mediation model using the PROCESS macro (Model 7). Table 5 revealed that, after accounting for all control variables, the interaction of LMXSC and guanxi was significant and positive in predicting perceived obligation ( $b=0.146, p<0.01$ ). Simple slope tests indicated that the effect of LMXSC on perceived obligation was stronger at higher levels of guanxi (+1 SD;  $b=0.448, t=5.638, p<0.01$ ) than at lower levels (−1 SD;  $b=0.156, t=1.985, p<0.05$ ; Figure 1). Thus, Hypothesis 2 was supported. The interaction of LMXSC and Zhongyong thinking was significant and negative in predicting self-esteem ( $b=-0.113, p<0.05$ ). The effect of LMXSC on self-esteem was stronger at lower levels of Zhongyong thinking (−1 SD;  $b=0.377, t=5.421, p<0.01$ ) than at higher levels (+1 SD;  $b=0.150, t=2.153, p<0.05$ ; Figure 2). Thus, Hypothesis 4 was supported.

Table 6, for job performance, revealed that the index of moderated mediation when the mediator is perceived obligation and the moderator is guanxi was significant (index = 0.017; 95% CI = [0.003, 0.043]). The indirect effect of LMXSC on job performance *via* perceived obligation was significant and positive when guanxi was higher (+1 SD; estimate = 0.067; 95% CI = [0.020, 0.140]) but not when guanxi was lower (−1 SD; estimate = 0.023;



TABLE 2 Means, standard deviations, and bivariate correlations among studied variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
Sex													
Age	0.109*												
MS	0.236**	0.552**											
OT	0.071	0.702**	0.355**										
Education	0.075	−0.114*	0.054	−0.003									
LMXSC	0.053	0.103*	0.080	0.041	0.008								
LMX	−0.099	0.081	−0.083	−0.015	−0.131*	0.280**							
PO	−0.002	0.026	0.003	−0.054	0.092	0.255**	0.036						
SE	−0.004	0.052	0.088	0.016	0.091	0.254**	−0.013	0.278**					
Guanxi	0.063	0.083	0.017	0.079	−0.065	0.027	−0.042	−0.036	0.073				
ZY	−0.042	−0.018	0.029	−0.099	−0.079	−0.062	0.007	−0.040	−0.063	−0.081			
JP	−0.070	0.007	−0.079	0.004	0.018	0.324**	0.008	0.270**	0.239**	0.033	−0.069		
OCB	0.024	0.078	0.039	0.067	0.054	0.184**	0.037	0.340**	0.261**	−0.020	−0.025	0.192**	
Mean	0.60	29.04	1.61	53.24	4.13	4.360	5.117	5.044	4.625	4.099	3.642	5.299	5.635
SD	0.491	6.558	0.488	60.725	1.194	1.261	1.112	1.138	0.982	1.322	0.848	1.107	1.045

N = 370. \* $p < 0.05$ . \*\* $p < 0.01$ . MS = marital status; OT = organizational tenure; PO = perceived obligation; SE = self-esteem; ZY = Zhongyong thinking; JP = job performance.

TABLE 3 Confirmatory factor analyses.

Model	Factors	$\chi^2$	df	$\Delta\chi^2$	RMSEA	CFI	TLI	SRMR
Model1	Seven-factor	3341.931	1864		0.046	0.919	0.915	0.044
Model2	Six-factor (LMXSC+PO)	5160.960	1870	1819.029**	0.069	0.820	0.812	0.077
Model3	Five-factor (LMXSC+PO+SE)	6805.879	1875	3463.948**	0.084	0.731	0.720	0.100
Model4	Four-factor (LMXSC+PO+SE+OCB)	9007.643	1879	5665.712**	0.101	0.611	0.595	0.127
Model5	Three-factor (LMXSC+PO+SE+OCB+JP)	10694.513	1882	7352.582**	0.112	0.519	0.501	0.136
Model6	Two-factor (LMXSC+PO+SE+OCB+JP+ZY)	13316.152	1884	9974.221**	0.128	0.376	0.353	0.176
Model7	One-factor	14559.309	1885	11217.378**	0.135	0.308	0.283	0.183

N = 370. \*\* $p < 0.01$ . PO = perceived obligation; SE = self-esteem; JP = job performance; ZY = Zhongyong thinking.

95% CI = [−0.001, 0.075]). For OCB, revealed that the index of moderated mediation when the mediator is perceived obligation and the moderator is guanxi was significant (index = 0.025; 95% CI = [0.004, 0.055]). The indirect effect of LMXSC on OCB *via* perceived obligation was significant and positive when guanxi was higher (+1 SD; estimate = 0.103; 95% CI = [0.046, 0.182]) but not when guanxi was lower (−1 SD; estimate = 0.036; 95% CI = [−0.004, 0.097]). For job performance, revealed that the index of moderated mediation when the mediator is self-esteem and the moderator is Zhongyong thinking was significant (index = −0.020; 95% CI = [−0.054, −0.001]). The indirect effect of LMXSC on job performance *via* self-esteem was significant and positive when Zhongyong thinking was higher (+1 SD; estimate = 0.022; 95% CI = [0.000, 0.066]) and lower (−1 SD; estimate = 0.055; 95% CI = [0.012, 0.115]). For OCB, revealed that the index of moderated mediation when the mediator is self-esteem and the moderator is Zhongyong thinking was significant (index = −0.026; 95% CI = [−0.066, −0.002]). The indirect effect of LMXSC on OCB *via* self-esteem was significant and positive when Zhongyong thinking was lower (−1 SD; estimate = 0.072; 95% CI = [0.027, 0.143]) but not

when Zhongyong thinking was higher (+1 SD; estimate = 0.029; 95% CI = [−0.001, 0.078]). In addition, to perform a robust test, we utilized Mplus to undertake structural equation modeling in order to test all hypotheses; the results are shown in Figure 3. All hypotheses were also supported.

## 5. Discussion

Integrating social exchange theory and social comparison theory, we tested an integrated model to link LMXSC with employee job performance and OCB in the Chinese context. This research helps us deeply understand how and when LMXSC affects employee job performance and OCB in a particular Chinese cultural setting. We found that LMXSC indirectly impacts job performance and OCB *via* perceived obligation and self-esteem. Furthermore, we presented one contextual cultural factor (i.e., guanxi) as a boundary condition for the effects of LMXSC on perceived obligation and one individual cultural factor (i.e., Zhongyong thinking) as a boundary condition for the effects of LMXSC on self-esteem.

TABLE 4 Results for estimated coefficients of the mediation model.

Variables	Mediator: perceived obligation			Mediator: self-esteem			DV: job performance			DV: OCB		
	b	SE	t	b	SE	t	b	SE	t	b	SE	t
Constant	3.442**	0.488	7.051	3.508**	0.422	8.320	3.613**	0.507	7.120	3.084**	0.487	6.331
Age	0.027	0.014	1.861	0.007	0.012	0.549	0.007	0.013	0.523	0.002	0.013	0.168
Sex	−0.050	0.121	−0.411	−0.097	0.104	−0.929	−0.153	0.111	−1.370	0.044	0.107	0.409
Marital status	−0.124	0.147	−0.944	0.115	0.127	0.904	−0.308*	0.136	−2.268	−0.042	0.130	−0.321
Organizational tenure	−0.003*	0.001	−2.123	−0.001	0.001	−0.044	0.000	0.001	0.325	0.001	0.001	1.062
Education	0.101*	0.049	2.047	0.069	0.043	0.083	−0.007	0.046	−0.143	0.014	0.044	0.309
LMX	−0.046	0.055	−0.841	−0.073	0.048	−0.083	−0.097	0.051	−1.906	0.014	0.049	0.279
LMXSC	0.237**	0.048	4.979	0.212**	0.041	0.272	0.251**	0.046	5.408	0.051	0.045	1.152
Perceived obligation							0.161**	0.050	3.249	0.257**	0.048	5.387
Self-esteem							0.145*	0.057	2.516	0.177**	0.055	3.203
R <sup>2</sup>	0.087			0.085			0.183			0.157		
F	4.942**			4.781**			8.972**			7.438**		

Unstandardized regression coefficients are reported. \* $p < 0.05$ . \*\* $p < 0.01$ .

TABLE 5 Results for estimated coefficients of the moderated mediation model.

Variables	Mediator: perceived obligation			Mediator: self-esteem			DV: job performance			DV: OCB		
	b	SE	t	b	SE	t	b	SE	t	b	SE	t
Constant	4.517**	0.491	9.191	4.491**	0.426	10.542	4.688**	0.546	8.580	3.293**	0.530	6.214
Age	0.024	0.014	1.720	0.007	0.012	0.593	0.009	0.013	0.683	0.003	0.013	0.236
Sex	−0.030	0.120	−0.247	−0.088	0.104	−0.852	−0.169	0.111	−1.520	0.045	0.108	0.415
Marital status	−0.124	0.146	−0.848	0.105	0.126	0.832	−0.304*	0.135	−2.248	−0.048	0.131	−0.365
Organizational tenure	−0.003*	0.001	−2.004	−0.001	0.001	−0.773	0.000	0.001	0.146	0.001	0.001	1.062
Education	0.102*	0.049	2.075	0.063	0.042	1.479	−0.012	0.046	−0.271	0.011	0.044	0.247
LMX	−0.048	0.055	−0.878	−0.081	0.047	−1.696	−0.100	0.051	−1.957	0.011	0.049	0.232
LMXSC	0.302**	0.060	5.071	0.263**	0.052	5.098	0.311**	0.058	5.332	0.065	0.057	1.147
Guanxi	−0.047	0.057	−0.823				0.025	0.049	0.465	−0.029	0.052	−0.569
LMXSC*Guanxi	0.146**	0.052	2.802				−0.136**	0.050	−2.773	−0.041	0.047	−0.866
Perceived obligation							0.185**		3.683	0.262**	0.049	5.395
Zhongyong thinking				−0.038	0.050	−0.757	−0.036	0.053	−0.667	0.009	0.052	0.176
LMXSC*Zhongyong thinking				−0.113*	0.047	−2.429	−0.038	0.050	−0.756	−0.003	0.049	−0.070
Self-esteem							0.122*	0.058	2.104	0.175**	0.056	3.114
R <sup>2</sup>	0.108			0.102			0.203			0.160		
F	4.845**			4.524**			6.954**			5.199**		

\* $p < 0.05$ . \*\* $p < 0.01$ .

## 5.1. Theoretical implications

Our research provides several contributions to the existing literature. First, despite some empirical studies on the implications of LMXSC (Vidyarthi et al., 2010; Lee et al., 2019), our theoretical knowledge of this concept remains restricted and incomplete. The mechanisms that transmit the effects of LMXSC on job performance and OCB have not been

systematically integrated. This study examines two pathways from LMXSC to work performance and OCB: one through perceived obligation and the other *via* self-esteem, which gives a rather thorough picture of how the effects of LMXSC manifest. Social exchange and social comparison seem to be equally plausible pathways for LMXSC, according to the LMXSC literature (Tse et al., 2018; Lapointe et al., 2020; Weng et al., 2020). However, Vidyarthi et al. (2016), Sharma et al. (2020), and Lee et al.

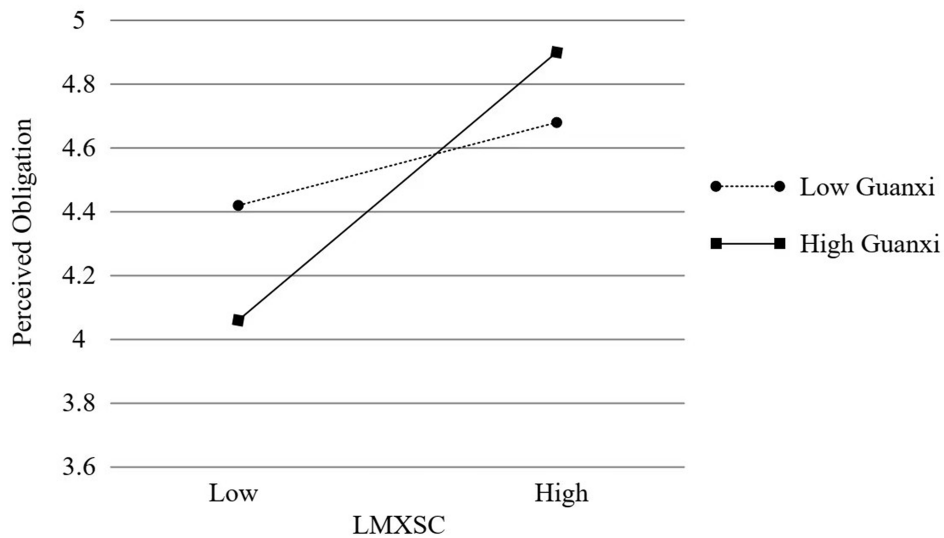


FIGURE 1  
Interactive effect of LMXSC and guanxi on perceived obligation.

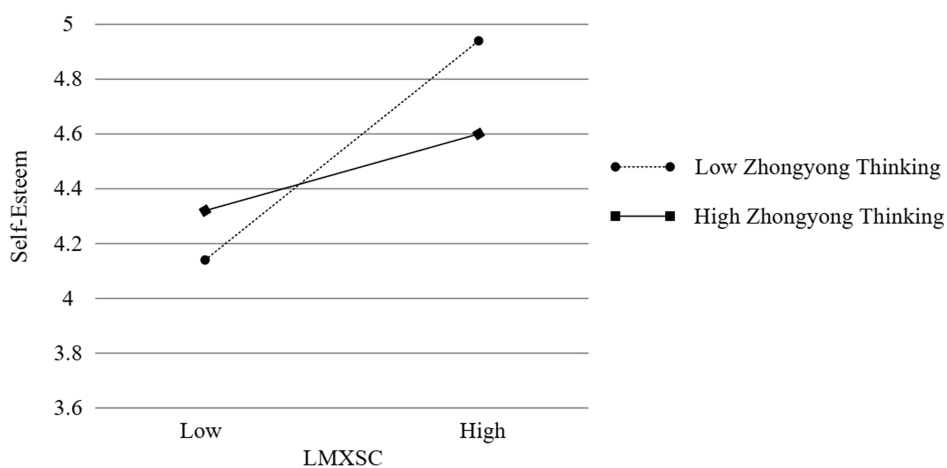


FIGURE 2  
Interactive effect of LMXSC and Zhongyong thinking on self-esteem.

(2019) address the processes behind the effects of LMXSC from only one theoretical approach, which largely limits the understanding of various mechanisms underlying the benefits associated with LMXSC. In this research, we adopted social exchange theory and social comparison theory simultaneously and found that perceived obligation and self-esteem concurrently mediate the relationship between LMXSC and job performance and OCB. That is, by assessing these two functions of LMXSC, we were able to discover social exchange and social comparison processes in the form of perceived obligation and self-esteem, respectively, which translated LMXSC into job performance and OCB. In doing so, we provide clear knowledge that the outcomes of the LMXSC are produced by two different underlying psychological processes.

Second, compared to earlier studies, the most notable aspect of this study is the cultural situations that influence the effects of LMXSC. Although Tse et al. (2013), Weng et al. (2020), Liu et al. (2022), and Huang et al. (2015) used Chinese samples to examine the generalizability of the LMXSC theory, they did not take into account

how and when specific Chinese cultural factors influence the outcomes of LMXSC. Chinese culture, based on Confucian culture, is obviously different from Western culture (Hill, 2006). Regarding interpersonal interaction, guanxi and Zhongyong thinking are two distinctive and unique elements in Confucian culture (Ma et al., 2018). Guanxi includes informal, non-work relationships between employees and supervisors, while LMXSC and LMX are based on official, work relationships (Zhang et al., 2015); there may be interaction effects between these two forms of relationships. Zhongyong thinking determines how Chinese individuals interact with others and evaluate or make sense of their surroundings, which may affect how they respond to their upward and downward comparisons, especially their relatively high or low LMX ranks in comparison to their peers. According to the social exchange perspective, guanxi facilitates social exchange by fostering a strong feeling of mutual benefit (Warren et al., 2004), and thus we found that guanxi positively moderated the relationship between LMXSC and perceived obligation. According to the social comparison perspective, we found Zhongyong

TABLE 6 Summary of indirect effects and conditional indirect effects.

Paths and effects	Estimates	SE	95% confidence intervals
<b>LMXSC-perceived obligation-job performance</b>			
Simple indirect effect	0.038	0.020	0.008, 0.087
<b>Moderated mediation</b>			
Lower guanxi (−1 SD)	0.023	0.019	−0.001, 0.075
Higher guanxi (+1 SD)	0.067	0.029	0.020, 0.140
Index of moderated mediation	0.017	0.010	0.003, 0.043
<b>LMXSC-perceived obligation-OCB</b>			
Simple indirect effect	0.061	0.023	0.023, 0.116
<b>Moderated mediation</b>			
Lower guanxi (−1 SD)	0.036	0.026	−0.004, 0.097
Higher guanxi (+1 SD)	0.103	0.035	0.046, 0.182
Index of moderated mediation	0.025	0.013	0.004, 0.055
<b>LMXSC-self-esteem-job performance</b>			
Simple indirect effect	0.031	0.018	0.002, 0.072
<b>Moderated mediation</b>			
Lower Zhongyong thinking (−1 SD)	0.055	0.026	0.012, 0.115
Higher Zhongyong thinking (+1 SD)	0.022	0.016	0.000, 0.066
Index of moderated mediation	−0.020	0.013	−0.054, −0.001
<b>LMXSC-self-esteem-OCB</b>			
Simple indirect effect	0.037	0.019	0.010, 0.087
<b>Moderated mediation</b>			
Lower Zhongyong thinking (−1 SD)	0.072	0.029	0.027, 0.143
Higher Zhongyong thinking (+1 SD)	0.029	0.020	−0.001, 0.078
Index of moderated mediation	−0.026	0.016	−0.066, −0.002

thinking, as a common way of thinking adopted by Chinese people (Zhou et al., 2021), negatively moderates the relationship between LMXSC and self-esteem. That is, if employees have a high level of Zhongyong thinking, the positive effects of LMXSC on self-esteem are largely diminished. Our work is the first to analyze the cultural influences on this connection, and it reflects previous demands for consideration of individual cultural values and contextual cultural elements. Our research facilitates LMXSC scholars' consideration of cultural aspects that may increase or decrease the impact of LMXSC understandings and helps explain distinctive management circumstances in a Confucian society, thereby contributing significantly to indigenous organizational studies on LMXSC in high-context nations.

Third, by investigating how guanxi moderates the link between LMXSC and perceived obligation, we add to a fuller knowledge of social exchange theory. LMXSC derives from the official and work-related LMX, while guanxi is a private and informal connection. Combining these two distinct forms of relationships between leaders and their followers, we investigate how LMXSC interact with guanxi and the effects of these interactions on perceived obligation based on the social exchange theory. We found that increased guanxi strengthens the positive link between LMXSC and perceived obligation due to the need of reciprocity in both relationships. To our knowledge, this is the first research to analyze the interplay between LMXSC and guanxi, thus expanding our grasp of social exchange theory, which illuminating the nature of distinct relationships and their accompanying obligation requirements.

Fourth, by demonstrating that the link between LMXSC and self-esteem is moderated by Zhongyong thinking, our study contributes to a deeper understanding of this relationship. Previous research tends to presume that the social comparison conclusions of LMXSC necessarily result in favorable outcomes, while disregarding the question of who, in particular, would have positive outcomes (Lee et al., 2019). We examined the effects of LMXSC in a Chinese social context by investigating Zhongyong thinking as a moderator that influences the relationships among LMXSC, self-esteem, job performance, and OCB. We found that LMXSC has a greater positive effect on self-esteem when Zhongyong thinking is low rather than high. This is because employees with Zhongyong thinking compare themselves to other coworkers who are in a low LMXSC situation, recognize that their high LMXSC does not guarantee that they will always be in a relatively high LMX position, and believe that everything, including LMXSC, may have both positive and negative aspects. After considering the aforementioned considerations, they find high LMXSC less appealing, and the benefits of high LMXSC are significantly lessened. Thus, when Zhongyong thinking is high, the positive effects of high LMXSC on self-esteem are weakened, which in turn limits employees' job performance and OCB. This conclusion prompts us to consider if being high LMXSC is always advantageous for employees, which extend our existing understanding of LMXSC deeply. In addition, we observed that Chinese cultural factors have mixed impacts on LMXSC by exhibiting the positive moderator of guanxi in the link between LMXSC and perceived obligation and the negative moderator of Zhongyong thinking in the relationship between LMXSC and self-esteem. This finding sheds even more insight on the complicated nature of LMXSC across various cultures.

Finally, since the outbreak of the COVID-19 pandemic, over 3 years have passed. The COVID-19 epidemic has thrust mankind into an uncharted period marked by anxiety and helplessness (Troughakos et al., 2020). During these 3 years, employees around the globe endured

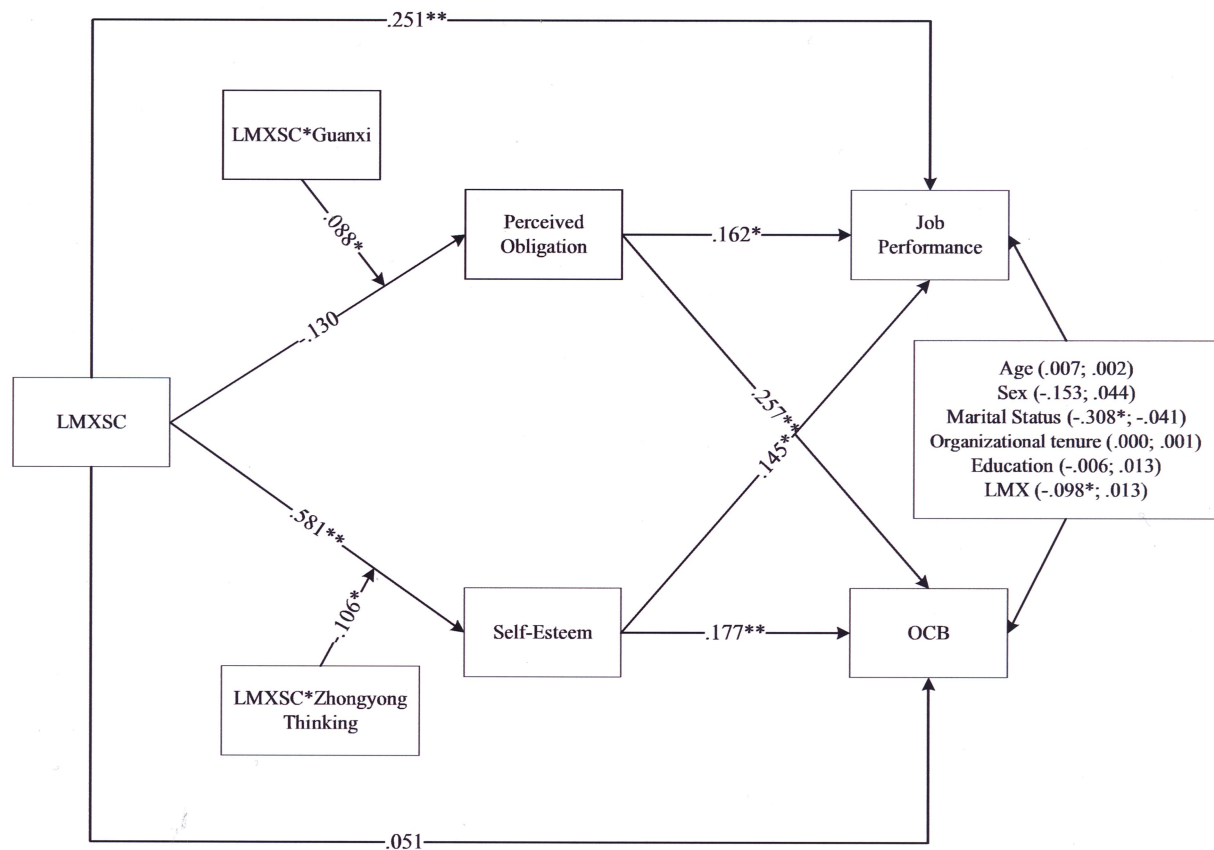


FIGURE 3  
Hypothesized model using structural equation modeling. \*  $p < 0.05$ , \*\*  $p < 0.01$ .

extreme psychological stress, fear, and anxiety, which directly and indirectly hampered their various performance, including job performance and OCB (Kumar et al., 2021; Lee et al., 2021; Pfeifer et al., 2021). Based on social exchange theory and social comparison theory, we found that LMXSC positively improves job performance and OCB *via* perceived obligation and self-esteem, which may provide an insight into how employees in the context of the COVID-19 pandemic keep and increase their performance.

## 5.2. Practical implications

Based on our findings, our research has several practical implications for organizations. First, we found that LMXSC had a positive effect on perceived obligation and self-esteem, which in turn improved employee job performance and OCB. Thus, managers should acknowledge that employees are concerned with their relative LMX position in the workplace (Epitropaki et al., 2016), and thus they can build distinct work connections with their employees and treat them differently depending on the quality of their work relationships. In especially for important or talented employees, managers should let them perceive high LMXSC in order that they have a high perceived obligation and self-esteem to enhance their performance outcomes through various means. For instance, leaders might tell these employees vocally that they are their favorites, which conveys the signal of their LMX rank.

Second, we found that guanxi positively moderated the relationship between LMXSC and perceived obligation. Thus, managers can use the

means of guanxi to influence the positive effects of LMXSC and perceived obligation. For example, if a manager wishes to inspire an employee with a low LMXSC, he or she might cultivate guanxi with this employee in order to increase his or her sense of obligation, job performance, and OCB. Leaders can share their thoughts, opinions, and emotions regarding work and life with employees, assist employees in resolving their life problems, call or connect *via* social media apps or visit in person, participate in social activities with employees, such as having dinner or enjoying entertainment, and become acquainted with the families of employees. All of these tactics may help leaders proactively build guanxi with their employees.

Third, we found that Zhongyong thinking adversely moderates the positive relationship between LMXSC and self-esteem; hence, managers must recognize the significance of Zhongyong thinking in the relationship. In short, Zhongyong thinking helps employees with low LMXSC while harming employees with high LMXSC. Thus, managers should communicate with their employees to identify the level of LMXSC perceived by them, know if their employees with high LMXSC have Zhongyong thinking, and encourage their employees with low LMXSC to make sense their standings with Zhongyong thinking.

## 5.3. Strengths, limitations, and future research directions

The current research has some strengths. For example, we use the temporal separation of focal variables and multi-source data



(leaders and employees) to decrease the common method bias. However, our research has several limitations. First, employees simultaneously provided ratings on LMXSC, perceived obligation, and self-esteem, which may raise concerns about the common method bias. In addition, the subjective bias of leaders might influence how they rate job performance and OCB. Thus, further research can use objective performance metrics (e.g., salary) or multiple peer-rated OCBs to test our model. Second, we only examine the influence of guanxi and Zhongyong thinking on the LMXSC function in Chinese culture. No doubt, Chinese and Western cultures distinguish individuals in several ways. For instance, Chinese culture causes Chinese to have an interdependent self, to be collectivist, and to have a greater power distance, while western culture causes westerners to have a dependent self, to be individualist, and to have a smaller power distance (Bochner and Hesketh, 1994; Jung and Avolio, 1999; Lee et al., 2000). Additional study may investigate if and how other Chinese cultural characteristics, such as interdependent self, collectivism, and power distance, impact the functions of LMXSC. Third, by detecting the negative moderator of Zhongyong thinking in the link between LMXSC and self-esteem, we recognize that high LMXSC is not always beneficial for all employees, hence revealing the possible negative side of LMXSC. Thus, further study should recognize that LMXSC may be a mixed blessing and investigate how and when high LMXSC may burden employees and impact their job performance and OCB. Finally, we only explore perceived obligation and self-esteem as mechanisms in the relationship between LMXSC and job performance and OCB. Further research can explore other variables, such as self-verification (Shantz and Booth, 2014), as an additional mediator based on other acceptable theories' perspectives.

## 6. Conclusion

Little is known about how and when LMXSC influences employee job performance and OCB in the Chinese context. Using social exchange theory and social comparison theory, we explained the indirect effects of LMXSC on job performance and OCB *via* perceived obligation and self-esteem. In addition, the results highlight the critical role of guanxi and Zhongyong thinking in shaping perceived obligation, self-esteem, and subsequent employee effectiveness.

## References

- Afshan, G., Serrano-Archimi, C., and Akram, Z. (2022). My LMX standing with my leader as compared to my coworkers: conditional indirect effect of LMX social comparison. *Leadersh. Organ. Dev. J.* 43, 238–260. doi: 10.1108/LODJ-08-2020-0371
- Apollo Technical. (2022). 25 surprising leadership statistics to take note of 2022. Available at: <https://www.apollotechnical.com/leadership-statistics/> [Accessed November 22, 2022].
- Araín, G. A., Afshan, G., Javed, U., and Serrano Archimi, C. (2017). *The conditional mediating role of leader-based self-esteem in the LMX-performance relationship*. Academy of management proceedings. Briarcliff Manor, NY: Academy of Management, 2017, 15864.
- Araín, G. A., Bhatti, Z., and Crawshaw, J. (2019). *Leader-member exchange and local/ expat promotive and prohibitive voice behaviors*. Academy of management proceedings. Briarcliff Manor, NY: Academy of Management, 2019, 13522.
- Aryee, S., Budhwar, P. S., and Chen, Z. X. (2002). Trust as a mediator of the relationship between organizational justice and work outcomes: test of a social exchange model. *J. Organ. Behav.* 23, 267–285. doi: 10.1002/job.138
- Avey, J. B., Palanski, M. E., and Walumbwa, F. O. (2011). When leadership goes unnoticed: the moderating role of follower self-esteem on the relationship between ethical leadership and follower behavior. *J. Bus. Ethics* 98, 573–582. doi: 10.1007/s10551-010-0610-2
- Balkundi, P., and Kilduff, M. (2006). The ties that lead: a social network approach to leadership. *Leadersh. Q.* 17, 419–439. doi: 10.1016/j.leaqua.2006.01.001
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs: Prentice Hall.
- Basit, A. A. (2017). Trust in supervisor and job engagement: mediating effects of psychological safety and felt obligation. *J. Psychol.* 151, 701–721. doi: 10.1080/00223980.2017.1372350
- Blau, P. M. (1964). *Exchange and power in social life*. New York, John Wiley and Sons.
- Bochner, S., and Hesketh, B. (1994). Power distance, individualism/collectivism, and job-related attitudes in a culturally diverse work group. *J. Cross-Cult. Psychol.* 25, 233–257. doi: 10.1177/0022022194252005
- Brislin, R. W. (1980). "Translation and content analysis of oral and written materials" in *Handbook of cross-cultural psychology*. eds. H. C. Triandis and J. W. Berry (Boston, MA: Allyn and Bacon), 389–444.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by School of Economics and Management, Yanshan University's ethics committee. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

CY and YC finished the manuscript. AC and SA collected the data and conducted the statistical analysis. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Buunk, B. P., Collins, R. L., Taylor, S. E., Van Yperen, N. W., and Dakof, G. A. (1990). The affective consequences of social comparison: either direction has its ups and downs. *J. Pers. Soc. Psychol.* 59, 1238–1249. doi: 10.1037/0022-3514.59.6.1238
- Buunk, A. P., and Gibbons, F. X. (2007). Social comparison: the end of a theory and the emergence of a field. *Organ. Behav. Hum. Decis. Process.* 102, 3–21. doi: 10.1016/j.obhdp.2006.09.007
- Buunk, B., and Ybema, J. (1997). “Social comparisons y occupational stress: the identification-contrast model” in *Health, coping, and well-being: Perspectives from social comparison theory*. eds. B. P. Buunk and F. X. Gibbons (Mahwah, NJ: Erlbaum), 359–388.
- Chan, P. S. (2015). A study of ingratiating behavior towards coworkers. [doctoral dissertation]. [Hong Kong]: The Hong Kong Polytechnic University
- Chang, S. J., van Witteloostuijn, A., and Eden, L. (2020). “Common method variance in international business research” in *Research methods in international business*. eds. L. Eden, B. Nielsen and A. Verbeke (Cham: Palgrave Macmillan), 385–398.
- Chang, T. Y., and Yang, C. T. (2014). Individual differences in Zhong-Yong tendency and processing capacity. *Front. Psychol.* 5:1316. doi: 10.3389/fpsyg.2014.01316
- Chen, X. P., and Chen, C. C. (2004). On the intricacies of the Chinese guanxi: a process model of guanxi development. *Asia Pacific J. Manag.* 21, 305–324. doi: 10.1023/B:APJM.0000036465.19102.d5
- Chen, C. C., Chen, X. P., and Huang, S. (2013). Chinese guanxi: An integrative review and new directions for future research. *Manag. Organ. Rev.* 9, 167–207. doi: 10.1111/more.12010
- Chen, S., and Zhang, C. (2021). What happens to a black sheep? Exploring how multilevel leader–member exchange differentiation shapes the organizational altruism behaviors of low leader–member exchange minority. *Group. Organ. Manag.* 46, 1073–1105. doi: 10.1177/10596011211998584
- Chiu, C. (2000). Assessment of Zhong-Yong (dialectic) thinking: preliminary findings from a cross-regional study. *Hong Kong J. Soc. Sci.* 18, 33–35.
- Choi, D., Kraimer, M. L., and Seibert, S. E. (2020). Conflict, justice, and inequality: why perceptions of leader–member exchange differentiation hurt performance in teams. *J. Organ. Behav.* 41, 567–586. doi: 10.1002/job.2451
- Chou, L. F., Chu, C. C., Yeh, H. C., and Chen, J. (2014). Work stress and employee well-being: the critical role of Zhong-Yong. *Asian J. Soc. Psychol.* 17, 115–127. doi: 10.1111/ajsp.12055
- Cogliser, C. C., Schriesheim, C. A., Scandura, T. A., and Gardner, W. L. (2009). Balance in leader and follower perceptions of leader–member exchange: relationships with performance and work attitudes. *Leadersh. Q.* 20, 452–465. doi: 10.1016/j.leaqua.2009.03.010
- Cooley, C. H. (1972). “The looking glass self” in *Symbolic interaction*. eds. J. Manis and A. Meltzer (Boston, MA: Allyn & Bacon), 231–233.
- Cropanzano, R., and Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *J. Manag.* 31, 874–900. doi: 10.1177/0149206305279602
- Dulebohn, J. H., Bommer, W. H., Liden, R. C., Brouer, R. L., and Ferris, G. R. (2012). A meta-analysis of antecedents and consequences of leader–member exchange: integrating the past with an eye toward the future. *J. Manag.* 38, 1715–1759. doi: 10.1177/0149206311415280
- Eisenberger, R., Armeli, S., Rexwinkel, B., Lynch, P. D., and Rhoades, L. (2001). Reciprocity of perceived organizational support. *J. Appl. Psychol.* 86, 42–51. doi: 10.1037/0021-9010.86.1.42
- Epitropaki, O., Kapoutsis, I., Ellen, B. P. III, Ferris, G. R., Drivas, K., and Ntotsi, A. (2016). Navigating uneven terrain: the roles of political skill and LMX differentiation in prediction of work relationship quality and work outcomes. *J. Organ. Behav.* 37, 1078–1103. doi: 10.1002/job.2100
- Erdogan, B., and Liden, R. C. (2002). “Social exchanges in the workplace: a review of recent developments and future research directions in leader–member exchange theory” in *Leadership*. eds. L. N. Linda and A. S. Chester (Greenwich, CT: Information Age), 65–114.
- Ferris, D. L., Lian, H., Brown, D. J., and Morrison, R. (2015). Ostracism, self-esteem, and job performance: when do we self-verify and when do we self-enhance? *Acad. Manag. J.* 58, 279–297. doi: 10.5465/amj.2011.0347
- Festinger, L. (1954). A theory of social comparison processes. *Hum. Relat.* 7, 117–140. doi: 10.1177/001872675400700202
- Flores, G., Fowler, D. J., and Posthuma, R. A. (2020). Educational leadership, leader–member exchange and teacher self-efficacy. *J. Glob. Edu. Res.* 4, 140–153. doi: 10.5038/2577-509X.4.2.1040
- Garcia, S. M., Tor, A., and Schiff, T. M. (2013). The psychology of competition: a social comparison perspective. *Perspect. Psychol. Sci.* 8, 634–650. doi: 10.1177/1745691613504114
- Gergen, K. J. (1969). *The psychology of behavioral exchange*. Reading, MA: Addison-Wesley.
- Haibo, G. (2020). “Confucianism” in *Rituals and practices in world religions*. eds. D. Yaden, Y. Zhao, K. Peng and A. Newberg (Cham: Springer), 87–98.
- Hakmiller, K. L. (1966). Threat as a determinant of downward comparison. *J. Exp. Soc. Psychol.* 1, 32–39. doi: 10.1016/0022-1031(66)90063-1
- Han, Y., and Altman, Y. (2009). Supervisor and subordinate guanxi: a grounded investigation in the People’s republic of China. *J. Bus. Ethics* 88, 91–104. doi: 10.1007/s10551-008-9827-8
- Harris, T. B., Li, N., and Kirkman, B. L. (2014). Leader–member exchange (LMX) in context: how LMX differentiation and LMX relational separation attenuate LMX’s influence on OCB and turnover intention. *Leadersh. Q.* 25, 314–328. doi: 10.1016/j.leaqua.2013.09.001
- He, Y., and Li, T. (2021). Mediating model of college students’ Chinese Zhongyong culture thinking mode and depressive symptoms. *Psychol. Res. Behav. Manag.* 14, 1555–1566. doi: 10.2147/PRBM.S327496
- Henderson, D. J., Liden, R. C., Glibkowski, B. C., and Chaudhry, A. (2009). LMX differentiation: a multilevel review and examination of its antecedents and outcomes. *Leadersh. Q.* 20, 517–534. doi: 10.1016/j.leaqua.2009.04.003
- Hill, J. S. (2006). Confucianism and the art of Chinese management. *J. Asia Bus. Stud.* 1, 1–9. doi: 10.1108/15587890680001299
- Hollander, E. P. (1980). “Leadership and social exchange processes” in *Social exchange*. eds. K. J. Gergen, M. S. Greenberg and R. H. Willis (Boston, MA: Springer), 103–118.
- Hooper, D. T., and Martin, R. (2008). Beyond personal leader–member exchange (LMX) quality: the effects of perceived LMX variability on employee reactions. *Leadersh. Q.* 19, 20–30. doi: 10.1016/j.leaqua.2007.12.002
- Huang, J., Shi, L., Xie, J., and Wang, L. (2015). Leader–member exchange social comparison and employee deviant behavior: evidence from a Chinese context. *Soc. Behav. Pers.* 43, 1273–1286. doi: 10.2224/sbp.2015.43.8.1273
- Jahantab, F., Vidyarthi, P. R., Anand, S., and Erdogan, B. (2021). When are the bigger fish in the small pond better citizens? A multilevel examination of relative overqualification in workgroups. *Group. Organ. Manag.* doi: 10.1177/105960112111048055
- Ji, L. J., and Chan, E. (2017). “Chinese thinking styles and religion” in *Religious cognition in China*. eds. R. G. Hornbeck, J. L. Barrett and M. Kang (Cham: Springer), 35–54.
- Jung, D. I., and Avolio, B. J. (1999). Effects of leadership style and followers’ cultural orientation on performance in group and individual task conditions. *Acad. Manag. J.* 42, 208–218. doi: 10.5465/257093
- Kim, H. L. R., Bae, H., Lee, J. H., and Kim, S. L. (2017). “The effect of coworker LMXSC on citizenship behaviors: the mediating role of coworker exchange” in *Academy of management proceedings* (Briarcliff Manor, NY: Academy of Management)
- Kim, H., Callan, M. J., Gheorghiu, A. I., and Skylark, W. J. (2018). Social comparison processes in the experience of personal relative deprivation. *J. Appl. Soc. Psychol.* 48, 519–532. doi: 10.1111/jasp.12531
- Kim, S. L., Han, S., Son, S. Y., and Yun, S. (2017). Exchange ideology in supervisor–subordinate dyads, LMX, and knowledge sharing: a social exchange perspective. *Asia Pac. J. Manag.* 34, 147–172. doi: 10.1007/s10490-016-9483-y
- Kim, S., O’Neill, J. W., and Cho, H. M. (2010). When does an employee not help coworkers? The effect of leader–member exchange on employee envy and organizational citizenship behavior. *Int. J. Hosp. Manag.* 29, 530–537. doi: 10.1016/j.ijhm.2009.08.003
- Kim, U., Yang, K. S., and Hwang, K. K. (2006). “Contributions to indigenous and cultural psychology” in *Indigenous and cultural psychology: Understanding people in context*. eds. U. Kim, K. S. Yang and K. K. Hwang (New York, NY: Springer), 3–25.
- Korman, A. K. (1976). Hypothesis of work behavior revisited and an extension. *Acad. Manag. Rev.* 1, 50–63. doi: 10.5465/amr.1976.4408762
- Korman, B., Troester, C., and Giessner, S. R. (2020). *LMXSC and paradoxical coworker-directed behaviors: A dual-path mediation model involving pride*. *Academy of management proceedings*. Briarcliff Manor, NY: Academy of Management, 2020, 17052.
- Kumar, P., Kumar, N., Aggarwal, P., and Yeap, J. A. (2021). Working in lockdown: the relationship between COVID-19 induced work stressors, job performance, distress, and life satisfaction. *Curr. Psychol.* 40, 6308–6323. doi: 10.1007/s12144-021-01567-0
- Lam, C. K., Huang, X., and Chan, S. C. (2015). The threshold effect of participative leadership and the role of leader information sharing. *Acad. Manag. J.* 58, 836–855. doi: 10.5465/amj.2013.0427
- Lapointe, É., Vandenbergh, C., Ben Ayed, A. K., Schwarz, G., Tremblay, M., and Chenevert, D. (2020). Social comparisons, self-conceptions, and attributions: assessing the self-related contingencies in leader–member exchange relationships. *J. Bus. Psychol.* 35, 381–402. doi: 10.1007/s10869-019-09628-9
- Law, K. S., Wong, C. S., Wang, D., and Wang, L. (2000). Effect of supervisor–subordinate guanxi on supervisory decisions in China: An empirical investigation. *Int. J. Hum. Resour. Manag.* 11, 751–765. doi: 10.1080/09585190050075105
- Leary, M. R., Tambor, E. S., Terdal, S. K., and Downs, D. L. (1995). Self-esteem as an interpersonal monitor: the sociometer hypothesis. *J. Pers. Soc. Psychol.* 68, 518–530. doi: 10.1037/0022-3514.68.3.518
- Lee, A., Gerbasi, A., Schwarz, G., and Newman, A. (2019). Leader–member exchange social comparisons and follower outcomes: the roles of felt obligation and psychological entitlement. *J. Occup. Organ. Psychol.* 92, 593–617. doi: 10.1111/joop.12245
- Lee, C., Pillutla, M., and Law, K. S. (2000). Power-distance, gender and organizational justice. *J. Manage.* 26, 685–704. doi: 10.1177/014920630002600405
- Lee, C., Song, J., and Ryan, B. (2022). When employees feel envy: the role of psychological capital. *Int. J. Hosp. Manag.* 105:103251. doi: 10.1016/j.ijhm.2022.103251
- Lee, T. C., Yao-Ping Peng, M., Wang, L., and Hung, H. K. (2021). Factors influencing employees’ subjective wellbeing and job performance during the COVID-19 global pandemic: the perspective of social cognitive career theory. *Front. Psychol.* 12:577028. doi: 10.3389/fpsyg.2021.577028

- Li, P. P. (2007). "Guanxi as the Chinese norm for personalized social capital: toward an integrated duality framework of informal exchange" in *Handbook of research on Asian business*. ed. H. W. Yeung (London: Edward Elgar), 62–83.
- Liao, H., and Chuang, A. (2004). A multilevel investigation of factors influencing employee service performance and customer outcomes. *Acad. Manag. J.* 47, 41–58. doi: 10.5465/20159559
- Liden, R. C., Wayne, S. J., and Stilwell, D. (1993). A longitudinal study on the early development of leader-member exchanges. *J. Appl. Psychol.* 78, 662–674. doi: 10.1037/0021-9010.78.4.662
- Lin, S. W., and Lo, L. Y. S. (2015). Mechanisms to motivate knowledge sharing: integrating the reward systems and social network perspectives. *J. Knowl. Manag.* 19, 212–235. doi: 10.1108/JKM-05-2014-0209
- Liu, P., An, X., and Li, X. (2022). You are an outsider! How and when observed leader incivility affect hospitality employees' social categorization and deviant behavior. *Int. J. Hosp. Manag.* 106:103273. doi: 10.1016/j.ijhm.2022.103273
- Lyubomirsky, S., and Ross, L. (1997). Hedonic consequences of social comparison: a contrast of happy and unhappy people. *J. Pers. Soc. Psychol.* 73, 1141–1157. doi: 10.1037/0022-3514.73.6.1141
- Ma, C., Liu, H., Gu, J., and Dou, J. (2018). How entrepreneurs' Zhong-yong thinking improves new venture performance: the mediating role of guanxi and the moderating role of environmental turbulence. *Chinese Manag. Stud.* 12, 323–345. doi: 10.1108/CMS-10-2016-0219
- Ma, E., Zhang, Y., Xu, F. Z., Wang, D., and Kim, M. S. (2021). Feeling empowered and doing good? A psychological mechanism of empowerment, self-esteem, perceived trust, and OCBs. *Tour. Manag.* 87:104356. doi: 10.1016/j.tourman.2021.104356
- Marescaux, E., De Winne, S., and Rofcanin, Y. (2021). Co-worker reactions to i-deals through the lens of social comparison: the role of fairness and emotions. *Hum. Relat.* 74, 329–353. doi: 10.1177/0018726719884103
- Markus, H. R., and Kitayama, S. (1991). Culture and the self: implications for cognition, emotion, and motivation. *Psychol. Rev.* 98, 224–253. doi: 10.1037/0033-295X.98.2.224
- Martin, R., Thomas, G., Charles, K., Epitropaki, O., and McNamara, R. (2005). The role of leader-member exchanges in mediating the relationship between locus of control and work reactions. *J. Work Organ. Psychol.* 78, 141–147. doi: 10.1348/096317904X23763
- Martin, R., Thomas, G., Legood, A., and Dello Russo, S. (2018). Leader-member exchange (LMX) differentiation and work outcomes: conceptual clarification and critical review. *J. Organ. Behav.* 39, 151–168. doi: 10.1002/job.2202
- Maslach, C. (1993). "Burnout: a multidimensional perspective" in *Professional burnout: Recent developments in theory and research*. eds. W. B. Schaufeli, C. Maslach and T. Marek (Washington, DC: Taylor & Francis), 19–32.
- Matta, F. K. (2016). The gift and the curse of LMX social comparisons: When they help and when they hurt. Doctoral dissertation [East Lansing (MI)]: Michigan State University.
- Mead, G. H. (1934). *Mind, self and society*. Chicago: University of Chicago Press.
- Miao, C., Qian, S., Banks, G. C., and Seers, A. (2020). Supervisor-subordinate guanxi: a meta-analytic review and future research agenda. *Hum. Resour. Manag. Rev.* 30:100702. doi: 10.1016/j.hrmmr.2019.100702
- Morse, S., and Gergen, K. J. (1970). Social comparison, self-consistency, and the concept of self. *J. Pers. Soc. Psychol.* 16, 148–156. doi: 10.1037/h0029862
- Moser, S., Reinwald, M., and Kunze, F. (2022). Does my leader care about my subgroup? A multilevel model of team faultlines, LMX quality, and employee absenteeism. *Eur. J. Work. Organ. Psychol.* doi: 10.1080/1359432X.2022.2136522
- Organ, D. W. (1988). *Organizational citizenship behavior: The good soldier syndrome*. Lexington: Lexington Books.
- Ott-Holland, C. (2015). Leader-member exchange social comparisons and LMX-related emotions: Examining attributions and interpersonal justice as moderators. [doctoral dissertation]. [East Lansing (MI)]: Michigan State University
- Pan, J., Zheng, X., Xu, H., Li, J., and Lam, C. K. (2021). What if my coworker builds a better LMX? The roles of envy and coworker pride for the relationships of LMX social comparison with learning and undermining. *J. Organ. Behav.* 42, 1144–1167. doi: 10.1002/job.2549
- Pfeifer, L. S., Heyers, K., Ocklenburg, S., and Wolf, O. T. (2021). Stress research during the COVID-19 pandemic and beyond. *Neurosci. Biobehav. Rev.* 131, 581–596. doi: 10.1016/j.neubiorev.2021.09.045
- Pierce, J. R., and Aguinis, H. (2013). The too-much-of-a-good-thing effect in management. *J. Manage.* 39, 313–338. doi: 10.1177/0149206311410060
- Pyszczynski, T., Greenberg, J., Solomon, S., Arndt, J., and Schimel, J. (2004). Why do people need self-esteem? A theoretical and empirical review. *Psychol. Bull.* 130, 435–468. doi: 10.1037/0033-2909.130.3.435
- Reh, S., Van Quaquebeke, N., Tröster, C., and Giessner, S. R. (2022). When and why does status threat at work bring out the best and the worst in us? A temporal social comparison theory. *Organ. Psychol. Rev.* 12, 241–267. doi: 10.1177/0413866221100200
- Rich, B. L., Lepine, J. A., and Crawford, E. R. (2010). Job engagement: antecedents and effects on job performance. *Acad. Manag. J.* 53, 617–635. doi: 10.5465/amj.2010.51468988
- Rockstuhl, T., Dulebohn, J. H., Ang, S., and Shore, L. M. (2012). Leader-member exchange (LMX) and culture: a meta-analysis of correlates of LMX across 23 countries. *J. Appl. Psychol.* 97, 1097–1130. doi: 10.1037/a0029978
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton: Princeton University.
- Sedikides, C., and Brewer, M. B. (2001). *Individual self, relational self, collective self*. Philadelphia: Taylor & Francis.
- Shalendra, S., and Kang, S. (2021). Examining the effect of leader-member exchange social comparison on employee voice behavior: the role employee-organization and supervisors' organizational embodiment. *Int. J. Manag.* 10, 1–21. doi: 10.18488/journal.11.2021.101.1.21
- Shantz, A., and Booth, J. E. (2014). Service employees and self-verification: the roles of occupational stigma consciousness and core self-evaluations. *Hum. Relat.* 67, 1439–1465. doi: 10.1177/0018726713519280
- Sharma, D., Mishra, M., Pandey, S. K., and Ghosh, K. (2020). Can leader-member exchange social comparison elicit uncivil employee behavior? The buffering role of aggression-preventive supervisor behavior. *Int. J. Confl. Manag.* 32, 422–444. doi: 10.1108/IJCM-07-2020-0122
- Singh, S., and Vidyarthi, P. R. (2018). Idiosyncratic deals to employee outcomes: mediating role of social exchange relationships. *J. Leadersh. Organ. Stud.* 25, 443–455. doi: 10.1177/1548051818762338
- Sparrowe, R. T., and Liden, R. C. (1997). Process and structure in leader-member exchange. *Acad. Manag. Rev.* 22, 522–552. doi: 10.5465/amr.1997.9707154068
- Strauss, J. P. (2005). Multi-source perspectives of self-esteem, performance ratings, and source agreement. *J. Manag. Psychol.* 20, 464–482. doi: 10.1108/02683940510615424
- Thibaut, J. W., and Kelley, H. H. (1959). *Interpersonal relations: A theory of interdependence*. New York: Wiley.
- Thomas, G., Martin, R., Epitropaki, O., Guillaume, Y., and Lee, A. (2013). Social cognition in leader-follower relationships: applying insights from relationship science to understanding relationship-based approaches to leadership. *J. Organ. Behav.* 34, S63–S81. doi: 10.1002/job.1889
- Trougakos, J. P., Chawla, N., and McCarthy, J. M. (2020). Working in a pandemic: exploring the impact of COVID-19 health anxiety on work, family, and health outcomes. *J. Appl. Psychol.* 105, 1234–1245. doi: 10.1037/apl0000739
- Tse, H. H., Lam, C. K., Gu, J., and Lin, X. S. (2018). Examining the interpersonal process and consequence of leader-member exchange comparison: the role of procedural justice climate. *J. Organ. Behav.* 39, 922–940. doi: 10.1002/job.2268
- Tse, H. H., Lam, C. K., Lawrence, S. A., and Huang, X. (2013). When my supervisor dislikes you more than me: the effect of dissimilarity in leader-member exchange on coworkers' interpersonal emotion and perceived help. *J. Appl. Psychol.* 98, 974–988. doi: 10.1037/a0033862
- Uhl-Bien, M., and Maslyn, J. M. (2003). Reciprocity in manager-subordinate relationships: components, configurations, and outcomes. *J. Manag.* 29, 511–532. doi: 10.1016/S0149-2063\_03\_00023-0
- Valdiviezo, S. (2017). An organizational attachment model: LMX-social comparison, job embeddedness and psychological ownership. [doctoral dissertation]. [El Paso (TX)]: The University of Texas at El Paso
- Vidyarthi, P. R., Liden, R. C., Anand, S., Erdogan, B., and Ghosh, S. (2010). Where do I stand? Examining the effects of leader-member exchange social comparison on employee work behaviors. *J. Appl. Psychol.* 95, 849–861. doi: 10.1037/a0020033
- Vidyarthi, P. R., Singh, S., Erdogan, B., Chaudhry, A., Posthuma, R., and Anand, S. (2016). Individual deals within teams: investigating the role of relative i-deals for employee performance. *J. Appl. Psychol.* 101, 1536–1552. doi: 10.1037/apl0000145
- Wang, J., Wang, G. G., Ruona, W. E., and Rojewski, J. W. (2005). Confucian values and the implications for international HRD. *Hum. Resour. Dev. Int.* 8, 311–326. doi: 10.1080/13678860500143285
- Warren, D. E., Dunfee, T. W., and Li, N. (2004). Social exchange in China: the double-edged sword of guanxi. *J. Bus. Ethics* 55, 353–370. doi: 10.1007/s10551-004-1526-5
- Wei, J., Chen, Y., Zhang, Y., and Zhang, J. (2020). How does entrepreneurial self-efficacy influence innovation behavior? Exploring the mechanism of job satisfaction and Zhongyong thinking. *Front. Psychol.* 11:708. doi: 10.3389/fpsyg.2020.00708
- Wei, X., and Wang, F. (2020). Effect of Zhongyong thinking in the relationship of crystallized intelligence and wisdom. *Soc. Behav. Pers.* 48, 1–8. doi: 10.2224/sbp.9092
- Weng, Q., Latif, K., Khan, A. K., Tariq, H., Butt, H. P., Obaid, A., et al. (2020). Loaded with knowledge, yet green with envy: leader-member exchange comparison and coworkers-directed knowledge hiding behavior. *J. Knowl. Manag.* 24, 1653–1680. doi: 10.1108/JKM-10-2019-0534
- Wheeler, L., and Miyake, K. (1992). Social comparison in everyday life. *J. Pers. Soc. Psychol.* 62, 760–773. doi: 10.1037/0022-3514.62.5.760
- White, K., and Lehman, D. R. (2005). Culture and social comparison seeking: the role of self-motives. *Personal. Soc. Psychol. Bull.* 31, 232–242. doi: 10.1177/0146167204271326
- Williams, L. J., and Anderson, S. E. (1991). Job satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors. *J. Manag.* 17, 601–617. doi: 10.1177/014920639101700305
- Wong, A. H. K., Wu, C. X., Whitla, P., and Snell, R. S. (2022). How LMX and marketing capabilities guide and motivate customer-facing employees' learning. *J. Bus. Res.* 138, 161–169. doi: 10.1016/j.jbusres.2021.09.002

- Wood, J. V. (1996). What is social comparison and how should we study it? *Personal. Soc. Psychol. Bull.* 22, 520–537. doi: 10.1177/0146167296225009
- Wu, C. H., and Lin, Y. C. (2005). Development of a Zhong-Yong thinking style scale. *Indigenous Psychological Research in Chinese Societies* 24, 247–300.
- Yang, G., Wang, Z., and Wu, W. (2021). Social comparison orientation and mental health: the mediating role of psychological capital. *Soc. Behav. Pers.* 49, 1–11. doi: 10.2224/sbp.9767
- Yang, X., Zhang, P., Zhao, J., Zhao, J., Wang, J., Chen, Y. U., et al. (2016). Confucian culture still matters: the benefits of Zhongyong thinking (doctrine of the mean) for mental health. *J. Cross-Cult. Psychol.* 47, 1097–1113. doi: 10.1177/0022022116658260
- Yu, Y., and Yang, G. (2022). Zhongyong thinking, leader-member exchange, and employee innovative behavior. *Soc. Behav. Pers.* 50, 1–8. doi: 10.2224/sbp.10986
- Zhang, L., Deng, Y., Zhang, X., and Hu, E. (2016). Why do Chinese employees build supervisor-subordinate guanxi? A motivational analysis. *Asia. Pacific. J. Manag.* 33, 617–648. doi: 10.1007/s10490-015-9430-3
- Zhang, X. A., Li, N., and Harris, T. B. (2015). Putting non-work ties to work: the case of guanxi in supervisor-subordinate relationships. *Leadersh. Q.* 26, 37–54. doi: 10.1016/j.leaqua.2014.04.00
- Zhou, Z., Zhang, H., Li, M., Sun, C., and Luo, H. (2021). The effects of Zhongyong thinking priming on creative problem-solving. *J. Creat. Behav.* 55, 145–153. doi: 10.1002/jocb.441





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# Factors associated with COVID-19 preventive behaviors among taxi drivers in Bangkok

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**Objectives:** This paper aimed to identify factors associated with COVID-19 preventive behaviors among taxi drivers in Bangkok.

**Methods:** This cross-sectional study included 401 taxi drivers. Data were analyzed using descriptive statistics. The association between predisposing factors, enabling factors, and reinforcing factors with COVID-19 preventive behaviors was analyzed by using analysis of variance and Pearson's Product Moment Correlation. Multiple linear regression analysis was used to determine the influencing factors in predicting COVID-19 preventive behaviors of taxi drivers.

**Results:** The present findings revealed that income adequacy, support from family, co-workers, and healthcare professionals, perceived susceptibility, severity, benefits, barriers, and health motivation, accessibility to personal protective equipment for COVID-19 and preventative measures against COVID-19 from other agencies were associated with good COVID-19 preventive behaviors among taxi-driver in Bangkok during COVID-19 pandemic ( $R^2 = 0.349$ ,  $p = 0.008$ ). The model could predict 34.9% of variance in COVID-19 preventative behavior among taxi drivers.

**Conclusion:** Taxi drivers should be encouraged to engage in appropriate preventive behaviors against COVID-19, emphasizing the individual and organizational levels. There should be a policy by organizations to promote the implementation of COVID-19 safety control standards to ensure safe working conditions. In addition, appropriate welfare benefits should be provided for taxi drivers, such as loans, personal protective equipment, and access to health services to improve COVID-19 preventive behaviors.

## KEYWORDS

COVID-19, health behavior, taxi driver, occupational health, public transportation

## Introduction

The COVID-19 pandemic is a public health emergency since January 2020 (1). After the COVID-19 outbreak in China, Thailand was the first country that identifies a confirmed case of COVID-19 infection in February 2020 (2). The report on the first case of COVID-19 in Thailand was a taxi driver who worked in the Bangkok area. He reported contact with Chinese tourist passengers in his taxi who had had frequent coughing (2). The first wave of COVID-19 in Thailand began in March 2020; the peak of daily cases in March was under 200; by May 2020, there were 3,042 cumulative cases and 57 deaths (3). In the second wave of COVID-19, there were 21,584 additional cases in 2.5 months (between December 18, 2020, and February 27, 2021) (3).

Public transport systems are a high-risk environment as many peoples are in confined spaces with limited ventilation and no access control to identify infected persons, which may facilitate and accelerate the transmission of COVID-19. The possibility of indirect spread of COVID-19



is not only about disease spread among commuters in close contact but also between drivers and passengers. The World Health Organization (WHO) indicates that taxi drivers and passengers are at high risk of contracting COVID-19 due to frequent contact with passenger service (4). In addition, taxi drivers have been recognized as an occupationally COVID-19 at-risk group (5, 6) due to the nature of their job in a closed space, as they may include passengers who may be affected. For example, taxi drivers in New York have been said to be on the battlefield taking COVID-19 patients to hospitals. As a result, some taxi drivers got ill from occupationally related exposures (7). In Thailand, between May and August 2021, 353 people were infected by public transportation, and 128 were taxi drivers. 36% of public transportation drivers died, and 47% ( $N = 49$ ) of deaths were taxi drivers (8, 9). Persons in this profession are disproportionately negatively impacted by COVID-19. Despite this, taxi drivers can contribute to limiting the spread of COVID-19 (10) by using preventive measures, including cleaning vehicles and surfaces frequently, checking the fever of staff and passengers, improving vehicle ventilation, using masks, and keeping a physical distance (11).

The literature review revealed that most research on taxi drivers focused on socioeconomic and service behaviors. There was no study on behavior in preventing COVID-19 among taxi drivers in Thailand. As a result, this study explored the factors influencing behavior to prevent COVID-19 in taxi drivers.

Rojpaisarnkit's study utilized the PRECEDE-PROCEED model (12) to propose factors influencing disease prevention behaviors. The study found that individual attribute factors, predisposing factors, enabling factors, and reinforcing factors that affect COVID-19 disease prevention behaviors (13). Therefore, in this study, the following factors were selected according to the PRECEDE-PROCEED model (12), which included predisposing factors (i.e., personal characteristics and health beliefs), enabling factors (i.e., accessibility to personal protective equipment for COVID-19, preventive measures against COVID-19), and reinforcing factors (i.e., support in the implementation of COVID-19 preventive behavior). In addition, in this study, health belief was assessed by using the Health Beliefs Model (14) to examine taxi drivers' perception in accordance with COVID-19 preventive behaviors, including perceived susceptibility and severity of COVID-19, perceived of the benefits and barriers to practicing preventive behavior against COVID-19, and motivation to practice preventive behavior.

During the pandemic, the COVID-19 preventive behaviors among taxi drivers in Thailand and the associated factors remain unknown. A greater understanding of factors associated with COVID-19 preventive behaviors among taxi drivers is important to reduce COVID-19 transmission in public transportation in Thailand to enhance the personal safety of both taxi drivers and their passengers during the COVID-19 situation and potentially improve the effectiveness of the public health response. This paper aims to describe factors influencing taxi drivers' COVID-19 preventive behaviors.

The findings of this study may be useful to encourage taxi drivers to implement effective COVID-19 preventive behaviors to prevent the spread of COVID-19 across society and can be used for policy making for public transportation.

## Methods

This cross-sectional survey study was to identify factors associated with COVID-19 preventive behaviors among taxi drivers in Bangkok. This study identified different variables influencing taxi drivers' COVID-19 prevention behaviors by classifying factors into three categories: predisposing, enabling, and reinforcing (12). Personal characteristics and health beliefs, which are internal factors, are considered predisposing factors. External factors that affect the working environment are referred to as enabling and reinforcing factors.

According to the PRECEDE-PROCEED model (12), the predisposing, enabling, and reinforcing constructs in Educational Diagnosis and Evaluation (PRECEDE) behavioral model states that being healthy and having healthy behaviors results from predisposing factors, including knowledge, attitudes, beliefs, values, and perceptions. Enabling factors such as the availability and accessibility of resources or services facilitate the appropriate health behaviors. Last, reinforcing factors help support the desired health behaviors, such as warning, praise, and encouragement (12). This cross-sectional study has been reported using the STROBE guideline (15).

## Participants

Participants in this study were taxi drivers in Bangkok who registered with the Department of Land Transport. They were recruited using systematic random sampling. The sample size calculation was 384 taxi drivers. Anticipating missing data, researchers aimed to recruit 401 participants. At the Department of Land Transport in Bangkok, there was a list of 300 taxi drivers who received the service for vehicle inspection per day, and we want to survey 60 of them. Thus, the sampling interval would be one-fifth. Participants were sampled from every fifth person in the list of 300 customers. To ensure a random sample, researchers used a random start, e.g., a number within the range of the sampling interval. For example, the researcher started with the list's first name and then sampled every fifth person (e.g., 1, 6, 11, ..., 300).

Eligible study participants were registered taxi drivers aged 22 years and over. Taxi drivers who have been diagnosed with pulmonary tuberculosis, lung fungal disease, chronic pneumonia, or have to practice anti-infection behaviors regularly due to immunodeficiency or receive immunosuppressive drugs, or are undergoing chemotherapy treatment or those with low white blood cells were excluded from the study. The data was data collected from March to April 2021.

## Measurements

### Research measurement

Structural questionnaires were developed based on theory and literature reviews for collecting the participants' data for data collection. Three parts of the questionnaire with the Thai version were focused on (1) the predisposing factors, (2) the enabling factors, and (3) the reinforcing factors.

## Part 1: Predisposing factors

### Socio-demographic characteristics

Demographic data of the participants were assessed using a 12-item questionnaire consisting of multiple-choice and short-answer questions on the participant's age, gender, marital status, education, work experience, working hours, underlying disease, and treatment of underlying disease, health care coverage, income adequacy, and vehicle ownership.

### Health beliefs

The 20-item Health Beliefs questions were developed to assess taxi drivers' perceptions. The questionnaire used a Health belief model structure (14) for data collection consisting of six parts, including perceived susceptibility to COVID-19, perceived severity of COVID-19, perceived benefits of practicing preventive behavior against COVID-19, perceived barriers to practicing preventive behavior against COVID-19 and motivation to practicing preventive behavior against COVID-19.

The questions consist of three answer options: agree, fair, and disagree. Scores on each item range from 1 to 3. For each part, the scores of each item were totaled. According to the classification, the mean total scale is calculated by summing all subscale scores and dividing by the number of subscales; total scores on each classification range from 1 to 3. The scores were divided into three categories according to Levin and Rubin's classification (16): low level = 1–1.66, moderate level = 1.67–2.33, and high level = 2.34–3.00. Higher scores reflect a higher perception corresponding to health belief.

## Part 2: Enabling factors

### Accessibility to personal protective equipment for COVID-19

The four-item questions were developed to assess taxi drivers' capacity to use personal protection equipment against COVID-19 for themselves and also available for their passengers. The questions used a Likert scale consisting of three answer options: yes, not sure, and no. Scores on each item range from 1 to 3. For each part, the scores of each item were totaled. According to the classification, the mean total scale is calculated by summing all subscale scores and dividing by the number of subscales; total scores on each classification range from 1 to 3. The scores were divided into three categories according to Levin and Rubin's classification (16): low level = 1–1.66, moderate level = 1.67–2.33, and high level = 2.34–3.00. Higher scores reflect a higher capacity to access protection equipment against COVID-19.

### Preventive measures against COVID-19

The four-item questions were developed to assess the benefit of facilitating COVID-19 preventive behaviors from the Department of Land Transport and other agencies. The questions used a Likert scale consisting of three answer options: Ever, Uncertain, and Never. Scores on each item range from 1 to 3. For each part, the scores of each item were totaled. According to the classification, the mean total scale is calculated by summing all subscale scores and dividing by the number of subscales; total scores on each classification range from 1 to 3. The scores were divided into three categories according to Levin and Rubin's classification (16): low level = 1–1.66, moderate level = 1.67–2.33, and high level = 2.34–3.00. Higher scores reflect a higher benefit of facilitating COVID-19 preventive behaviors from the Department of Land Transport and other agencies.

## Part 3: Reinforcing factors

### Support in the implementation of COVID-19 preventive behaviors

The two-item questions were developed to assess the support in implementing COVID-19 preventive behaviors, such as support from the family, co-workers, healthcare workers, and information from the media resource. The questions used a Likert scale consisting of four answer options: never, ever received an extensive, ever received a moderate, and used to get less. Scores on each item range from 0 to 3. For each part, the scores of each item were totaled. According to the classification, the mean total scale is calculated by summing all subscale scores and dividing by the number of subscales; total scores on each classification range from 0 to 3. The scores were divided into three categories according to Levin and Rubin's classification (16): low level = 0–1.0, moderate level = 1.1–2.1, and high level = 2.2–3.00. Higher scores reflect higher support for implementing COVID-19 preventive behaviors.

### Outcome

#### The COVID-19 preventive behaviors

The 15-item questions were developed to evaluate taxi drivers' use of COVID-19 preventative practices during the last month. The questions consisted of the following topic:

- 1) Prevention and control of environmental hazards.
- 2) Eliminating or avoiding hazardous behaviors.
- 3) Personal hygiene.
- 4) Personal protection equipment against COVID-19.

The questions used a Likert scale consisting of four answer options: often, sometimes, rarely, and never. Scores on each item range from 0 to 3. For each part, the scores of each item were totaled. According to the classification, the mean total scale is calculated by summing all subscale scores and dividing by the number of subscales; total scores on each classification range from 0 to 3. The scores were divided into three categories according to Levin and Rubin's classification (16): low level = 0–1.0, moderate level = 1.1–2.1, and high level = 2.2–3.00. Higher scores reflect higher COVID-19 preventive behaviors.

Each of the research tools passed a content validity check by three experts in the field of public health. The questionnaire reliability was tested on 40 participants. Parts 1–4 obtained a Content validity index of 0.89, 1.00, 1.00, and 1.00, respectively.

The questionnaire had a total Cronbach's alpha coefficient confidence score of 0.848.

Perceived susceptibility to COVID-19, perceived severity of COVID-19, perceived benefits of practice preventive behavior against COVID-19, perceived barriers of practice preventive behavior against COVID-19, and motivation of practice preventive behavior against COVID-19 had Cronbach's alpha coefficients at confidence levels of 0.880, 0.637, 0.875, 0.783, and 0.779, respectively.

## Data collection

Data were collected between March 29 to April 9, 2021. A 58-items self-administered questionnaire was used to collect data on the socio-demographic characteristics (12 items), health beliefs (20 items), accessibility to personal protective equipment for COVID-19 (4 items), preventive measures against COVID-19 (4 items), support

in the implementation of COVID-19 preventive behaviors (2 items), and COVID-19 preventive behaviors (15 items).

## Ethical considerations

This research has been approved by Ethics Review Committee for Human Research at Mahidol University (COA MUPH 2020-157, Dated December 17, 2020). Written informed consent was obtained from all participants. The study was conducted following the Declaration of Helsinki.

## Data analysis

Data were analyzed using SPSS version 18. The data were analyzed descriptively using mean, percentage, standard deviation, maximum, and minimum. The association between predisposing factors, enabling factors, and reinforcing factors with COVID-19 preventive behaviors was analyzed by using analysis of variance and Pearson's Product Moment Correlation. Stepwise multiple regression analysis was used to determine the influencing factors in predicting COVID-19 preventive behaviors of taxi drivers.

## Results

### Predisposing factors

#### Socio-demographic characteristics

Table 1 present the participant characteristics. There were a total of 401 taxi drivers in the study. The majority of participants were male (99.0%), had completed primary school (48.6%), and were married (88.0%). The mean age of participants was  $54.2 \pm 8.96$  years. The average daily income was  $451 \pm 199.9$  baht, and 52.1% had inadequate income. 93.8% of participants worked full-time and 77.1% of participants drove taxis for more than 8 hrs per day. The average year of taxi drivers' experience was  $15.1 \pm 9.06$  years. Over 80% of participants had private ownership of taxis. In total, 69.3% were healthy, while the remaining 31.7% had at least one chronic disease, such as diabetes and hypertension; most were treated (97.8%). The Universal Health Coverage Plan was used by 61.8% of participants for health insurance. Tables 2–4 presents the descriptive statistics for the predisposing factors, enabling factors, and reinforcing factors among taxi drivers.

#### COVID-19 health belief

Regarding COVID-19 health beliefs, high perceived susceptibility and perceived severity of COVID-19 were reported by 94.1% and 98.0% of participants, respectively. In addition, 98.0% of participants had a high perception of the benefits of practicing preventive behavior against COVID-19, 75.3% of the participant had a high perception of the barriers to practicing preventive behavior against COVID-19, and 99.3% of participants had high motivation to practice preventive behavior against COVID-19.

TABLE 1 Participant characteristics ( $N = 401$ ).

	<i>N</i>	%	Mean	SD	Range
<b>Gender (<math>n = 401</math>)</b>					
Male	397	99.0			
Female	4	1.0			
<b>Age (years) (<math>n = 401</math>)</b>					
<31	4	1.0			
31–40	27	6.7			
41–50	89	22.2			
51–60	190	47.4			
61–70	79	19.7			
<b>Marital status (<math>n = 401</math>)</b>					
Single	23	5.7			
Married	353	88.0			
Widow	4	1.0			
Divorce	14	3.5			
Separate	7	1.7			
<b>Education level</b>					
Primary school	195	48.6			
Secondary school	159	39.7			
Vocational certificate	30	7.5			
Bachelor's degree and above	17	4.2			
<b>Work experience</b>					
<b>Taxi driver as a full-time job (year) (<math>n = 377</math>)</b>			15.1	9.06	0–58
<10	110	29.17			
10–20	187	49.61			
>20	80	21.22			
<b>Taxi driver as a part-time job (year) (<math>n = 50</math>)</b>			11.2	8.6	0–31
<10	24	48.0			
10–20	19	38.0			
>20	7	14.0			
<b>Working hours (hours/day) (<math>n = 401</math>)</b>			11	3	3–24
≤8	92	22.9			
>8	309	77.1			
<b>Underlying disease (<math>n = 401</math>)</b>					
No	278	69.3			
Yes	93	23.2			
Unknown	30	7.5			

(Continued)

TABLE 1 (Continued)

	N	%	Mean	SD	Range
<b>Treatment of underlying disease (n = 93)</b>					
No	2	2.15			
Yes	91	97.8			
<b>Health care coverage (n = 401)</b>					
Universal health coverage	248	61.8			
Self-paid	83	20.7			
Social security scheme	49	12.2			
Civil service medical benefit scheme	17	4.2			
Others	4	1.0			
<b>Income (baht/day) (n = 401)</b>			451	199.9	100–1,500
≤300	158	39.4			
300–1,000	242	60.3			
≥1,000	1	0.2			
<b>Income adequacy (n = 401)</b>					
Adequate	192	47.9			
Not adequate	209	52.1			
<b>Owner of taxi (n = 401)</b>					
Self-owner	328	81.8			
Regular rental	70	17.5			
Non-regular rental	3	0.7			
<b>Access to information (n = 401)</b>					
Social media	180	44.89			
Radio	131	32.67			
Television	86	21.45			
Others	4	1.0			

## The enabling factors

### Accessibility to personal protective equipment for COVID-19 and preventive measures against COVID-19

It was found that participants had a high level of accessibility to personal protective equipment for COVID-19 (93.0%). However, COVID-19 prevention measures that help facilitate COVID-19 prevention behaviors were at a low level (78.6%). In addition, the preventive measures against COVID-19 from the Department of Land Transportation were at a low level (93.0%), and preventive

measures against COVID-19 from other agencies were at a low level (69.1%).

## The reinforcing factors

### Support in the implementation of COVID-19 preventive behaviors

The majority of the participants received a high level of family support (69.3%), moderate levels of co-worker support (43.4%), and low levels of healthcare worker support (82.3%). In addition, 44.9% of participants received information about COVID-19 *via* social media channels.

### COVID-19 preventive behaviors

Table 5 presents descriptive statistics of COVID-19 preventives behaviors among taxi drivers. Most participants had a high level of overall COVID-19 preventive behaviors (74.3%). When each item was considered, most of them had a high level of prevention (83.3%) and control of environmental hazards and personal hygiene (73.6%). Eliminating or avoiding hazardous behaviors (54.1%) and using personal protection equipment against COVID-19 (68.1%) were at a moderate level.

## Factors associated with COVID-19 preventive behaviors

### Predisposing factors

Marital status, underlying disease, and income adequacy were statistically significantly associated with COVID-19 preventive behaviors ( $F = 6.666, 7.536, 26.063, p < 0.01$ , respectively). Age, education, work experiences, working hours, and vehicle ownership were not associated with COVID-19 preventive behaviors. Overall health belief scores were positively associated with COVID-19 preventive behaviors ( $r = 0.474, p < 0.01$ ). When each aspect was considered, it was found that perceived susceptibility to COVID-19, perceived severity of COVID-19, perceived benefits of practicing preventive behavior against COVID-19, perceived barriers to practicing preventive behavior against COVID-19 and motivation to practicing preventive behavior against COVID-19 had a significant positive association with COVID-19 preventive behaviors ( $r = 0.234, 0.372, 0.373, 0.351$  and  $0.262, p < 0.01$ , respectively), as seen in Table 6.

### Enabling factors

The accessibility to personal protective equipment for COVID-19 and preventive measures against COVID-19 had a statistically significant positive association with COVID-19 preventive behaviors ( $r = 0.339, 0.168; p < 0.01$ , respectively). The preventive measures against COVID-19 from other agencies, such as Bangkok Metropolitan, and the Ministry of Public Health, had a positive correlation with COVID-19 preventive behaviors ( $r = 0.209, p < 0.01$ ). Interestingly, no association was found between the preventive

TABLE 2 Descriptive statistics of predisposing factors among taxi drivers ( $N = 401$ ).

Predisposing factors	Low		Moderate		High	
	Number	%	Number	%	Number	%
Overall health belief	1	0.2	5	1.2	395	98.5
$\bar{x} = 2.8$ , $SD = 0.193$ , $\min = 1$ , $\max = 3$						
Perceived susceptibility to COVID-19	9	2.2	15	3.7	377	94.1
$\bar{x} = 2.89$ , $SD = 0.316$ , $\min = 1$ , $\max = 3$						
Perceived severity of COVID-19	2	0.5	6	1.5	393	98.0
$\bar{x} = 2.92$ , $SD = 0.231$ , $\min = 1$ , $\max = 3$						
Perceived benefits of practicing preventive behavior against COVID-19	2	0.5	6	1.5	393	98.0
$\bar{x} = 2.94$ , $SD = 0.203$ , $\min = 1$ , $\max = 3$						
Perceived barriers to practicing preventive behavior against COVID-19	29	7.2	70	17.5	302	75.3
$\bar{x} = 2.65$ , $SD = 0.528$ , $\min = 1$ , $\max = 3$						
Motivation to practice preventive behavior against COVID-19	1	0.2	2	0.5	398	99.3
$\bar{x} = 2.98$ , $SD = 0.139$ , $\min = 1$ , $\max = 3$						

TABLE 3 Descriptive statistics of enabling factors among taxi drivers ( $N = 401$ ).

Enabling factors	Low		Moderate		High	
	Number	%	Number	%	Number	%
Accessibility to personal protective equipment for COVID-19	1	0.2	27	6.7	373	93.0
$\bar{x} = 2.89$ , $SD = 0.281$ , $\min = 1.5$ , $\max = 3$						
Overall preventive measures against COVID-19	315	78.6	74	18.5	12	3.0
$\bar{x} = 1.44$ , $SD = 0.381$ , $\min = 1$ , $\max = 3$						
Preventive measures against COVID-19 from the department of land transport	373	93.0	15	3.7	13	3.2
$\bar{x} = 1.20$ , $SD = 0.395$ , $\min = 1$ , $\max = 3$						
Preventive measures against COVID-19 from other agencies	277	69.1	69	17.2	55	13.7
$\bar{x} = 1.67$ , $SD = 0.515$ , $\min = 1$ , $\max = 3$						

TABLE 4 Descriptive statistics of reinforcing factors among taxi drivers ( $N = 401$ ).

Reinforcing factors	Low		Moderate		High	
	Number	%	Number	%	Number	%
Support from family	20	5.0	103	25.7	278	69.3
$\bar{x} = 2.56$ , $SD = 0.656$ , $\min = 0$ , $\max = 3$						
Support from co-workers	87	21.7	174	43.4	140	34.9
$\bar{x} = 1.97$ , $SD = 0.859$ , $\min = 0$ , $\max = 3$						
Support from healthcare workers.	330	82.3	39	9.7	32	8.0
$\bar{x} = 0.601$ , $SD = 0.899$ , $\min = 0$ , $\max = 3$						

measures against COVID-19 from Department of Land Transport and COVID-19 preventive behaviors, as seen in Table 6.

## Reinforcing factors

Support for the practice of COVID-19 preventive behaviors from family, co-workers, and healthcare workers was found to

have a statistically significant positive relationship with COVID-19 preventive behaviors ( $r = 0.165$ ,  $0.298$ , and  $0.141$ ,  $p < 0.01$ , respectively). However, the information received about COVID-19 did not correlate with COVID-19 preventive behaviors, as seen in Table 6.

A stepwise multiple regression analysis was used to predict taxi drivers' COVID-19 preventive behaviors. Seven factors were used to predict taxi drivers' COVID-19 prevention behaviors,



TABLE 5 Descriptive statistics of COVID-19 preventives behaviors among taxi drivers ( $N = 401$ ).

COVID-19 preventive behaviors	Low		Moderate		High	
	Number	%	Number	%	Number	%
Overall COVID-19 preventive behaviors	0	0	103	25.7	298	74.3
$\bar{x} = 2.38$ , SD = 0.95, min = 1.2, max = 3						
Prevention and control of environmental hazards	3	0.7	64	16.0	334	83.3
$\bar{x} = 2.64$ , SD = 0.465, min = 1, max = 3						
Eliminating or avoiding hazardous behaviors	61	15.2	217	54.1	123	30.7
$\bar{x} = 1.99$ , SD = 0.75, min = 0, max = 3						
Personal hygiene	13	3.2	93	23.2	295	73.6
$\bar{x} = 2.47$ , SD = 0.536, min = 0.667, max = 3						
Personal protection equipment against COVID-19	1	0.2	273	68.1	127	31.7
$\bar{x} = 2.19$ , SD = 0.474, min = 0.667, max = 3						

including; perceived benefits of practicing preventive behavior against COVID-19, perceived barriers to practicing preventive behavior against COVID-19, accessibility to personal protective equipment for COVID-19, support from co-workers, perceived severity of COVID-19, income adequacy, and preventive measures against COVID-19 from other agencies (beta = 0.183, 0.164, 0.185, 0.120, 0.188, -0.130, 0.110, respectively), as seen in Table 7. The multiple linear regression analysis explained 34.9% of the COVID-19 preventive behaviors among taxi drivers. The multiple regression equation was COVID-19 preventive behaviors ( $Y$ ) =  $-11.694 + 1.337$  (perceived benefits of practicing preventive behavior against COVID-19) +  $0.459$  (perceived barriers to practicing preventive behavior against COVID-19) +  $0.976$  (accessibility to personal protective equipment for COVID-19) +  $0.413$  (support from co-workers) +  $1.207$  (perceived severity of COVID-19) -  $1.538$  (income adequacy) +  $0.316$  (preventive measures against COVID-19 from other agencies).

## Discussion

This cross-sectional study found that most taxi drivers in Bangkok had COVID-19 preventive behaviors at a high level (74.3%) which is consistent with previous studies on preventing respiratory problems in other occupations in Thailand (17–22). In addition, the taxi driver in Thailand followed the safety practice for COVID-19 prevention, such as mask-wearing and frequent hand washing with soap or hand sanitizer. In contrast, in a study in Ethiopia, public taxi drivers had poor COVID-19 prevention practices and were highly dependent on traditional medicines and religious practices (23).

We found that marital status, underlying disease, and income adequacy were associated with COVID-19 preventive behaviors. The marriage status of taxi drivers was associated with COVID-19 preventive behaviors. Taxi drivers who were married had a greater predisposition to limiting the transmission of COVID-19 than those who were single/ widowed/divorced and separated. If a taxi driver gets COVID-19 infection, he may spread the virus to other family members. Moreover, COVID-19 may affect households in many

ways, such as loss of income. Additionally, married persons were more likely to have a caregiver and an interest in marriage health care, which was supported by Pender's assumption that marital health care is a significant source of health promotion (24).

The underlying disease was associated with COVID-19 preventive behaviors, which may be related to the fact that COVID-19 frequently caused severe symptoms in people with underlying diseases such as diabetes, hypertension, obesity, and heart disease. In this study, 23.2% of taxi drivers had a chronic illness. Thus, taxi drivers with underlying diseases showed more protective behaviors against COVID-19 than taxi drivers who did not have an underlying disease. In addition, Thailand had proactive measures to monitor and prevent high-risk groups, especially people with an underlying disease, by providing knowledge and increasing awareness of COVID-19 infection through various media. Therefore, taxi drivers also create new normal behaviors to prevent COVID-19 infection.

Income was associated with COVID-19 preventive behaviors. Consistent with a previous study among older adults in urban communities in Thailand, adequate income was associated with good COVID-19 preventive behaviors (25). In contrast, Wang and Tang's study reported that adequate income is associated with health behaviors (26). However, some taxi drivers have faced financial difficulty during the COVID-19 pandemic (27). Without sufficient support for personal protective equipment against COVID-19 (masks and hand sanitizers) from other authorities, taxi drivers with inadequate incomes may not be able to access personal protective equipment against COVID-19.

Interestingly, education level was not associated with COVID-19 preventive behaviors, consistent with the previous study among older adults in urban communities in Thailand (25). Previous research has revealed that socioeconomic status indicators, such as education levels, were associated with health behaviors (28). For example, highly educated people can take care of themselves, protect themselves against risk factors (29) and seek health information to manage their chronic illnesses (30). This result contrasts with a study among Chinese residents in Hubei, where knowledge was significantly associated with attitudes and preventive practices toward COVID-19 (31). Kebede et al.'s study revealed that knowledge could predict hand washing and avoiding handshaking (32). COVID-19 is the disease caused by the new coronavirus that has just emerged

**TABLE 6** Correlations coefficient among predisposing factors, enabling factors, and reinforcing factors and COVID-19 preventive behaviors among taxi drivers in Bangkok ( $N = 401$ ).

Predisposing factors	<i>F</i>	Sig
Marital status	6.666*	<0.01
Education level	0.840	0.473
Underlying disease	7.536*	<0.01
Sufficiency of income	26.063*	<0.01
Car owner	1.193	0.304
Predisposing factors	<i>r</i>	Sig
Age	−0.021	0.678
Working experiences	0.017	0.739
Working hours	0.071	0.155
Overall health belief	0.474*	<0.01
Perceived susceptibility to COVID-19	0.234*	<0.01
Perceived severity of COVID-19	0.372*	<0.01
Perceived benefits of practicing preventive behavior against COVID-19	0.373*	<0.01
Perceived barriers to practicing preventive behavior against COVID-19	0.351*	<0.01
Motivation to practice preventive behavior against COVID-19	0.262*	<0.01
Enabling factors	<i>r</i>	Sig
Accessibility to personal protective equipment for COVID-19	0.339*	<0.01
Overall preventive measures against COVID-19	0.168*	<0.01
Preventive measures against COVID-19 from the department of land transport	0.052	0.258
Preventive measures against COVID-19 from other agencies	0.209*	<0.01
Reinforcing factors	<i>r</i>	Sig
Support from family	0.165	<0.01
Support from co-workers	0.298	<0.01
Support from healthcare workers	0.141	<0.01

\* $p < 0.01$ .

globally, and everyone has to pay attention to their health and infection prevention. As a result, preventing the spread of COVID-19 requires everyone to adapt to a new normal, and there were strict disease control and prevention measures in cooperation with the government. In addition, taxi drivers' agencies are responsible for monitoring and guiding how to prevent COVID-19 infections for professional taxi drivers.

Regarding health beliefs and COVID-19 preventive behaviors, perceived susceptibility, severity, benefits, barriers, and health motivation were associated with COVID-19 preventive behaviors. Taxi drivers were at a high risk of COVID-19 infection compared to other populations. Continuous media reports about COVID-19's severity and impact on taxi drivers, such as the transmission of infection to family members, loss of income, or death, make taxi drivers aware of the disease's severity. Thus, they practice COVID-19 preventive behaviors.

We found that the accessibility to personal protective equipment for COVID-19 and preventive measures against COVID-19 implemented by the Department of Land Transport and other agencies were associated with the prevention of COVID-19 behavior among taxi drivers in Bangkok. In addition, a previous study among older adults in urban communities in Bangkok also found that access to protective material was associated with COVID-19 preventive behaviors (25).

We found that support from family, co-workers, and healthcare providers were associated with COVID-19 preventive behaviors among taxi drivers. Interestingly, no association was found between receiving information about COVID-19 from the media and taxi drivers' COVID-19 preventive behaviors. As Thailand was the first country outside China to report a confirmed case of COVID-19, Thai society was interested in reading any news reported by all types of media (33). However, the dissemination of misleading information led to adverse effects, such as rumors, false knowledge, fear, disguised history of exposure to risk groups of COVID-19, and social stigma (33). These adverse effects caused panic in society rather than raising awareness of practices to prevent further infection in the community (34).

The findings of the study revealed that multiple factors could predict COVID-19 preventive behaviors. The combination of predisposing, enabling, and reinforcing factors could predict COVID-19 preventive behaviors among taxi drivers in Bangkok. This finding was statistically significant ( $p < 0.001$ ), with 34.9

**TABLE 7** Coefficient multiple regression of factors in predicting the preventive behavior of COVID-19 among taxi drivers in Bangkok.

Variables	B	Std. error	Beta	p-value	$R^2$	$R^2$ change
Perceived benefits of practicing preventive behavior against COVID-19	1.337	0.339	0.183	<0.001	0.139	0.139
Perceived barriers to practicing preventive behavior against COVID-19	0.459	0.124	0.164	<0.001	0.216	0.077
Accessibility to personal protective equipment for COVID-19	0.976	0.226	0.185	<0.001	0.270	0.054
Support from co-workers	0.413	0.153	0.120	0.007	0.298	0.028
Perceived severity of COVID-19	1.207	0.299	0.188	<0.001	0.322	0.025
Income adequacy	−1.538	0.504	−0.130	0.002	0.339	0.016
Preventive measures against COVID-19 from other agencies	0.316	0.123	0.110	0.011	0.349	0.011
Constant = −11.694; $F = 30.152$ ; $R^2 = 0.349$ ; $p = 0.008$						

percent ( $R^2 = 0.349$ ). The predisposing factors that significantly predict COVID-19 preventive behaviors are perceived COVID-19 severity, perceived benefits of practicing preventive behavior against COVID-19, perceived barriers to practicing preventive behavior against COVID-19, and income adequacy. The enabling factors were accessibility to personal protective equipment for COVID-19 and preventative measures against COVID-19 from other agencies. The reinforcing factor was co-worker support.

The findings of this study corroborated the conceptual framework, PRECEDE-PROCEED Model, which states that health behavior is influenced by internal and external factors (12). Therefore, taxi drivers should be encouraged to engage in appropriate preventive behaviors against COVID-19, with an emphasis on the individual, by raising awareness of the perceived severity of COVID-19, the perceived benefits of practicing preventive behavior against COVID-19, and the perceived barriers to practicing preventive behavior against COVID-19, including having income adequacy. Additionally, external factors should be encouraged by supporting taxi drivers in practicing COVID-19 preventive behaviors by supporting taxi drivers in receiving personal prevention equipment against COVID-19. Training on how to prevent the spread of COVID-19 includes an annual physical examination, influenza vaccine, chest x-ray, publicity about the posting of warning signs for taxi drivers to prevent the spread of COVID-19, and support from others, particularly co-workers, which helps promote consistent behaviors for health and productive work life.

The findings of this study suggested that there should be a policy by organizations in the responsibility of taxi driver supervision to promote the implementation of COVID-19 safety control standards to ensure safe working conditions. Protective equipment such as masks, hand wash gel, and a car barrier should be provided. Taxi associations and taxi garages should regularly increase awareness of COVID-19 prevention, such as by communicating the benefits of COVID-19 prevention and the severity of COVID-19. Friends remind friends activities should also be developed to increase support from co-workers. Safe taxis should be promoted through the taxi service business by having loans and protective equipment as welfare benefits. The Occupational Health Nurses Association should be involved in developing taxi driver health policies and healthcare services to improve COVID-19 preventive behaviors.

Further study in COVID-19 preventive behaviors among other public transportation drivers, such as vans and buses, should be conducted to identify factors influencing preventive behaviors in COVID-19 and other respiratory diseases. In addition, qualitative research to obtain insights into different aspects and to develop policy proposals should be conducted to provide suitable policy suggestions relevant to the issue and career context.

## Conclusion

The present findings revealed that income adequacy, good support from family, co-workers, and healthcare professionals, perceived susceptibility, severity, benefits, barriers, and health motivation, and accessibility to personal protective equipment for COVID-19 and preventative measures against COVID-19 from other agencies were associated with COVID-19 preventive behaviors among taxi-driver in Bangkok during COVID-19 pandemic. Therefore, taxi drivers with COVID-19 preventive behaviors will

have a low risk of getting COVID-19 infection. Based on these results, healthcare providers should consider health beliefs, social support, and access to personal protective equipment when developing interventions to improve COVID-19 preventive behaviors. Also, appropriate measures or policies should be developed to maintain physical distancing in the public transport system, and necessary information or training should be provided to the staff and passengers.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Review Committee for Human Research at Mahidol University (COA MUPH 2020-157, Dated December 17, 2020). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

AD, WK, SK, and JS contributed to the design and implementation of the research and to the analysis of the results. AD and WK wrote the manuscript with input from all authors. All authors contributed to the article and approved the submitted version.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- World Health Organization. *Coronavirus Disease (COVID-19) Advice for the Public. Basic Protective Measures Against the New Coronavirus* (2021). Available online at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>
- Pongpirul WA, Pongpirul K, Ratnarathon AC, Prasithsirikul W. Journey of a Thai taxi driver and novel coronavirus. *N Engl J Med.* (2020) 382:1067–8. doi: 10.1056/NEJMc2001621
- Rajatanavin N, Tuangratananon T, Suphanchaimat R, Tangcharoensathien V. Responding to the COVID-19 second wave in Thailand by diversifying and adapting lessons from the first wave. *BMJ Global Health.* (2021) 6:e006178. doi: 10.1136/bmjgh-2021-006178
- Natnael T, Alemnew Y, Berihun G, Abebe M, Andualem A, Ademe S, et al. Facemask wearing to prevent COVID-19 transmission and associated factors among taxi drivers in Dessie City and Kombolcha Town, Ethiopia. *PLoS ONE.* (2021) 16:e0247954. doi: 10.1371/journal.pone.0247954
- Lan FY, Wei CF, Hsu YT, Christiani DC, Kales SN. Work-related COVID-19 transmission in six Asian countries/areas: a follow-up study. *PLoS ONE.* (2020) 15:e0233588. doi: 10.1371/journal.pone.0233588
- Sim MR. The COVID-19 pandemic: major risks to healthcare and other workers on the front line. *Occup Environ Med.* (2020) 77:281. doi: 10.1136/oemed-2020-106567
- Long H. *A New York City Taxi Driver Kept Working to Pay Bills. Now He and His Family Are Sick.* Washington, DC: The Washington Post (2020).
- Centre for the Administration of the Situation due to the Outbreak of the Communicable Disease Coronavirus (COVID-19). *Progress on the Situation of the Novel Coronavirus Disease 2019 (COVID-19) in Thailand.* (2019). Available online at: <https://news.thaipbs.or.th/content/306916>
- Centre for the Administration of the Situation due to the Outbreak of the Communicable Disease Coronavirus (COVID-19) (2020). Available online at: [https://ddc.moph.go.th/viralpneumonia/situation\\_more.php](https://ddc.moph.go.th/viralpneumonia/situation_more.php)
- Wong JEL, Leo YS, Tan CC. COVID-19 in Singapore-current experience: critical global issues that require attention and action. *JAMA.* (2020) 323:1243–4. doi: 10.1001/jama.2020.2467
- Gkiotsalitis K, Cats O. Public transport planning adaption under the COVID-19 pandemic crisis: literature review of research needs and directions. *Transp Rev.* (2021) 41:374–92. doi: 10.1080/01441647.2020.1857886
- Green LW, Kreuter MW. *Health Program Planning: An Educational and Ecological Approach.* 4th ed. New York, NY: McGraw-Hill (2005).
- Rojpaisarnkit K. Factors influencing well-being in the elderly living in the rural areas of Eastern Thailand. *J Behav Sci.* (2016) 11:31–50.
- Glanz K, Rimer BK, Viswanath K. *Health Behavior: Theory, Research, and Practice.* 5th ed. Hoboken, NJ: John Wiley and Sons (2015). p. 512
- Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *PLoS Med.* (2007) 4:e297. doi: 10.1371/journal.pmed.0040297
- Levin R, Rubin D. *Statistics for Management.* Hoboken, NJ: Prentice Hall (1998).
- Khoenpeg C, Tantipanaporn T. Predicting factors of preventive behaviors from air pollution exposure among motorcycle taxi drivers in Mae Sot District, Tak Province. *J Saf Health.* (2016) 9:14–25.
- Jaidee C, Sansati S, Kongsaktrakul C. Factors related to child care workers' behavior in prevention of acute respiratory infection in child care center. *Ramathibodi Nurs J.* (2012) 18:389–403.
- Laemthaisong J, Tunsiri C, Homsin P. Factor influencing on preventive behaviors of respiratory tract infections among caregivers of preschool aged children in childcare center, Bangkok metropolitan administration. *J Public Health Nurs.* (2019) 33:1–19.
- Wapattanawong P, Supapvanich C, Sontichai A. Preventive behaviors of occupational tuberculosis among healthcare workers in Naradhiwas Rajanagarindra Hospital, Narathiwat Province. *Princ Naradhiwas Univ J.* (2017) 2017:74–85.
- Bashirian S, Jenabi E, Khazaei S, Barati M, Karimi-Shahanjari A, Zareian S, et al. Factors associated with preventive behaviours of COVID-19 among hospital staff in Iran in 2020: an application of the Protection Motivation Theory. *J Hosp Infect.* (2020) 105:430–3. doi: 10.1016/j.jhin.2020.04.035
- Jaisan J. *COVID-19 Preventative Behavior of the Staff in the National Institute of Health, Department of Medical Sciences* (2020). Available online at: <https://mmm.ru.ac.th/MMM/IS/sat16/6114060102.pdf>
- Teka B, Wabalo E, Getnet M. *Public Taxi Drivers' Experience in COVID-19 Prevention.* (2021). p. 17.
- Pender N, Murdaugh C, Parsons M. *Health Promotion in Nursing Practice* New Jersey, NJ: Prentice Hall (2005).
- Yodmai K, Pechrapa K, Kittipichai W, Charupoonpol P, Suksatan W. Factors associated with good COVID-19 preventive behaviors among older adults in urban communities in Thailand. *J Prim Care Commun Health.* (2021) 12:21501327211036251. doi: 10.1177/21501327211036251
- Wang Z, Tang K. Combating COVID-19: health equity matters. *Nat Med.* (2020) 26:458. doi: 10.1038/s41591-020-0823-6
- James K, Thompson C, Chin-Bailey C, Donaldson Davis K, Walters D, Holder Nevins D. Taxi drivers and COVID-19 in Jamaica: occupationally related income decline and health behaviour. *Health Soc Care Commun.* (2022) 30:1818–26. doi: 10.1111/hsc.13561
- Assari S. Blacks' diminished return of education attainment on subjective health; mediating effect of income. (2018) 8:176. doi: 10.3390/brainsci8090176
- Baker DP, Leon J, Smith Greenaway EG, Collins J, Movit M. The education effect on population health: a reassessment. *Popul Dev Rev.* (2011) 37:307–32. doi: 10.1111/j.1728-4457.2011.00412.x
- Choi AI, Weekley CC, Chen SC Li S, Kurella Tamura M, Norris KC, et al. Association of educational attainment with chronic disease and mortality: the Kidney Early Evaluation Program (KEEP). *Am J Kidney Dis.* (2011) 58:228–34. doi: 10.1053/j.ajkd.2011.02.388
- Zhong B-L, Luo W, Li H-M, Zhang Q-Q, Liu X-G, Li W-T, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci.* (2020) 16:1745–52. doi: 10.7150/ijbs.45221
- Kebede Y, Yitayih Y, Birhanu Z, Mekonen S, Ambelu A. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medical center visitors, Southwest Ethiopia. *PLoS ONE.* (2020) 15:e0233744. doi: 10.1371/journal.pone.0233744
- Namwat C, Suphanchaimat R, Nittayasoot N, Iamsirithaworn S. Thailand response against Coronavirus disease 2019: challenge and lessons learned. *Outbreak Surv Investig Response.* (2020) 13:33–7.
- Ahmad AR, Murad HR. The impact of social media on panic during the COVID-19 pandemic in Iraqi Kurdistan: online questionnaire study. *J Med Internet Res.* (2020) 22:e19556. doi: 10.2196/19556





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# Understanding employee creativity from the perspectives of grit, work engagement, person organization fit, and feedback

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**Purpose:** Drawing on the growing emphasis in the literature on the importance of creativity in the workplace, the present study examines the effect of personal and organizational level factors that influences employee creativity. Precisely, we examine how grit, work engagement, person-organization fit, and feedback influence creativity in the workplace.

**Design/methodology/approach:** We sampled data from 422 research assistants who are professional workers at top-notch Universities in China. They were recruited to participate in the survey through an online medium known as WeChat. We empirically tested the effect of grit, work engagement, person-organization fit, and feedback on employee creativity. These hypotheses were supported by confirmatory and exploratory factor analysis, and path analysis.

**Findings:** The results show that work engagement strengthens the relationship between grit and creativity. In addition, the results proved that person-organization fit positively moderates the link between grit and work engagement. Feedback also had a positive mediating effect on the link between work engagement and creativity.

**Practical implications:** Based on the appropriateness of an individual work environment, a gritty person will likely become engaged and creative with task execution. Consequently, a person's organizational fit will strongly interact with grit, work engagement, and creativity.

**Originality/value:** We shed light on the blended value of personal and organizational-level factors that positively affect creativity in the workplace. Specifically, grit being both a personal and organizational factor influences employee creativity via work engagement. This research explored the effect of work engagement as a mechanism that serves as a motivational feature enhancing creativity. We also simultaneously identify the moderation conditions of person-organization fit and feedback. The theoretical and practical implications of the findings are discussed in detail. The study makes a theoretical contribution through its assessment of the impact of grit on employee creativity. The trait activation theory portrays how grit



can be expressed through feedback and person-organization fit. In terms of practice, grit can be an important consideration in hiring decisions, and feedback should be given to make the workplace more creative.

#### KEYWORDS

grit, work engagement, person-organization fit, feedback, creativity

## Introduction

In today's knowledge-based economy and dynamic business environment, different organizations are placing a high focus on employee creativity to gain a competitive and sustainable advantage (Mubarak and Noor, 2018; Bakker et al., 2020). Creativity has been identified as a key element in facilitating social and economic reform (Zhou and Shalley, 2011) while improving individual performance (Amabile, 1998). Research has pointed out that creativity is the process by which people develop new and useful ideas or solutions to problems. Several pieces of studies indicated that employee creativity relates to employee high growth needs, strength, and employee learning orientation (Gong et al., 2009; Shalley et al., 2009) as well as ensures organizations remain competitive, productive, and relevant in the global market sphere (Yoshida et al., 2014; Gu et al., 2015; Ouakouak and Ouedraogo, 2017). This elucidates why many organizations strive so hard to ensure employees are well-motivated to relish the outcomes of employees' creativity (Liu et al., 2012; Gu et al., 2015). Extant studies examined the dynamics that revolve around creativity and identified personality traits and abilities significantly related to individuals' creativity (Li et al., 2020). For instance, studies showed that extroverts show a high sense of creativity (Woodman et al., 1993).

In addition, some behavioral processes such as social learning (Tims and Parker, 2020); networking (Baer, 2010); and help/feedback-seeking attitude (De Stobbeleir et al., 2011; Mueller and Kamdar, 2011) strongly predict creativity. Based on these findings, scholars recommended the need for suitable job crafting for employee creative performance (Tian et al., 2021). Although this is necessary, it is equally vital to note that creativity does not solely depend on who is creative and how an organization's working environment engenders substantial employee creative outcomes but also has to do with what employees themselves must do to contribute to their creativity. In this light, further research is required to aid employee self-realization of inherent traits and the mechanisms that expedite such traits for high levels of employee creativity and outcomes. Much is unknown about the role of grit on employee creativity in these prior investigations as a result, exploring vital factors such as person-organization fit and feedback can stimulate employee creativity and enhance organizational performance.

Based on trait activation theory (TAT), scholars devoted considerable attention to the special role of grit in organizational

performance. Grit, a new construct in the field of behavioral science (Jordan et al., 2019b) is a highly significant predictor of an employee and organization's success (Mueller et al., 2017; Dugan et al., 2019) and highlights "passion and perseverance for achieving long-term objectives" (Duckworth et al., 2007; Crede, 2018). Past studies established that higher levels of grit effectively relate to employee creativity and positive attitude toward work engagement (Chandrawaty and Widodo, 2020). Scholars concluded that when employees demonstrate high levels of passion and tenacity, it can positively alter the value that such employees attach to such work as well as kindle the employees' creative (Suzuki et al., 2015; Chandrawaty and Widodo, 2020; Nisar et al., 2020).

A review of the literature emphasized feedback mechanisms accounting for grit's developmental properties over time (Jordan et al., 2019b). Hartmann and Rutherford (2015) asserted that feedback from supervisors or colleagues promotes employees' grit. Such a phenomenon indicates that employees can be creative in a positive work atmosphere. However, to the best of the authors' knowledge, no study has examined the relationship between grit and creativity. This study aims at filling this gap. Given the insights from the TAT, this study also aims to incorporate the mediating role of work engagement and the moderating role of person-organization fit and feedback in the interplay between employee grit and creativity.

Drawing on the aforementioned gaps and arguments, this study makes multiple contributions. Theoretically, we contribute to organizational behavior literature by identifying grit, work engagement, person-organization fit, and feedback as determinants of employee creativity. Similarly, we add to TAT's highlights on the effect of personality variables in the workplace (Tett and Burnett, 2003). This study shows that although grit positively relates to employee creativity it also does so *via* other imperative mechanisms. Precisely, grit affects creativity *via* the mediating effect of work engagement. In addition, we show the moderating effects of person-organization fit and feedback in these relationships. Empirically, there has been no empirical research into the effects of grit, work engagement, person-organization fit, and feedback on creativity at the workplace, specifically, research assistants' creativity in Chinese universities. Consequently, this research has implications for the conditions that underpin the effect of these determinants in organizational behavior research. This insight could be replicated in similar contexts.

The remaining sections of this study are classified as follows. The literature review and theoretical background are presented. Thereafter, sections on methodology, results, discussion, and conclusion are included.

## Literature review

### Theoretical background

Personality traits are dominant conceptions in psychology and have been characterized in numerous ways (Phares and Chaplin, 1997). Presently, they are conceived to be intra-individual consistencies and inter-individual uniqueness in propensities to behave in identifiable ways in light of situational demands (Tett and Guterman, 2000). This indicates that the concept of trait should mainly encompass the interpretations regarding an individual's behavior patterns and how the individual's grit influences creativity. The TAT has provided insight into how personality is related to performance in the workplace as a response to trait-relevant cues (Tett and Burnett, 2003). Tett and Guterman (2000) argued that traits are a person's latent potential and relevant situational cues can trigger trait expressions (i.e., behaviors). These situational cues may stem from an organization, social, and/or task cues. These cues can activate personality traits (i.e., grit) that are task-related cues (i.e., engaging in work activities) and organizational expectations that the organization values (i.e., employee creativity/performance). Although trait expression is a fundamental part of human nature, TAT emphasizes that the impact of a trait depends on the work situational cues provided (Tett et al., 2021) which can also be expressed in a person's work behavior.

The response to situations is also an important factor for individual behavior in the workplace (Day and Silverman, 1989). The basic premise of trait activation is that the degree to which a trait is likely to drive behavior is a function of the extent to which the situation provides an opportunity for or creates a necessity for the trait (Tett and Burnett, 2003). For instance, the interaction of trait-related situational activators is a stimulus for one personality trait to manifest itself into conduct (Tett and Guterman, 2000). The importance of a trait and its context should be aligned such that the individual possesses the trait that allows them to respond effectively to the situation's indications (Luria et al., 2019). Accordingly, scholars emphasized grit as individual behavior under three categorizations including consistency, perseverance, and interest (Duckworth et al., 2007). Taken together with recent endorsements, TAT gives insight into how personality is related to work engagement (Scharp et al., 2019).

Work engagement is defined as a positive affective-motivational state of fulfillment marked by vigor, dedication, and absorption (Demerouti et al., 2001). In this regard, scholars identified employees' high levels of energy and enthusiasm (May et al., 2004; Macey and Schneider, 2008) as variables that affect work engagement. Other studies found that work engagement

varies per individual due to work surroundings, personal characteristics, and behavioral strategies (Bakker and Xanthopoulou, 2013). Thus, work engagement leads to multiple positive-performance outcomes such as higher job satisfaction, lower intent to leave, and higher organizational commitment (Bakker and Leiter, 2010). Along these lines of emphasis, some scholars for instance, Zhang and Bartol (2010) endorsed the positive relationship between grit personality and engagement as well as work engagement and creativity in a work setting. Nonetheless, they concluded that the relationship between grit and creativity is not direct. This necessitates further exploration to answer the earlier call for empirical studies on the influencing mechanisms in the link between grit and employee creativity (Shalley et al., 2004).

Different perspectives showed a positive impact on employee creativity. First, from the standpoint of feedback (appropriate response), scholars noted that the TAT is appropriate to explain variance in employee creativity (Amabile and Pillemer, 2012) in different organizational contexts (Shalley et al., 2004; Zhang et al., 2011). Prior studies, for instance, Harding (2010) examined how creativity is related to leadership (appropriate responses) and work engagement. The study discovered that entrepreneurial leadership is crucial in promoting employee and team creativity by exhibiting creativity-favoring behaviors that are specifically tailored to workplace creative pursuits. Second, considerable evidence showed the predictive effect of person-organization fit (POF) and work engagement on employees' creativity (Harding, 2010; Rich et al., 2010; Sarac et al., 2014). Yet, less research has used TAT to investigate how person-organization fit interacts with grit, work engagement, and feedback to promote creativity in the university setting.

### Conceptual framework and hypotheses development

First, this study's conceptual framework examines the potential effects of grit and work engagement on employee creativity from the perspective of TAT. At this stage, we also analyze the mediating effect of work engagement in the link between grit and employee creativity. Second, we examine two other mechanisms (feedback, and person-organization fit) based on the proposition that both factors interact with grit and work engagement (moderating effects) to influence employee creativity. The research model as shown in Figure 1 details the direct, mediation, and moderation factors as well as the hypotheses.

### Grit and employee creativity

Creativity plays a tremendous role in the progress of human endeavors as it relates to originality and novelty. Past studies argued that creativity is needed in almost every job or work (Shalley et al., 2000; Unsworth, 2001). Over the years, a lot of work

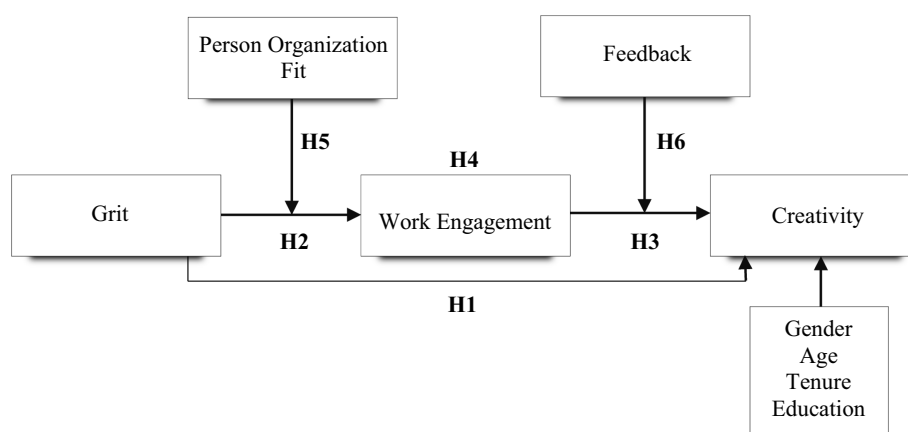


FIGURE 1  
Conceptual model.

has been conducted in the area of creativity, accounting for about 9,000 published articles (Runco et al., 1998). Creativity has been conceptualized in many different ways, however, the most widely recognized definition describes creativity as the rubrics involved in producing, conceptualizing, or developing new, and important ideas by an individual or group of individuals working in harmony (Shalley, 1991; Amabile, 1998). Employee creativity, therefore, describes the ability of an employee to generate new and useful ideas which are of crucial value to achieve effectiveness, innovation, and significant breakthroughs (Shalley et al., 2009; Liu et al., 2012; Yoshida et al., 2014). Extant studies also documented some factors that precede employee creativity. For instance, perseverance and passion are important predictors of creativity (Helson et al., 1995; Csikszentmihalyi, 1996). Moreover, both perseverance and passion are key subscales of the recent conceptualization of grit. Creative individuals show a high sense of perseverance. In the study conducted by Wilson (1990), through the process of observation, interviews, and psychological tests, it was revealed that poets persist or persevere in their writings even when they are confronted with a myriad of difficulties and challenges. Although the ability to persist or persevere is not only restricted to poets alone, it also actually depends on the domain in focus. In the field of education, women who have shown a high sense of occupational creativity 30 years after college are said to be those who displayed a high level of persistence or perseverance while in college despite the adversity (Helson et al., 1995). Perseverance has also been revealed to exert a strong and significant influence on the scientific creativity of laureates (Adelson, 2003). This implies that individuals need to be perseverant in the face of challenges to be creative. Similarly, creative individuals are passionate about any work they do (Csikszentmihalyi, 1988; Fisher and Amabile, 2008). Thus, passion influences employees' creativity within a work setting (Liu et al., 2011). Earlier emphasis showed that passion affects the creativity of students majoring in performing arts (Vallerand et al., 2007). As a result of the various insights gathered from the review of the

literature, we assume that grit which encompasses a blend of perseverance and passion can predict employee creativity. It is on this basis that the next hypothesis is developed:

*H1: Grit is positively related to employees' creativity.*

## Employee's grit and work engagement

Grit is defined as "perseverance and passion for long-term goals" (Bernardy and Antoni, 2021). Grit has been identified to have a strong relationship with positive outcomes such as an individual's impulse for more education and higher performance at work (Duckworth et al., 2007); effective teaching behaviors (Duckworth and Quinn, 2009); lower burnout in surgical residents (Salles et al., 2014); increased hardiness of US Military Academy Cadets (Maddi et al., 2012); and increased level of soldier's retention as well as sales workers (Eskreis-Winkler et al., 2014). Researchers also established that employees with a significant level of grit tend to go the extra mile to ensure that they get their jobs effectively done. We have, therefore, within the context of this study, conceptualized grit as an employee's "perseverance and passion for long-term goals" with an organization setup.

In the literature, the conceptual disparities between grit and some of its related constructs have been established (Schimschal et al., 2021). A very common case in point is self-control and grit. The two concepts have been said to be success determinants regardless of the difficulties attached, however, self-control constitutes the qualities that an individual possesses in the process of effectively and efficiently reaching a resolution between two sets of unprompted actions. On the other hand, grit typifies the determined resolution toward long-term goals (Duckworth and Gross, 2014). In addition, conscientiousness is also associated with grit (Duckworth et al., 2007); however, grit highlights the

discrepancy in the gradual increase of results (Duckworth et al., 2007), thereby implying a distinctive “construct domain.” The positive correlation between grit and hardiness is also reflected in Maddi et al. (2012)’s definition of hardiness as a pattern of attitudes and skills that provides the existential form of courage and motivation needed for learning from stressful circumstances, to determine what will be the most effective performance. The above-cited examples have shown grit as a unique construct despite its relations with other related constructs.

Work engagement refers to the desire, zeal, and energy that an individual has for his or her work. This panoply of feelings can be grouped into three main dimensions, which include vigor, dedication, and absorption (Schaufeli and Bakker, 2004). Scholars further described work engagement as the feelings or action that exhibits strong positivity and fulfillment predicated on vigor, dedication, and absorption in a particular work situation. These three dimensions of work engagement according to scholars can be explained as follows: vigor represents the high degree of mental resilience and energy in the process of working, the readiness or disposition to exert one’s effort in the work, and the persistence when challenges and difficulties beckon. Dedication relates to a sense of significance, excitement, inspiration, pride, and challenge. Absorption is defined as being fully concentrated and happily engrossed in one’s task, such that time goes swiftly and it is difficult to disengage oneself from work.

Past empirical evidence revealed a positive relationship between grit and employee engagement in the workplace. Duckworth et al. (2007) conducted a study using US Military Cadets as its sample. The study showed that the grit component of the cadets was a significant predictor of their work engagement, subsequent performance, and retention in their military training. This goes to show that grit has the potential of stimulating the spirit of work engagement in individuals and has the proclivity to influence good performance in the workplace. In addition, other studies explored the association between employees’ grit, work engagement, and performance. One such study was conducted by Kim and Lee (2022). The findings showed that employees’ grit plays a positive imperative role in influencing employees’ quality of work life and in a similar manner affects their quality of life. It can be deduced from these findings that an employee who has higher grit is very likely to rate higher on work engagement level as a result of the positive effect that grit exerts on their quality of work-life and quality of life. The research of Von Culin et al. (2014) asserted that the discrepancies in terms of orientation as it relates to happiness might produce some sort of individual disparity in grit. In other words, grit represents a medium-sized relationship in connection with engagement, “small-to-medium” correlation with a predilection towards substance, and “small-to-medium (inverse)” relationship with a mindset directed at pleasure. Based on this study, Suzuki et al. (2015) indicated that individuals with a sense of happiness when engaging in work activities were more likely to attain success. Concisely, Suzuki et al. (2015) revealed that employee grit exerts a significant and

positive influence on work engagement. Similarly, the study showed that when employees possess grit they are more likely to engage with their work totally compared to those without grit. Hence, it could be presumed that the grittier an employee, the potentially higher the influence, and subsequently, the work engagement.

As a result of the above-mentioned discussion, this study fairly assumes that an employee with a high level of grit will probably rate higher on the work engagement scale. The following hypothesis is therefore advanced:

H2: Grit is positively related to employees’ work engagement.

## Work engagement and employee creativity

Work engagement within an organization has remained imperative for the upward positive progress of an organization, agency, or company. It is also very essential when it comes to stimulating smooth working attitudes within an organization which could eventually influence organizational success. The study by Bakker et al. (2020) argued that employees who are diligently engaged with their respective work are very probable to show a high level of improvement in their creative performance in the workplace. Corroborating this assertion is the study of Asif et al. (2019) which posited that employees’ creativity, in an ethical leadership milieu is positively impacted in the workplace where employees are properly engaged with their work. This establishes the fact that there are empirical connections between the work engagement of employees and employees’ creativity. A positive link between the work engagement of school principals and their creativity has also been established (Bakker and Xanthopoulou, 2013). Based on the above arguments, we hypothesize that:

H3: Work engagement is positively related to employees’ creativity.

## The mediating role of work engagement

This study incorporates into the research framework the mediating role of employees’ work engagement in the relationship between employees’ grit and creativity in the workplace. Accordingly, we seek to extend the existing bodies of research on work engagement and creativity. Numerous studies explored the mediating role of employees’ work engagement in different contexts (Sulea et al., 2012; Yalabik et al., 2013; Gupta and Shaheen, 2017; Chaudhary and Akhouri, 2018; Coetzee and van Dyk, 2018). A conspicuous inference drawn from these studies pointed to the effectiveness of work engagement as a mediator



between constructs that are related to different organizational activities, practices, and settings. In the study of [Schaufeli and Bakker \(2004\)](#) the association between job resources and turnover intentions was found to be mediated by engagement. In another study by [Richardson et al. \(2006\)](#) work engagement was identified to partially mediate how individual features, JD-R (job demands-resources) affect organizational commitment and self-efficacy. In the same vein, work engagement fully mediates the association between job resources (variety, control, and feedback) and behaviors that are proactive ([Salanova and Schaufeli, 2008](#)). Some past studies also identified a positive relationship between employees' grit and work engagement ([Von Culin et al., 2014](#); [Suzuki et al., 2015](#); [Kim and Lee, 2022](#)). Similarly, other previous studies affirmed the link between work engagement and employees' creativity in the workplace ([Bakker and Xanthopoulou, 2013](#); [Asif et al., 2019](#); [Bakker et al., 2020](#)). Thus, we ask that apart from the foregrounded interplays, that is, between employees' grit and work engagement; work engagement, and employees' creativity, could there be any mediating influence that employees' engagement exerts in the entire relationship? The quest to answer this question triggers the idea of integrating work engagement as a mediator. This results in developing the hypothesis below:

*H4: Work engagement mediates the relationship between grit and employees' creativity.*

## The moderating role of person-organization fit and feedback-seeking

Person organization fit theory (POF) delineates the consistency or conformity that exists between the interests, values, aims, and objectives of the organization and those of the employees ([Amah and Ahiauzu, 2014](#)). In other words, "P-E" fit explains the alignment and congruence between the employees and their organization's critical mission, vision, values, or objectives ([Sarac et al., 2014](#)). According to the study by [Edwards \(2008\)](#), it was asserted that employees' attitude or behavior in the workplace is not only predicted by their personal features or the environment where the organization is situated but also by the relationship between these highlighted predictive factors. Past research established the fact that in a situation whereby there is a strong person-organization fit both the employees and organization tend to benefit significantly as well as achieve a productive uptick. Also, more commitment to organizational goals or objectives, increased satisfaction, and turnover diminishment are other noticeable benefits ([Tepeci and Bartlett, 2002](#)).

The associative relationship between employees' grit and employees' work engagement deserves to be explored further along the lines of moderating mechanisms like person-organization fit. An employee with high grit disposition tends to

work harder with determination toward work engagement within the organization. The results of the study by [Vogelsang \(2018\)](#) showed a significant relationship between person-organization fit, grit, and task performance. Task performance in this instance is a behavioral outcome similar to work engagement that every organization invariably aims to evaluate at one point or the other. This lends credence to the assertion that a good person-organization fit may stimulate employees into leveraging their grit characteristics to strengthen their desire, zeal, and energy for work. In other words, it is not improbable that an employee with strong grit features combined with a good person-organization fit will engage more effectively and efficiently with the work and vice versa. This notion leads to the next hypothesis which highlights person-organization fit as a moderating construct.

*H5: Person organization fit moderates the relationship between grit and work engagement.*

Many scholars defined the concept of feedback in different ways as it relates to different contexts. However, for this study, the definition of feedback within the context of organizations becomes appropriate. In this sense, [Ashford and Cummings \(1983\)](#) explained feedback as "a subset of information available to individuals in their work environment." Feedback is information that denotes how well individuals are meeting various goals. In the interpersonal realm, feedback involves information about how an individual's behaviors are perceived and evaluated by relevant others. Research focusing on feedback within an organization is rapidly becoming an important area of interest. This is because, gifted or talented employees are seen as "the most valuable asset and the key to organizational success" ([Whelan et al., 2010](#); [van der Rijt et al., 2012](#)). Feedback helps in stimulating employee learning and steady development that can engender viable performance in individuals ([Maurer et al., 2003](#); [Ericsson, 2009](#); [Linderbaum and Levy, 2010](#); [Salas et al., 2010](#)). Other scholars also found that feedback plays a vital role in organizational competitiveness ([Maurer, 2001](#)), organizational effectiveness, and other work outcomes ([Kluger and DeNisi, 1996](#)). Feedback enhances work performance ([Becker and Klimoski, 1989](#)), affects organizational commitment ([Norris-Watts and Levy, 2004](#)), job motivation ([Gagne and Deci, 2005](#)), and creativity ([Zhou, 1998](#)). Findings in the study of [Gabriel et al. \(2014\)](#) revealed that feedback is strongly and positively related to the dimensions of employee psychological empowerment such as; meaning, competence, and self-determination. In other words, the feedback environment fostered by supervisors can increase employee empowerment. In another study by [Anseel et al. \(2011\)](#), feedback type was found to be an important moderator between achievement goals and task performance. It is therefore against the backdrop of extant literature review that this study integrates the moderating role of feedback in the relationship between employee work engagement and employee creativity. It is believed that feedback can strengthen how well an employee engages with



work within a work organization. Similarly, past studies also identified feedback as highly significant in improving organizational performance, creativity, and innovation (De Stobbeleir et al., 2011). This study, therefore, comes up with the hypothesis below, situating feedback as a mediator:

*H6: Feedback moderates the relationship between work engagement and employees' creativity.*

## Materials and methods

### Participants and procedures

Participants were Master's and Ph.D. research assistants from top-notch universities in China and were engaged *via* WeChat. WeChat is the most extensive social media application in China. The research assistants meet the criteria of being knowledge workers because they are experienced, creative, and have high degrees of expertise in their field of specialization. Therefore, we believe that these participants are highly involved with creative engagement in their workplace.

A total of 450 respondents were expected to participate, however only 422 participated. From these, 21 were excluded during the screening stage due to incomplete information. The Kaiser-Meyer-Olkin Measure (KMO) approach was used to measure the 401 sample's adequacy or strength (Kaiser, 1974). The resulting value of 0.814 exceeded the criteria of >0.50, showing that the sample size is adequate for this study's estimations. The final sample of 401 consisted of 102 females (25.4%) and 299 males (74.6%). The majority of the participants were not more than age 29 (54.6%). Participants' work experience was between 1 and 5 years (54.1%) (Table 1).

TABLE 1 Sample demographics statistics, *N* = 401.

Variable	Category	Frequency	Percent
Gender	Male	299	74.6
	Female	102	25.4
Age	18–29 years	219	54.6
	30–39 years	124	30.9
	40–49 Years	39	9.7
	50 years and above	19	4.7
Work experience	≤ a year	46	11.5
	1–5 years	217	54.1
	6–10 years	78	19.5
	≥ 10 years	60	15.0
Education	Masters	203	50.6
	Ph.D.	198	49.4

## Measures

All scale items were validated English scales from extant literature and were translated from English into Chinese and then translated back into English to confirm their contextual meaning was maintained (Brislin, 1980). We used a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree) to measure each item.

### Grit

Participants completed the translated Chinese version of the short grit scale. The eight items on the short grit scale (Grit-S) developed by Duckworth and Quinn (2009) were used to assess participants' grit-passion and perseverance for a long-term goal. The Grit-S comprised two subscales: perseverance and consistency of interest. The Grit-S is a simplified version of the original grit scale (Grit-O; Duckworth et al., 2007). Four items assessed the consistency of interest (e.g., "I often set a goal but later choose to pursue a different one") and four items assessed the perseverance of effort (e.g., "I finish whatever I begin"). In this study, the Cronbach alpha for the scale was 0.786.

### Work engagement

We adopted the five scales from Utrecht Work Engagement Scale (UWES) from Schaufeli and Bakker (2004) to measure the extent to which employees are motivated to engage in their work. The five-scale was developed by Bledow et al. (2011). The affective shift model of work engagement assessed the three dimensions of work engagement—vigor, dedication, and absorption. Respondents were asked to indicate their agreement with items such as: (1) I feel strong and vigorous in my work; and (2) At my work, I feel bursting with energy. The Cronbach alpha for the scale was 0.958.

### Creativity

Creativity was assessed with four items which were adapted from the scale developed by Farmer et al. (2003). Respondents were asked to report their level of creativity by indicating their agreement with items such as: (1) I try new ideas or methods first; (2) and I seek new ideas and ways to solve problems. This scale was developed for the Chinese context to reveal the Chinese view of employee creativity. The internal consistency of the scale, measured with Cronbach's alpha coefficient, was 0.935.

### Performance feedback

To assess the quality of the self-initiated feedback from the supervisor and coworker, we used one of the scales of widely used

feedback environment scales from Steelman et al. (2004) that measures the feedback quality of the supervisor and coworker. The scale consists of 10 items, 5 items measured the self-initiated feedback quality from the supervisors, and 5 items measured the self-initiated feedback quality from the coworker. Thus, self-initiated feedback quality is associated with the informational value of the feedback message. It also describes the perceived consistency and usefulness of self-initiated feedback. These items focused on the quality of the feedback employees themselves have initiated from their supervisors and colleagues. Sample items are: (1) My supervisor provides me valuable feedback concerning the performance of my tasks; and (2) my coworkers' performance feedback is beneficial. The Cronbach's alpha for performance feedback was 0.953.

## Person-organization fit

We followed the definition of Kristof (1996). In her integrative review, she defined P-O fit as the compatibility between people and organizations that occurs when at least one entity offers what the other needs or shares similar essential characteristics, or both. Therefore, we evaluated P-O fit using three items from Cable and DeRue (2002). Cable and DeRue (2002) measured employees' perceptions of P-O fit as a core work value by which employees judge their P-O fit by being drawn to organizations that exhibit characteristics similar to their own, and organizations, in turn, tend to choose individuals who are most similar to the organization. This scale has been validated in organizational behavior research (Cable and DeRue, 2002; Edwards, 2008). Sample items include: (1) The things I value in life are extremely similar to things my university's values; and (2) My personal values align with my university's values and culture. The Cronbach's alpha for the scale was 0.784.

## Control variables

Age, gender, work experience, and education were chosen as control variables because they accurately reflect the respondents' compositional situation. For the inclusion of these controls, we followed the advice of previous researchers (Adewale and Mustapha, 2015; Allena-Ozoluna and Bazbauers, 2017). According to their hypothesis, the aforementioned controls will have a positive significant impact on human behavior.

## Data analysis

This section reports the data analytical strategy adopted to validate the proposed relationships of this study. The estimations were conducted using the Statistical Package for Social Sciences (SPSS) version 22 and Analysis of Moment Structures (AMOS) 24 software.

## Results

### Common method bias and multicollinearity analysis

To rule out the likelihood of a high degree of common method bias due to a cross-sectional design and data (Podsakoff et al., 2003), Harman's one-factor was conducted. Using the condition of no factor rotation, the cumulative percentage of 41.95% was below the recommended cut off point of less than 50% (Podsakoff et al., 2003). In addition, we estimated the level of collinearity between constructs using the variance inflation factor (VIF) approach (Kock and Lynn, 2012). The highest VIF value of 1.849 obtained (Table 2) was below the cutoff point of 10 recommended by (Khan et al., 2021).

### Reliability and validity analysis

Along with a similar prior cross-sectional design technique (Xiabao et al., 2022), we conducted an exploratory and confirmatory factor analysis (EFA and CFA) of grit, work engagement, feedback, person-organization fit, and employee creativity. Governed by the rule of thumb (Hair et al., 2010, 2017), composite reliability (CR) and Cronbach's alpha (CA) were used to calculate construct reliability for each of these constructs. Table 3 reports the indices of Cronbach's alpha (CA) and composite reliability (CR). The indices of these two types of reliability were greater than the minimum cutoff point of 0.70 for significance, indicating that all constructs/variables in this study's conceptual model were reliable.

Convergent validity (Table 3) was assessed using the values of average variance extracted (AVE) for all constructs. The AVE values were greater than the minimum cutoff point (0.5) for significance. This implied that there is adequate convergent validity for all constructs (Hair et al., 2010, Hair et al., 2017). The discriminant validity of constructs was confirmed using the square root of constructs AVEs. All AVE values (Table 2) were higher than the square of their correlation coefficients. This inferred that all constructs had discriminant validity (Fornell and Larcker, 1981).

### Descriptive statistics and correlations

The means, standard deviations, and correlations of variables/constructs were calculated using the Pearson correlation approach. The Pearson correlation approach estimated the degree of straight-line relationship or strength of the linear relationship between constructs based on a correlation magnitude of 1.00 or -1.00 (Pallant, 2016). Table 2 reports the results in full detail.

### Hypothesis testing

Prior to the estimation of the hypothesis, we evaluated the fit of data to the model using the structural equation modeling

TABLE 2 Descriptive statistics, mean, standard deviation, and correlations.

Variables	1	2	3	4	5	6	7	8	9
Gender	1								
Tenure	0.153**	1							
Education	0.460**	0.053	1						
Age	0.096	0.366**	0.149**	1					
Grit	−0.011	0.033	−0.112*	−0.051	<b>(0.822)</b>				
Person organization fit	−0.028	−0.069	0.096	0.102*	0.220**	<b>(0.847)</b>			
Work engagement	0.197**	0.058	0.217**	0.128*	0.069	0.374**	<b>(0.889)</b>		
Feedback	0.215**	0.025	0.254**	0.228**	0.120*	0.311**	0.638**	<b>(0.848)</b>	
Creativity	0.088	0.030	0.199**	0.106*	0.087	0.286**	0.655**	0.621**	<b>(0.843)</b>
Mean	1.25	2.38	1.97	1.65	37.59	14.27	27.76	49.54	20.13
SD	0.436	0.875	0.717	0.842	4.551	2.803	4.975	7.313	4.457
VIF	1.342	1.214	1.362	1.259	1.102	1.275	1.836	1.849	
CMB = 41.95%									

*N* = 401; \*\**p* < 0.01 level (2-tailed); \**p* < 0.05 level (2-tailed). Square roots of AVEs are bracketed and bolded (constructs discriminant validity). SD, standard deviation; VIF, variance inflation factor; CMB, common method bias.

technique. As shown in Table 4, the results of RMSEA, GFI, CFI, NFI, IFI, and TLI values exceeded the required values of 0.90 while chi-square statistics were less than the given cutoff point of 5.0 (Hoe, 2008). Thus, we had an acceptable fit.

As illustrated in Table 5, Hypothesis 1, which states that employees' grit has a significant positive relationship with employees' creativity at the workplace was tested. We found a significant positive correlation for this relationship ( $\beta = 0.093$ ,  $p < 0.05$ ). This means that Hypothesis 1 was valid. Hypothesis 2 was also valid with  $\beta = 0.115$ ,  $p < 0.001$ . This infers that employees' grit has a significant positive relationship with employees' work engagement at the workplace. Hypothesis 3 which claimed that employees' work engagement has a significant positive relationship with employees' creativity at the workplace was supported with a positive significant value of  $\beta = 0.649$ ,  $p < 0.05$ . Employee work engagement was confirmed to mediate the relationship between employees' grit and employees' creativity ( $\beta = 0.781$ ,  $p < 0.05$ ). This validated Hypothesis 4. The final estimation validated the moderating effect of person-organization fit ( $\beta = 0.555$ ,  $p < 0.05$ ) and feedback ( $\beta = 0.639$ ,  $p < 0.05$ ). As a result, person-organization fit positively moderates the relationship between employees' grit and employees' work engagement (Hypothesis 5). In addition, feedback positively moderates the relationship between employees' work engagement and employees' creativity (Hypothesis 6). Table 5 reports the results of the path analysis.

Furthermore, the mediating effect of work engagement in the relationship between grit and creativity was further tested following step-by-step instructions recommended by Zhao et al. (2010). Zhao et al. (2010)'s method eliminates the necessity for an initial test of the significance of the X–Y variables. Accordingly, to assess the mediating effect, the estimation of the effects of  $a = X$  (independent variable) on  $M$  (mediator variable) and  $b = M$  on the  $Y$  (dependent variable) is the only requirement. Table 6

summarizes the significant results of the mediation test for Hypothesis 4.

## Discussion and conclusion

This study examined the relationship between grit and employee creativity through the mediating role of employee engagement and the moderating role of person-organization fit and feedback. A research model was also proposed to provide insights into the relationship between the variables mentioned earlier in this study (grit, feedback, person-organization fit, creativity). This research focus was triggered by prior emphases on grit and other organization outcome variables (Jordan et al., 2019a; Kim and Lee, 2022) and the limited research on the role of grit in performance (i.e., grit and employee creativity; Crede, 2018). The study confirmed that grit is associated with creativity as well as grit positive relationship with work engagement.

In general, the results support the proposed research model (Figure 1), which shows employee engagement as a positive mediator in the interplay between grit and employee creativity. The result of the mediating role of employee engagement further reaffirms its mediating role in different contexts (Salanova and Schaufeli, 2008; Sulea et al., 2012; Yalabik et al., 2013; Gupta and Shaheen, 2017; Chaudhary and Akhouri, 2018; Coetzee and van Dyk, 2018). In addition, the mediating role which employee engagement plays in the relationship between grit and employee creativity provides a more comprehensive approach to examining grit and employee creativity within an organization. Furthermore, positive relationships between grit, employee engagement, and employee creativity were also established in the results. We also found how two moderators (i.e., POF and Feedback) can strengthen the grit relationship with work engagement while

TABLE 3 Constructs measurement scale and properties.

Constructs	Items	Factor loadings	CA	CR	AVE
Feedback	FQ1	0.792	0.950	0.954	0.720
	FQ2	0.857			
	FQ3	0.877			
	FQ4	0.897			
	FQ6	0.891			
	FQ7	0.905			
	FQ8	0.751			
	FQ9	0.806			
Work engagement	WE1	0.933	0.957	0.950	0.792
	WE2	0.977			
	WE3	0.879			
	WE4	0.832			
	WE5	0.818			
Creativity	EC1	0.903	0.933	0.908	0.712
	EC2	0.929			
	EC3	0.800			
	EC4	0.729			
Person organization fit	POF1	0.796	0.825	0.884	0.718
	POF2	0.831			
	POF3	0.911			
Grit	SGS1	0.730	0.720	0.926	0.677
	SGS2	0.867			
	SGS4	0.803			
	SGS5	0.702			
	SGS7	0.919			
	SGS8	0.891			

TABLE 4 Model fit indexes.

Categories	Fit Indexes	Measurement	Values
Parsimonious fit	$\chi^2/df$	<5.00	2.609
Absolute fit	RMSEA	>0.08	0.091
	GFI	>0.90	0.903
Incremental fit	CFI	>0.90	0.952
	NFI	>0.90	0.943
	IFI	>0.90	0.925
	TLI	>0.95	0.935

RMSEA, Root Mean Square of Error Approximation; GFI, Good of Fit Index; CFI, Comparative Fit Index; NFI, Normed Fit Index;  $\chi^2/df$ , Chi-square/Degree of Freedom; IFI, Incremental Fit Index; TLI, Tucker-Lewis Index.

feedback strengthens the relationship between work engagement and employee creativity. The results also show that

TABLE 5 Summary of path analysis/hypotheses results

Hypothesis	Path	Coefficient ( $\beta$ )	Interpretation
H1	G->>C	0.093**	Supported
H2	G->>WE	0.115***	Supported
H3	WE->>C	0.649***	Supported
H4	G->>WE->>C	0.781**	Supported
H5	POF, G->>WE	0.555***	Supported
H6	F,WE->>C	0.639**	Supported

G, grit; C, creativity; WE, work engagement; POF, Person organization fit; F, feedback.

TABLE 6 Mediation analysis.

Path	Estimate	95% confidence interval		Result
		Lower level	Upper level	
G → WE → C	0.0320	0.0205	0.0708	Supported

G, grit; WE, work engagement; C, creativity.

person-organization fit significantly moderates the relationship between grit and work engagement, while feedback also moderates the relationship between work engagement and employee creativity. These results also reaffirm the important role that person-organization fit (Tepeci and Bartlett, 2002) and feedback (Maurer et al., 2003; Ericsson, 2009; Linderbaum and Levy, 2010; Salas et al., 2010) play within an organization. In other words, grit becomes effective in influencing employee work engagement when the person-organization fit is high. In addition, just like the indispensable moderating role of person-organization fit, feedback also plays a significant moderating role. The moderation analysis shows that work engagement is associated employee creativity when feedback is high. This study has several implications in facilitating gritty employees to remain engaged in organizational activities and request feedback on their job. This study revealed that the appropriateness of an individual work environment is most likely for a gritty person to become highly engaged with creative work activities. POF will strongly interact with grit, work engagement, and creativity especially when the organization correlates with one's personality and the appropriate feedback is received, the organization is expected to show a strong relationship between grit and employee creativity (Figure 2).

Precisely, grit will affect creativity *via* the mediating effect of work engagement. It contributes to the literature by proposing the effect of personality variables in the workplace and situational mechanisms, addressing organizational performance results. Second, this study focused on the impact of grit on creativity, which has not been discussed much by previous researchers. Third, we add to the literature on organizational behavior by showing that grit, work engagement, person-organization fit, and feedback are all determinants of employee creativity.

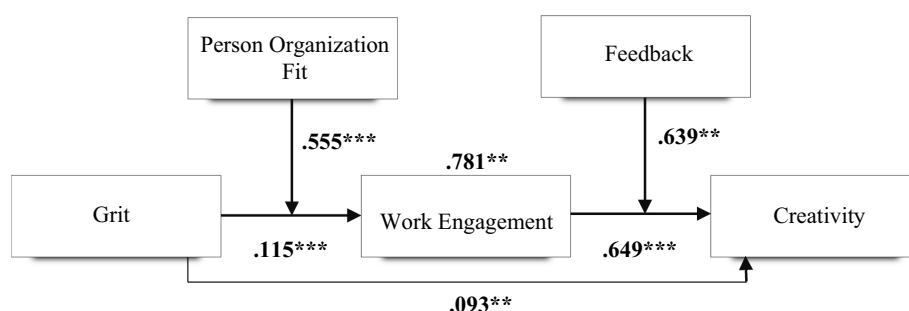


FIGURE 2  
Structural model with estimates.

## Theoretical and empirical contributions

This study contributes to TAT (Tett and Burnett, 2003) in two ways. First, we accentuate grit, work engagement, person-organization fit, and feedback as important determinants of employee creativity. Accordingly, this study extends the inadequate research on the effect of TAT's emphasis on individuals' traits in the workplace (Tandler et al., 2020). Specifically, we identify grit as a vital trait that influences workplace factors such as work engagement, person-organization fit, feedback, and creativity. To the best of our knowledge, no existing study has assessed the effects of these determinants of employee creativity in a work setting.

Second, our examination of the mediating and moderating effects of person-organization fit and feedback advances the TAT by providing a new understanding of the mechanisms *via* which an employee's grit influences his or her creativity. In general, extant studies provided insight into individuals' traits in the workplace (Duckworth and Gross, 2014; Tandler et al., 2020), yet there are no insights regarding grit and the mechanisms *via* which it contributes to employee creativity.

From the empirical standpoint, the roles of these determinants of employee creativity have received no attention in China, particularly how researchers' grit influences their creativity. Consequently, our empirical findings provide Chinese universities with a strategic posture to increase the outcomes of researchers. Empirically, we provide evidence that can be replicated in other contexts.

## Limitations and suggestions for future research

A few limitations were identified in this study despite the many significant findings generated. The first limitation has to do with the study's sample. The sample consisted of research assistants studying at top-notch Universities in China. This group of people cannot represent the totality of professional workers because they are only selected according to their educational level, and they cannot be compared with professional workers from other organizations. Despite these limitations, the study is the first to examine the

interplay between grit, person-organization fit, work engagement, feedback, and employee creativity. This study adds to the evidence for the direct effects of grit and work engagement on employee creativity. In furtherance of this, it would be suggested that future research should consider widening the scope of the sample to cover professional workers from different organizations especially those who are not studying but are full-time workers. This will help in generalizing the research findings.

Another limitation of this study is the use of a cross-sectional research method and data, which prevents significant causal inferences or prediction of the hypothesized correlations. Although, this is a shortcoming of single response cross-sectional research (Huang, 2016), future studies can adopt other approaches such as an experimental or a longitudinal research design to examine the causal relationships between grit, employee engagement, employee creativity, person-organization fit, and feedback. Subsequent studies should also integrate more mediating and moderating variables in studying the relationship between grit and employee creativity in organizations.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by [www.wjx.cn](http://www.wjx.cn). The ethics committee waived the requirement of written informed consent for participation.

## Author contributions

MG handled the conceptualization of the study. All sections except the methodology were jointly written by MG and SD. SD handled the data collection. TA conducted the data analysis and wrote the methodology. MG proofread the paper. All



authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

- Adelson, B. (2003). Issues in scientific creativity: insight, perseverance and personal technique - profiles of the 2002 Franklin Institute laureates. *J. Franklin Inst. Eng. Appl. Math.* 340, 163–189. doi: 10.1016/s0016-0032(03)00037-1
- Adewale, O. O., and Mustapha, U. (2015). The impact of gas flaring in Nigeria. *Int. J. Sci. Technol. Soc.* 3, 40–50. doi: 10.11648/j.ijsts.20150302.12
- Allena-Ozoluna, S., and Bazbauers, G. (2017). System dynamics model of research, innovation and education system for efficient use of bio-resources. *Energy Procedia* 128, 350–357. doi: 10.1016/j.egypro.2017.09.051
- Amabile, T. M. (1998). A Model of Creativity and Innovation in Organizations. *Research in Organizational Behavior*. 10, 154.
- Amabile, T. M., and Pillemer, J. (2012). Perspectives on the social psychology of creativity. *J. Creat. Behav.* 46, 3–15. doi: 10.1002/jobc.001
- Amah, E., and Ahiauzu, A. (2014). Shared values and organizational effectiveness: a study of the Nigerian banking industry. *J. Manag. Dev.* 33, 694–708. doi: 10.1108/JMD-09-2010-0065
- Anseel, F., Van Yperen, N. W., Janssen, O., and Duyck, W. (2011). Feedback type as a moderator of the relationship between achievement goals and feedback reactions. *J. Occup. Organ. Psychol.* 84, 703–722. doi: 10.1348/096317910x516372
- Ashford, S. J., and Cummings, L. L. (1983). Feedback as an individual resource: personal strategies of creating information. *Organ. Behav. Hum. Perform.* 32, 370–398. doi: 10.1016/0030-5073(83)90156-3
- Asif, M., Qing, M., Hwang, J., and Shi, H. (2019). Ethical leadership, affective commitment, work engagement, and creativity: testing a multiple mediation approach. *Sustainability* 11:4489. doi: 10.3390/su11164489
- Baer, M. (2010). The strength-of-weak-ties perspective on creativity: a comprehensive examination and extension. *J. Appl. Psychol.* 95, 592–601. doi: 10.1037/a0018761
- Bakker, A. B., and Leiter, M. P. (2010). “Where to go from here: Integration and future research on work engagement” in *Work Engagement: A Handbook of Essential Theory and Research* (New York, NY, USA: Psychology Press).
- Bakker, A. B., Petrou, P., Op Den Kamp, E. M., and Tims, M. (2020). Proactive vitality management, work engagement, and creativity: the role of goal orientation. *Appl. Psychol.* 69, 351–378. doi: 10.1111/apps.12173
- Bakker, A. B., and Xanthopoulou, D. (2013). Creativity and charisma among female leaders: the role of resources and work engagement. *Int. J. Hum. Resour. Manag.* 24, 2760–2779. doi: 10.1080/09585192.2012.751438
- Becker, T. E., and Klimoski, R. J. (1989). A field study of the relationship between the organizational feedback environment and performance. *Pers. Psychol.* 42, 343–358. doi: 10.1111/j.1744-6570.1989.tb00662.x
- Bernardy, V., and Antoni, C. H. (2021). With grit to innovative teams? A theoretical model to examine team grit as a team innovation competence. *Gruppe. Interaktion. Organ.* 52, 65–78. doi: 10.1007/s11612-021-00555-z
- Bledow, R., Schmitt, A., Frese, M., and Kuehnle, J. (2011). The affective shift model of work engagement. *J. Appl. Psychol.* 96, 1246–1257. doi: 10.1037/a0024532
- Brislin, R. W. (1980). “Translation and content analysis of oral and written materials” in *Handbook of Cross-Cultural Psychology*. eds. H. C. Triandis and W. W. Lambert (Boston: Allyn & Bacon), 349–444.
- Cable, D. M., and Derue, D. S. (2002). The convergent and discriminant validity of subjective fit perceptions. *J. Appl. Psychol.* 87, 875–884. doi: 10.1037/0021-9010.87.875
- Chandrawaty, C., and Widodo, W. (2020). An empirical effect of grit on task performance: mediating by transformational leadership and job involvement. *J. Xian Univ. Arch. Technol.*, 2461–2470. doi: 10.37896/jxat12.04/977
- Chaudhary, R., and Akhouri, A. (2018). Linking corporate social responsibility attributions and creativity: modeling work engagement as a mediator. *J. Clean. Prod.* 190, 809–821. doi: 10.1016/j.jclepro.2018.04.187
- Coetzee, M., and Van Dyk, J. (2018). Workplace bullying and turnover intention: exploring work engagement as a potential mediator. *Psychol. Rep.* 121, 375–392. doi: 10.1177/0033294117725073
- Crede, M. (2018). What shall we do about grit? A critical review of what we know and what we don't know. *Educ. Res.* 47, 606–611. doi: 10.3102/0013189x18801322
- Csikszentmihalyi, M. (1988). Motivation and creativity: toward a synthesis of structural and energetic approaches to cognition. *New Ideas Psychol.* 6, 159–176. doi: 10.1016/0732-118X(88)90001-3
- Csikszentmihalyi, M. (1996). *Creativity*. New York: Harper Collins.
- Day, D. V., and Silverman, S. B. (1989). Personality and job performance: evidence of incremental validity. *Pers. Psychol.* 42, 25–36. doi: 10.1111/j.1744-6570.1989.tb01549.x
- De Stobbeleir, K. E. M., Ashford, S. J., and Buyens, D. (2011). Self-regulation of creativity at work: the role of feedback-seeking behavior in creative performance. *Acad. Manag. J.* 54, 811–831. doi: 10.5465/amj.2011.64870144
- Demerouti, E., Bakker, A. B., Nachreiner, F., and Schaufeli, W. B. (2001). The job demands-resources model of burnout. *J. Appl. Psychol.* 86, 499–512. doi: 10.1037/0021-9010.86.3.499
- Duckworth, A., and Gross, J. J. (2014). Self-control and grit: related but separable determinants of success. *Curr. Dir. Psychol. Sci.* 23, 319–325. doi: 10.1177/0963721414541462
- Duckworth, A. L., Peterson, C., Matthews, M. D., and Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *J. Pers. Soc. Psychol.* 92, 1087–1101. doi: 10.1037/0022-3514.92.6.1087
- Duckworth, A. L., and Quinn, P. D. (2009). Development and validation of the short grit scale (grit-S). *J. Pers. Assess.* 91, 166–174. doi: 10.1080/00223890802634290
- Dugan, R., Hochstein, B., Rouziou, M., and Britton, B. (2019). Gritting their teeth to close the sale: the positive effect of salesperson grit on job satisfaction and performance. *J. Pers. Sell. Sales Manag.* 39, 81–101. doi: 10.1080/08853134.2018.1489726
- Edwards, J. R. (2008). Person-environment fit in organizations: an assessment of theoretical Progress. *Acad. Manag. Ann.* 2, 167–230. doi: 10.1080/19416520802211503
- Ericsson, K. A. (2009). *Development of Professional Expertise: Toward Measurement of Expert Performance and Design of Optimal Learning Environments*. New York, NY, USA: Cambridge University Press.
- Eskreis-Winkler, L., Shulman, E. P., Beal, S. A., and Duckworth, A. L. (2014). The grit effect: predicting retention in the military, the workplace, school and marriage. *Front. Psychol.* 5:36. doi: 10.3389/fpsyg.2014.00036
- Farmer, S. M., Tierney, P., and Kung-Mcintyre, K. (2003). Employee creativity in Taiwan: an application of role identity theory. *Acad. Manag. J.* 46, 618–630. doi: 10.2307/30040653
- Fisher, C. M., and Amabile, T. M. (2008). Creativity, Improvisation, and Organizations. Routledge, 13–25.
- Fornell, C., and Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: algebra and statistics. *J. Mark. Res.* 18, 382–388. doi: 10.2307/3150980
- Gabriel, A. S., Moran, C. M., and Gregory, J. B. (2014). How can humanistic coaching affect employee well-being and performance? An application of self-determination theory. *Coach. Int. J. Theory Res. Pract.* 7, 56–73. doi: 10.1080/17521882.2014.889184
- Gagne, M., and Deci, E. L. (2005). Self-determination theory and work motivation. *J. Organ. Behav.* 26, 331–362. doi: 10.1002/job.322
- Gong, Y., Huang, J.-C., and Farh, J.-L. (2009). Employee learning orientation, transformational leadership, and employee creativity: the mediating role of

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- employee creative self-efficacy. *Acad. Manag. J.* 52, 765–778. doi: 10.5465/amj.2009.43670890
- Gu, Q., Tang, T. L.-P., and Jiang, W. (2015). Does moral leadership enhance employee creativity? Employee identification with leader and leader-member exchange (LMX) in the Chinese context. *J. Bus. Ethics* 126, 513–529. doi: 10.1007/s10551-013-1967-9
- Gupta, M., and Shaheen, M. J. J. P. U. J. O. M. (2017). The relationship between psychological capital and turnover intention: work engagement as mediator and work experience as moderator. *Jurnal Pengurusan* 49, 117–126. doi: 10.17576/pengurusan-2017-49-10
- Hair, J. F., Babin, B. J., and Krey, N. (2017). Covariance-based structural equation modeling in the journal of advertising: review and recommendations. *J. Advert.* 46, 163–177. doi: 10.1080/00913367.2017.1281777
- Hair, J. F., William, C. B., Barry, J. B., and Rolph, E. A. (2010). *Multivariate Data Analysis* Harlow, Essex, England: Pearson Education.
- Harding, T. (2010). Fostering creativity for leadership and leading change. *Arts Educ. Policy Rev.* 111, 51–53. doi: 10.1080/10632910903455827
- Hartmann, N. N., and Rutherford, B. N. (2015). Psychological contract breach's antecedents and outcomes in salespeople: the roles of psychological climate, job attitudes, and turnover intention. *Ind. Mark. Manag.* 51, 158–170. doi: 10.1016/j.indmarman.2015.07.017
- Helson, R., Roberts, B., and Agronick, G. (1995). Enduringness and change in creative personality and the prediction of occupational creativity. *J. Pers. Soc. Psychol.* 69, 1173–1183. doi: 10.1037/0022-3514.69.6.1173
- Hoe, S. L. (2008). Issues and procedures in adopting structural equation modeling technique. *J. Appl. Quant. Methods* 3, 76–83.
- Huang, H.-Y. (2016). Examining the beneficial effects of individual's self-disclosure on the social network site. *Comput. Hum. Behav.* 57, 122–132. doi: 10.1016/j.chb.2015.12.030
- Jordan, S. L., Ferris, G. R., Hochwarter, W. A., and Wright, T. A. (2019a). Toward a work motivation conceptualization of grit in organizations. *Group Org. Manag.* 44, 320–360. doi: 10.1177/1059601119834093
- Jordan, S. L., Wihler, A., Hochwarter, W. A., and Ferris, G. R. (2019b). “The roles of grit in human resources theory and research” in *Research in Personnel and Human Resources Management*. Vol. 37. eds. M. R. Buckley, A. R. Wheeler, J. E. Baur and J. R. B. Halbesleben (Bingley: Emerald Publishing Limited)
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika* 39, 31–36. doi: 10.1007/BF02291575
- Khan, S. H., Majid, A., Yasir, M., and Javed, A. (2021). Social capital and business model innovation in SMEs: do organizational learning capabilities and entrepreneurial orientation really matter? *Eur. J. Innov. Manag.* 24, 191–212. doi: 10.1108/ejim-04-2020-0143
- Kim, M. Y., and Lee, H. J. (2022). Does grit matter to Employees' quality of work life and quality of life? The case of the Korean public sector. *Public Pers. Manage.* 51, 97–124. doi: 10.1177/00910260211012713
- Kluger, A. N., and Denisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychol. Bull.* 119, 254–284. doi: 10.1037/0033-2909.119.2.254
- Kock, N., and Lynn, G. S. (2012). Lateral collinearity and misleading results in variance-based SEM: an illustration and recommendations. *J. Assoc. Inf. Syst.* 13, 546–580. doi: 10.17705/1jais.00302
- Kristof, A. L. (1996). Person-organization fit: an integrative review of its conceptualizations, measurement, and implications. *Pers. Psychol.* 49, 1–49. doi: 10.1111/j.1744-6570.1996.tb01790.x
- Li, H., Jin, H., and Chen, T. (2020). Linking proactive personality to creative performance: the role of job crafting and high-involvement work systems. *J. Creat. Behav.* 54, 196–210. doi: 10.1002/jocb.355
- Linderbaum, B. A., and Levy, P. E. (2010). The development and validation of the feedback orientation scale (FOS). *J. Manag.* 36, 1372–1405. doi: 10.1177/0149206310373145
- Liu, D., Chen, X.-P., and Yao, X. (2011). From autonomy to creativity: a multilevel investigation of the mediating role of harmonious passion. *J. Appl. Psychol.* 96, 294–309. doi: 10.1037/a0021294
- Liu, D., Liao, H., and Loi, R. (2012). The dark side of leadership: a three-level investigation of the cascading effect of abusive supervision on employee creativity. *Acad. Manag. J.* 55, 1187–1212. doi: 10.5465/amj.2010.0400
- Luria, G., Kahana, A., Goldenberg, J., and Noam, Y. (2019). Contextual moderators for leadership potential based on trait activation theory. *J. Organ. Behav.* 40, 899–911. doi: 10.1002/job.2373
- Macey, W. H., and Schneider, B. (2008). The meaning of employee engagement. *Ind. Organ. Psychol. Perspect. Sci. Pract.* 1, 3–30. doi: 10.1111/j.1754-9434.2007.0002.x
- Maddi, S. R., Matthews, M. D., Kelly, D. R., Villarreal, B., and White, M. (2012). The role of hardiness and grit in predicting performance and retention of USMA cadets. *Mil. Psychol.* 24, 19–28. doi: 10.1080/0895605.2012.639672
- Maurer, T. J. (2001). Career-relevant learning and development, worker age, and beliefs about self-efficacy for development. *J. Manag.* 27, 123–140. doi: 10.1016/s0149-2063(00)00092-1
- Maurer, T. J., Weiss, E. M., and Barbeite, F. G. (2003). A model of involvement in work-related learning and development activity: the effects of individual, situational, motivational, and age variables. *J. Appl. Psychol.* 88, 707–724. doi: 10.1037/0021-9010.88.4.707
- May, D. R., Gilson, R. L., and Harter, L. M. (2004). The psychological conditions of meaningfulness, safety and availability and the engagement of the human spirit at work. *J. Occup. Organ. Psychol.* 77, 11–37. doi: 10.1348/096317904322915892
- Mubarak, F., and Noor, A. (2018). Effect of authentic leadership on employee creativity in project-based organizations with the mediating roles of work engagement and psychological empowerment. *Cogent Bus. Manage.* 5, 1–14. doi: 10.1080/23311975.2018.1429348
- Mueller, J. S., and Kamdar, D. (2011). Why seeking help from teammates is a blessing and a curse: a theory of help seeking and individual creativity in team contexts. *J. Appl. Psychol.* 96, 263–276. doi: 10.1037/a0021574
- Mueller, B. A., Wolfe, M. T., and Syed, I. (2017). Passion and grit: an exploration of the pathways leading to venture success. *J. Bus. Ventur.* 32, 260–279. doi: 10.1016/j.jbusvent.2017.02.001
- Nisar, A., Butt, T. H., Abid, G., Farooqi, S., and Qazi, T. F. (2020). Impact of grit on voice behavior: mediating role of organizational commitment. *Future Bus. J.* 6, 1–14. doi: 10.1186/s43093-020-00028-7
- Norris-Watts, C., and Levy, P. E. (2004). The mediating role of affective commitment in the relation of the feedback environment to work outcomes. *J. Vocat. Behav.* 65, 351–365. doi: 10.1016/j.jvb.2003.08.003
- Ouakouak, M. L., and Ouedraogo, N. (2017). Antecedents of employee creativity and organisational innovation: an empirical study. *Int. J. Innov. Manag.* 21:1750060. doi: 10.1142/s1363919617500608
- Pallant, J. (2016). *SPSS Survival Manual. A Step by Step Guide to Data Analysis Using IBM SPSS McGraw Hill Education*. 6th Edn. London, UK: Taylor & Francis Group.
- Phares, E. J., and Chaplin, W. F. (1997). *Introduction to Personality* New York: Longman, 4th Edn.
- Podsakoff, P. M., Mackenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Rich, B. L., Lepine, J. A., and Crawford, E. R. (2010). Job engagement: antecedents and effects on job performance. *Acad. Manag. J.* 53, 617–635. doi: 10.5465/amj.2010.51468988
- Richardsen, A. M., Burke, R. J., and Martinussen, M. (2006). Work and health outcomes among police officers: the mediating role of police cynicism and engagement. *Int. J. Stress. Manag.* 13, 555–574. doi: 10.1037/1072-5245.13.4.555
- Runco, M. A., Nemiro, J. E., and Walberg, H. (1998). Personal explicit theories of creativity. *J. Creat. Behav.* 32, 1–17.
- Salanova, M., and Schaufeli, W. B. (2008). A cross-national study of work engagement as a mediator between job resources and proactive behaviour. *Int. J. Hum. Resour. Manag.* 19, 116–131. doi: 10.1080/09585190701763982
- Salas, E., Rosen, M. A., and Diazgranados, D. (2010). Expertise-based intuition and decision making in organizations. *J. Manag.* 36, 941–973. doi: 10.1177/0149206309350084
- Salles, A., Cohen, G. L., and Mueller, C. M. (2014). The relationship between grit and resident well-being. *Am. J. Surg.* 207, 251–254. doi: 10.1016/j.amjsurg.2013.09.006
- Sarac, M., Efil, I., and Eryilmaz, M. (2014). A study of the relationship between person-organization fit and employee creativity. *Manag. Res. Rev.* 37, 479–501. doi: 10.1108/mrr-01-2013-0025
- Scharp, Y. S., Breevaart, K., Bakker, A. B., and Van Der Linden, D. (2019). Daily playful work design: a trait activation perspective. *J. Res. Pers.* 82:103850. doi: 10.1016/j.jrp.2019.103850
- Schaufeli, W. B., and Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *J. Organ. Behav.* 25, 293–315. doi: 10.1002/job.248
- Schimschal, S. E., Visentin, D., Kornhaber, R., and Cleary, M. (2021). Grit: a concept analysis. *Issues Ment. Health Nurs.* 42, 495–505. doi: 10.1080/01612840.2020.1814913
- Shalley, C. E. (1991). Effects of productivity goals, creativity goals, and personal discretion on individual creativity. *J. Appl. Psychol.* 76, 179–185. doi: 10.1037/0021-9010.76.2.179

- Shalley, C. E., Gilson, L. L., and Blum, T. C. (2000). Matching creativity requirements and the work environment: effects on satisfaction and intentions to leave. *Acad. Manag. J.* 43, 215–223. doi: 10.2307/1556378
- Shalley, C. E., Gilson, L. L., and Blum, T. C. (2009). Interactive effects of growth need strength, work context, and job complexity on self-reported creative performance. *Acad. Manag. J.* 52, 489–505. doi: 10.5465/amj.2009.41330806
- Shalley, C. E., Zhou, J., and Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: where should we go from here? *J. Manag.* 30, 933–958. doi: 10.1016/j.jm.2004.06.007
- Steelman, L. A., Levy, P. E., and Snell, A. F. (2004). The feedback environment scale: construct definition, measurement, and validation. *Educ. Psychol. Meas.* 64, 165–184. doi: 10.1177/0013164403258440
- Sulea, C., Virga, D., Maricutoiu, L. P., Schaufeli, W., Dumitru, C. Z., and Sava, F. A. (2012). Work engagement as mediator between job characteristics and positive and negative extra-role behaviors. *Career Dev. Int.* 17, 188–207. doi: 10.1108/13620431211241054
- Suzuki, Y., Tamesue, D., Asahi, K., and Ishikawa, Y. (2015). Grit and work engagement: a cross-sectional study. *PLoS One* 10:e0137501. doi: 10.1371/journal.pone.0137501
- Tandler, N., Krauss, A., and Proyer, R. T. (2020). Authentic happiness at work: self- and peer-rated orientations to happiness, work satisfaction, and stress coping. *Front. Psychol.* 11:1931. doi: 10.3389/fpsyg.2020.01931
- Tepeci, M., and Bartlett, A. L. B. (2002). The hospitality industry culture profile: a measure of individual values, organizational culture, and person–organization fit as predictors of job satisfaction and behavioral intentions. *Int. J. Hosp. Manag.* 21, 151–170. doi: 10.1016/S0278-4319(01)00035-4
- Tett, R. P., and Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *J. Appl. Psychol.* 88, 500–517. doi: 10.1037/0021-9010.88.3.500
- Tett, R. P., and Guterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: testing a principle of trait activation. *J. Res. Pers.* 34, 397–423. doi: 10.1006/jrpe.2000.2292
- Tett, R. P., Toich, M. J., and Ozkum, S. B. (2021). Trait activation theory: a review of the literature and applications to five lines of personality dynamics research. *Annu. Rev. Organ. Psych. Organ. Behav.* 8, 199–233. doi: 10.1146/annurev-orgpsych-012420-062228
- Tian, W., Wang, H., and Rispens, S. (2021). How and when job crafting relates to employee creativity: the important roles of work engagement and perceived work group status diversity. *Int. J. Environ. Res. Public Health* 18:291. doi: 10.3390/ijerph18010291
- Tims, M., and Parker, S. K. (2020). How coworkers attribute, react to, and shape job crafting. *Organ. Psychol. Rev.* 10, 29–54. doi: 10.1177/2041386619896087
- Unsworth, K. (2001). Unpacking creativity. *Acad. Manag. Rev.* 26, 289–297. doi: 10.2307/259123
- Vallerand, R. J., Salvy, S.-J., Mageau, G. A., Elliot, A. J., Denis, P. L., Grouzet, F. M. E., et al. (2007). On the role of passion in performance. *J. Pers.* 75, 505–534. doi: 10.1111/j.1467-6494.2007.00447.x
- Van Der Rijt, J., Van De Wiel, M. W. J., Van Den Bossche, P., Segers, M. S. R., and Gijssels, W. H. (2012). Contextual antecedents of informal feedback in the workplace. *Hum. Resour. Dev. Q.* 23, 233–257. doi: 10.1002/hrdq.21129
- Vogelsang, K. (2018) *The Relationship Between Person-Environment Fit, Grit, and Task Performance: A Mediation Analysis*. University of Twente.
- Von Culin, K. R., Tsukayama, E., and Duckworth, A. L. (2014). Unpacking grit: motivational correlates of perseverance and passion for long-term goals. *J. Posit. Psychol.* 9, 306–312. doi: 10.1080/17439760.2014.898320
- Whelan, E., Collings, D. G., and Donnellan, B. (2010). Managing talent in knowledge-intensive settings. *J. Knowl. Manag.* 14, 486–504. doi: 10.1108/13673271011050175
- Wilson, R. N. (1990). *The American Poet: A Role Investigation*. New York, NY, USA: Garland Publishing (Harvard Studies in Sociology).
- Woodman, R. W., Sawyer, J. E., and Griffin, R. W. (1993). Toward a theory of organizational creativity. *Acad. Manag. Rev.* 18, 293–321. doi: 10.5465/amr.1993.3997517
- Xiabao, P., Horsey, E. M., Song, X., and Guo, R. (2022). Developing social entrepreneurship orientation: the impact of internal work locus of control and bricolage. *Front. Psychol.* 13:877317. doi: 10.3389/fpsyg.2022.877317
- Yalabik, Z. Y., Popaitoon, P., Chowne, J. A., and Rayton, B. A. (2013). Work engagement as a mediator between employee attitudes and outcomes. *Int. J. Hum. Resour. Manag.* 24, 2799–2823. doi: 10.1080/09585192.2013.763844
- Yoshida, D. T., Sendjaya, S., Hirst, G., and Cooper, B. (2014). Does servant leadership foster creativity and innovation? A multi-level mediation study of identification and prototypicality. *J. Bus. Res.* 67, 1395–1404. doi: 10.1016/j.jbusres.2013.08.013
- Zhang, X., and Bartol, K. M. (2010). Linking empowering leadership and employee creativity: the influence of psychological empowerment, intrinsic motivation, and creative process engagement. *Acad. Manag. J.* 53, 107–128. doi: 10.5465/amj.2010.48037118
- Zhang, A. Y., Tsui, A. S., and Wang, D. X. (2011). Leadership behaviors and group creativity in Chinese organizations: the role of group processes. *Leadersh. Q.* 22, 851–862. doi: 10.1016/j.leaqua.2011.07.007
- Zhao, X., Lynch, J. G., and Chen, Q. (2010). Reconsidering baron and Kenny: myths and truths about mediation analysis. *J. Consum. Res.* 37, 197–206. doi: 10.1086/651257
- Zhou, J. (1998). Feedback valence, feedback style, task autonomy, and achievement orientation: interactive effects on creative performance. *J. Appl. Psychol.* 83, 261–276. doi: 10.1037/0021-9010.83.2.261
- Zhou, J., and Shalley, C. E. (2011). “Deepening our understanding of creativity in the workplace: a review of different approaches to creativity research” in *APA Handbook of Industrial and Organizational Psychology, Vol 1: Building and Developing the Organization* (Washington, DC, USA: American Psychological Association)



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# Do changes in working hours increase stress in Japanese white-collar workers?

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**Introduction:** High stress at work is associated with negative health outcomes for workers, making stress prevention a critical challenge. Overtime work is an influential stress factor. This study, therefore, aimed to longitudinally evaluate how stress increased depending on changes in working hours among Japanese white-collar workers.

**Methods:** We targeted 3,874 participants who were full-time workers and were recognized as having low stress in a web-based cohort in 2018 (T1) and 2019 (T2). We performed univariate and multivariate logistic regression with the following variables: years of experience, years of education, medical background, income, and roommates.

**Results:** We observed a greater increase in stress among female who worked 41–50 h per week at T1 and more than 50 hours per week at T2, and those who worked more than 50 h per week at T1 and 35–40/41–50 h per week at T2, compared to those who worked 41–50 h per week both at T1 and T2, with odds ratios (ORs) and 95% confidence intervals (95% CI) of OR = 2.09, 95% CI (1.18, 3.70); OR = 1.86, 95% CI (1.14, 3.03), respectively. However, no association between change in working hours and stress was found among male.

**Discussion:** These results show that reducing stress requires decreasing working hours as well as identifying factors that lead to high stress.

## KEYWORDS

stress, working hours, white-collar, longitudinal study, full-time workers

## 1. Introduction

High stress is generally viewed as harmful to an individual's physical and mental state (1). While there are several types of stressors, recent studies have shown that high stress at work is associated with increased risk of negative health outcomes, including impaired cognitive function, depression, cardiovascular diseases, and poor sleep quality (2–4). Hence, the prevention of work-related stress is widely recognized as a critical challenge for occupational health and safety (5).

Overtime work is generally thought to be one of the most influential risk factors for high stress (6). Typically defined as 55 working hours or more per week, overtime work is also a risk factor for health-related problems such as coronary heart disease (7). High job demands can result in burnout and other risks as a consequence of overwork (8). It is believed that stress increase as a result of these factors. Overtime work of more than 40 h per week was associated with higher levels of stress in a representative sample of the United States population (9). In a study analyzing the impact of long working hours on psychosocial stress response



among white-collar workers in one Korean company, working 60 or more hours per week was significantly associated with higher stress compared to working 40–44 h per week (10). Among 59,021 Japanese workers in 117 companies, the length of working hours was positively associated with various higher stress responses, including “irritability,” “fatigue,” “anxiety,” “depression,” and “somatic responses” for both genders (11). In fact, in Japan, where overtime work has been prevalent, the government has considered stress management to be of paramount importance. Japan is the first country in the world to make annual stress check tests legally mandatory in a workplace with 50 or more employees, since 2014 (12, 13). The stress check is performed using the Brief Job Stress Questionnaire (BJSQ), developed based on the demand-control-support model (14, 15).

In addition, the Japanese government is trying to reduce long working hours as one measure to address the shortage of workers (16). The outbreak of the novel coronavirus infection may have increased the working hours and various other burdens on some workers. Even previously stress-free individuals may have been exposed to new stress risks. However, previous research has shown that only those currently working long hours tend to have high stress. It remains to be seen which people will likely become highly stressed in the future, depending on changes in working style. Understanding who is prone to high stress among those who are not under high stress may help employers implement measures to prevent high levels of stress.

Therefore, we longitudinally examined how many participants were identified as having high stress after 1 year based on a survey conducted at two time points among a representative sample of Japanese workers. To focus on the increase in stress between the two points, we targeted those identified as having low stress at the first point. Additionally, we examined differences in how stress increased depending on changes in working hours by gender, considering that women and men in Japan have significantly different ways of working (17). As in the previous study mentioned earlier, we targeted white-collar workers aged 20–64 years, which is also validated by the fact that the most common type of work in Japan is white-collar.

## 2. Materials and methods

### 2.1. Data and materials

We used the same data as in a previous study (18). A web-based cohort survey regarding the occupational safety of 30,000 workers was conducted twice in October 2018 (T1) and October 2019 (T2) in collaboration with a research company in Tokyo, Japan. This company has one of the largest online research panels in Japan with over 1.8 million voluntarily registered panelists. To minimize selection bias, we selected a sample of Japanese workers aged 20–64 years based on the composition ratio of workers by industry, gender, and age in the Labor Force Survey by the Japanese Ministry of Internal Affairs and Communications. The research company randomly sent an e-mail invitation to registered workers to participate in the study. Workers who provided web-based informed consent were selected to participate in the survey. They completed a self-reported online questionnaire consisting of questions regarding demographic, job-related, and life-related variables, as well as health-related outcomes. The study protocol was approved by the

Institutional Review Board of the Jikei University School of Medicine, Tokyo, Japan, in 2018 [No. 30-153(9174)].

### 2.2. Measures of stress and working hours

We selected full-time employees (over 35 h per week as the average working hours during the last 6 months) who reported being professional or general clerks, based on the Japan Standard Industrial Classification established by the Japanese Ministry of Internal Affairs and Communications.

We targeted those employees identified as having low stress at T1 using the BJSQ, a tool widely used to evaluate job-related stress in Japan (19). In this study, low-stress population was identified as the population not determined to have high stress according to the following criteria. The BJSQ comprises 57 items that assess (A) job stressors, (B) psychological and physical stress responses, and (C) buffering factors. (A) Job stressors include quantitative job overload, qualitative job overload, physical demands, job control, skill utilization, interpersonal conflict, poor physical environment, suitable jobs, and intrinsic rewards (17 items). (B) Psychological and physical stress responses include lassitude, irritation, fatigue, anxiety, depression, and physical stress responses (29 items). (C) Buffering factors include supervisor support, co-worker support, and support from family and friends (9 items). Those whose scores in section (B) were over 76, or whose total scores in sections (A) and (C) were over 75 and scores in section (B) were over 62 were defined as having high stress (20).

The outcome measure of the present study was to check whether each participant was defined as having high stress at T2 in the following two ways: when the score criterion in section (B) only, representing physical reaction, was met (criterion A); when the score criterion in sections (A) and (C) were met even if the score criterion in section (B) was not met (criterion B).

We grouped self-reported average working hours per week in the last 6 months into seven categories based on how the hours changed between T1 and T2: 35–40 h/week in T1 remained the same or increased in T2, 41–50 h/week in T1 decreased, remained the same, or increased in T2, and 51 h/week or more in T1 decreased or remained the same in T2. Since many Japanese workers are required to work the full 40 legal working hours, we considered working 40 h plus a few hours of overtime per week as the most standard way of working. Therefore, we set the reference group as those who worked 41–50 h per week in both T1 and T2.

### 2.3. Other variables

We categorized years of experience in the job into four categories: 5 years or less, 6–10 years, 11–20 years, 21 years or more. We split years of education into two categories based on whether each participant graduated from college. We assessed medical background according to whether each participant was using medications. We divided income into four categories: those whose income at T2 increased, decreased, or remained the same compared to T1 and those who did not want to answer. We grouped roommate status into two categories: those whose number of roommates remained the same or increased/decreased.



## 2.4. Statistical analysis

First, we summarized the demographic and baseline characteristics of those who met the eligibility criteria for each category of working hours. Second, we conducted univariate logistic regression to determine whether participants had high or low stress at the second point based on criteria A and B, as well as only criterion A as the objective variable, and how working hours changed between the first and second points according to the classification mentioned above as the explanatory variable. We also conducted multivariate logistic regression with years of experience, years of education, medical background, income, and roommates as other variables. In these model analyses, crude/adjusted odds ratios (ORs) with 95% confidence intervals (CIs) and *p*-values were calculated. The robustness of the results was confirmed by a sensitivity analysis in which the cut-off for working hours was changed from 50 to 60 h. Statistical significance was set at  $P < 0.05$ . All analyses were conducted using STATA version 17.0 (STATA Corp., College Station, TX, USA).

## 3. Results

Of 7,012 voluntary registered panelists who answered that they were general clerks or professionals, 5,165 worked an average of over 35 h per week during the last 6 months. Among them, 4,051 were identified as having low stress at T1. After excluding those who did not answer at either T1 or T2 or changed occupations between T1 and T2, data from 3,874 participants (2,167 female and 1,707 male) were analyzed.

The characteristics of the study participants, according to the category of working hours, are shown in [Table 1](#). The mean age was approximately 43 years for both genders. About 45% of female participants and 72.5% of male participants reported having graduated from college; 27.7% of female participants and 58.4% of male participants reported being professional. Among female and male participants, the proportion of those identified as highly stressed based on criteria A and B was 14.6 and 14.3%, respectively. When identifying the highly stressed state using only criterion A, the rates were 13.1 and 12.7% for female and male participants, respectively.

[Table 2](#) shows the results of univariate and multivariate logistic regression for both male and female when identifying high stress at T2 based on criteria A and B. The percentages of female and male who were identified as highly stressed at T2 and who worked 41–50 h per week at both T1 and T2 (reference) were 11.2 and 13.6%, respectively. In [Table 3](#), crude ORs for high stress among female were higher for those who worked 41–50 h per week at T1 and more than 50 h at T2, for those who worked more than 50 h per week at T1 and 35–40 h/41–50 h per week at T2, and for those who worked more than 50 h per week at both T1 and T2 [OR = 2.20 [95% CI, 1.25–3.88]; OR = 2.07 [95% CI, 1.28–3.34]; OR = 1.78 [95% CI, 1.06–3.00], respectively]. However, among male, none of the categories of working hours showed statistically significant results.

When analyzing other variables together with working hours, ORs for high stress among female were higher for those who worked 41–50 h per week at T1 and more than 50 h at T2, and for those who worked more than 50 h per week at T1 and 35–40 h/41–50 h per week at T2 (OR = 2.09 [95% CI, 1.18–3.70]; OR = 1.86 [95% CI, 1.14–3.03], respectively). In addition, ORs for high stress among female were

higher for those whose income had decreased at T2 (OR = 1.54 [95% CI, 1.09–2.17]). ORs for high stress among female were lower for those whose years of experience were more than 10 years and more than 20 years [OR = 0.67 [95% CI, 0.49–0.93]; OR = 0.68 [95% CI, 0.46–1.00], respectively]. On the other hand, among male, none of the categories of working hours showed statistically significant results, except that ORs for high stress were significantly higher among male whose number of roommates had increased or decreased (OR = 2.07 [95% CI, 1.28–3.35]).

The direction of ORs did not change in the sensitivity analyses in which the cut-off for working hours was changed ([Supplementary Table S1](#)).

[Table 4](#) shows results of univariate and multivariate logistic regression of both male and female participants when identifying high stress at T2 based only on criterion A. The rate of female and male participants who were identified as highly stressed at T2 and who worked 41–50 h per week both at T1 and T2 (reference) were 9.2 and 12.0%, respectively. In addition to categories of working hours which showed statistically significant data in [Table 4](#), crude ORs for high stress among female were higher for those who worked 35–40 h per week at T1 and T2, and for those who worked 35–40 h per week at T1 and 41–50/51 h per week at T2 as well [OR = 1.52 [95% CI, 1.06–2.18]; OR = 1.69 [95% CI, 1.05–1.72], respectively]. When analyzing other variables, ORs for high stress among male were lower for those whose type of work was professional.

## 4. Discussion

In the present study, we used a nationally representative sample of white-collar workers in Japan to examine the prevalence of those who had low stress at the first time point but had high stress 1 year later. We considered the relationship between changes in working hours and stress levels. The incidence of high stress for male and female in this population based on criteria A and B was 14.6 and 14.3%, respectively, reflecting no gender difference in the number of new cases of stress per year. Our results were consistent with the prevalence of stress studied cross-sectionally (20). We evaluated an association between changing working hours and high stress in a longitudinal design, which had previously been proposed only in a cross-sectional manner (21). Although, as expected, high stress occurred when working hours increased in a longitudinal design, more than 11.5% of those whose working hours either decreased or remained the same were highly stressed 1 year later. Because stress levels can change over time, it is important to monitor these levels in workers (12, 13) to prevent accidents, injuries, and worsening health (5).

Regarding the degree of increasing stress between categories of changes in working hours, an interesting result was that in female, there was a greater increase in stress compared to the reference group in several working categories; contrastingly, none of the working hour categories showed statistically significant data among male. One potential reason for this phenomenon could be that, as the previous study mentioned, long working hours were related to the risk of high stress levels; women were also more likely to respond negatively to high job strain (22) than were men. Higher job strain due to increased working hours can predispose women to higher stress. Additionally, the effect of increased work intensity on worker satisfaction can be buffered by high autonomy (23, 24).

TABLE 1 Summary of backgrounds and characteristics of female workers.

Working hours (Hours per week)	T1 (October 2018)	35~40		41~50			51~		Total (female)
	T2 (October 2019)	35~40	41~50/51~	35~40	41~50	51~	35~40/41~50	51~	
n		842	225	218	509	92	150	131	2,167
Age, mean (standard deviation)		44.1 (10.1)	42.6 (9.6)	42.6 (9.7)	43.5 (9.5)	42.3 (8.7)	41.4 (9.7)	42.2 (9.6)	43.3 (9.8)
Education year $\geq 16$ years, <i>n</i> (%)		355 (42.2)	97 (43.1)	89 (40.8)	238 (46.8)	48 (52.2)	73 (48.7)	75 (57.3)	975 (45.0)
Professional, <i>n</i> (%)		157 (18.7)	75 (33.3)	72 (33.0)	154 (30.3)	30 (32.6)	55 (36.7)	57 (43.5)	600 (27.7)
Years of experience, <i>n</i> (%)									
$\leq 5$ years		256 (30.4)	71 (31.6)	77 (35.3)	148 (29.1)	33 (35.9)	47 (31.3)	38 (29.0)	670 (30.9)
6~10 years		199 (23.6)	54 (24.0)	36 (16.5)	103 (20.2)	27 (29.4)	41 (27.3)	33 (25.2)	493 (22.8)
11~20 years		239 (28.4)	67 (29.8)	66 (30.3)	158 (31.0)	22 (23.9)	40 (26.7)	32 (24.4)	624 (28.8)
$\geq 21$ years		148 (17.6)	33 (14.7)	39 (17.9)	100 (19.7)	10 (10.9)	22 (14.7)	28 (21.4)	380 (17.5)
Income change, <i>n</i> (%)									
No change		384 (45.6)	108 (48.0)	101 (46.3)	256 (50.3)	47 (51.1)	55 (36.7)	70 (53.4)	1,021 (47.1)
Increased		161 (19.1)	39 (17.3)	35 (16.1)	97 (19.1)	20 (21.7)	28 (18.7)	21 (16.0)	401 (18.5)
Decreased		125 (14.9)	29 (12.9)	33 (15.1)	64 (12.6)	12 (13.0)	25 (16.7)	19 (14.5)	307 (14.2)
No answer		172 (20.4)	49 (21.8)	49 (22.5)	92 (18.1)	13 (14.1)	42 (28.0)	21 (16.0)	438 (20.2)
The number of roommates changed, <i>n</i> (%)		46 (5.5)	15 (6.7)	16 (7.3)	33 (6.5)	3 (3.3)	15 (10.0)	12 (9.2)	140 (6.5)
With treatment, <i>n</i> (%)		59 (7.0)	14 (6.2)	9 (4.1)	34 (6.7)	5 (5.4)	13 (8.7)	18 (13.7)	172 (7.0)
High-stressed at T2 (all the region), <i>n</i> (%)		121 (14.4)	36 (16.0)	28 (12.8)	57 (11.2)	20 (21.7)	31 (20.7)	24 (18.3)	317 (14.6)
High-stressed at T2 (only B region), <i>n</i> (%)		113 (13.4)	33 (14.7)	26 (11.9)	47 (9.2)	18 (19.6)	26 (17.3)	20 (15.3)	283 (13.1)

T1, Survey in October 2018; T2, Survey in October 2019.

TABLE 2 Summary of backgrounds and characteristics of male workers.

Working hours (Hours per week)	T1 (October 2018)	35~40		41~50			51~		Total (male)
	T2 (October 2019)	35~40	41~50/51~	35~40	41~50	51~	35~40/41~50	51~	
n		344	153	152	493	133	165	267	1,707
Age, mean (standard deviation)		48.7 (10.7)	44.7 (10.3)	45.6 (10.1)	43.8 (10.5)	43.4 (9.5)	43.9 (10.0)	43.3 (10.2)	44.9 (10.5)
Education year ≥ 16 years, <i>n</i> (%)		229 (66.6)	106 (69.3)	110 (72.4)	362 (73.4)	97 (72.9)	127 (77.0)	206 (77.2)	1,237 (72.5)
Professional, <i>n</i> (%)		158 (45.9)	85 (55.6)	84 (55.3)	299 (60.7)	86 (64.7)	102 (61.8)	183 (68.5)	997 (58.4)
Years of experience, <i>n</i> (%)									
≤5 years		126 (36.6)	64 (41.8)	53 (34.9)	175 (35.5)	48 (36.1)	56 (33.9)	84 (31.5)	606 (35.5)
6~10 years		59 (17.2)	30 (19.6)	25 (16.5)	94 (19.1)	25 (18.8)	34 (20.6)	53 (19.9)	320 (18.8)
11~20 years		72 (20.9)	25 (16.3)	37 (24.3)	112 (22.7)	33 (24.8)	40 (24.2)	60 (22.5)	379 (22.2)
≥21 years		87 (25.3)	34 (22.2)	37 (24.3)	112 (22.7)	27 (20.3)	35 (21.2)	70 (26.2)	402 (23.6)
Income change, <i>n</i> (%)									
No change		183 (53.2)	69 (45.1)	74 (48.7)	271 (55.0)	62 (46.6)	90 (54.6)	137 (51.3)	886 (51.9)
Increased		65 (18.9)	34 (22.2)	34 (22.4)	102 (20.7)	40 (30.1)	34 (20.6)	60 (22.5)	369 (21.6)
Decreased		44 (12.8)	26 (17.0)	21 (13.8)	63 (12.8)	17 (12.8)	15 (9.1)	40 (15.0)	226 (13.2)
No answer		52 (15.1)	24 (15.7)	23 (15.1)	57 (11.6)	14 (10.5)	26 (15.8)	30 (11.2)	226 (13.2)
The number of roommates changed, <i>n</i> (%)		19 (5.5)	11 (7.2)	8 (5.3)	25 (5.1)	8 (6.0)	14 (8.5)	15 (5.6)	100 (5.9)
With treatment, <i>n</i> (%)		94 (27.3)	30 (19.6)	33 (21.7)	88 (17.9)	22 (16.5)	25 (15.2)	44 (16.5)	336 (19.7)
High-stressed at T2 (all the region), <i>n</i> (%)		43 (12.5)	24 (15.7)	22 (14.5)	67 (13.6)	22 (16.5)	20 (12.1)	46 (17.2)	244 (14.3)
High-stressed at T2 (only B region), <i>n</i> (%)		42 (12.2)	22 (14.4)	20 (13.2)	59 (12.0)	16 (12.0)	19 (11.5)	38 (14.2)	216 (12.7)

T1, Survey in October 2018; T2, Survey in October 2019.

TABLE 3 Estimated odds ratios for high stress based on the Brief Job Stress Questionnaire by gender.

		Female						Male					
		Crude			Adjusted			Crude			Adjusted		
		OR	95%CI	p value	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value
Working hours (hours per week)	35~40 at T1 and 35~40 at T2	1.33	0.95–1.86	0.096	1.31	0.93–1.84	0.119	0.91	0.60–1.37	0.646	0.84	0.55–1.27	0.413
	35~40 at T1 and 41~50/51~ at T2	1.51	0.96–2.37	0.073	1.45	0.92–2.29	0.108	1.18	0.71–1.96	0.515	1.14	0.68–1.90	0.616
	41~50 at T1 and 35~40 at T2	1.17	0.72–1.89	0.527	1.13	0.70–1.84	0.613	1.08	0.64–1.81	0.783	1.04	0.62–1.76	0.871
	41~50 at T1 and 41~50 at T2	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
	41~50 at T1 and 51~ at T2	2.20	1.25–3.88	0.006	2.09	1.18–3.70	0.012	1.26	0.75–2.13	0.388	1.29	0.76–2.18	0.352
	51~ at T1 and 35~40/41~50 at T2	2.07	1.28–3.34	0.003	1.86	1.14–3.03	0.013	0.88	0.51–1.50	0.630	0.86	0.50–1.47	0.570
	51~ at T1 and 51~ at T2	1.78	1.06–3.00	0.030	1.69	1.00–2.87	0.051	1.32	0.88–1.99	0.179	1.37	0.91–2.07	0.134
Years of experience	≤5 years				1.00	reference					1.00	reference	
	6~10 years				1.08	0.79–1.48	0.613				0.74	0.50–1.17	0.147
	11~20 years				0.67	0.49–0.93	0.017				0.99	0.68–1.43	0.936
	≥ 21 years				0.68	0.46–1.00	0.048				1.06	0.73–1.54	0.768
Education years	< 16 years				1.00	reference					1.00	reference	
	≥ 16 years				1.12	0.87–1.43	0.388				0.77	0.57–1.04	0.091
Treatment	Without medication				1.00	reference					1.00	reference	
	With medication				0.87	0.53–1.43	0.580				1.07	0.76–1.51	0.709
Income change	No change				1.00	reference					1.00	reference	
	Increased				1.08	0.77–1.51	0.663				0.88	0.62–1.26	0.479
	Decreased				1.54	1.09–2.17	0.015				0.92	0.60–1.40	0.698
	No answer				1.32	0.96–1.81	0.089				1.00	0.66–1.52	0.988
Someone who lives with you	No change				1.00	reference					1.00	reference	
	Increased/decreased				1.42	0.92–2.20	0.118				2.07	1.28–3.35	0.003
Type of work	General clerk				1.00	reference					1.00	reference	
	Professional				1.14	0.87–1.50	0.347				0.76	0.57–1.02	0.066

OR, odds ratio; 95% CI, 95% confidence interval; T1, Survey in October 2018; T2, Survey in October 2019.

TABLE 4 Estimated odds ratios for high stress based on (B) psychological and physical stress responses category of the Brief Job Stress Questionnaire by gender.

T1	T2	Female						Male					
		Crude			Adjusted			Crude			Adjusted		
		OR	95%CI	p value	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value
35~40	35~40	1.52	1.06~2.18	0.022	1.50	1.04~2.15	0.030	1.02	0.67~1.56	0.916	0.95	0.62~1.47	0.830
	41~50/51~	1.69	1.05~1.72	0.031	1.64	1.02~2.65	0.043	1.24	0.73~2.09	0.432	1.19	0.70~2.03	0.526
41~50	35~40	1.33	0.80~2.21	0.270	1.31	0.78~2.18	0.304	1.11	0.65~1.92	0.696	1.08	0.62~1.86	0.794
	41~50	1.00	reference		1.00	reference		1.00	reference		1.00	reference	
	51~	2.39	1.32~4.34	0.004	2.26	1.24~4.13	0.008	1.01	0.56~1.81	0.984	1.01	0.56~1.83	0.967
51~	35~40/41~50	2.06	1.23~3.46	0.006	1.86	1.10~3.15	0.020	0.96	0.55~1.66	0.876	0.92	0.53~1.61	0.772
	51~	1.77	1.01~3.11	0.047	1.68	0.95~2.97	0.075	1.22	0.79~1.89	0.372	1.26	0.81~1.96	0.310
Years of experience	≤5 years				1.00	reference					1.00	reference	
	6~10 years				1.12	0.81~1.54	0.510				0.74	0.47~1.15	0.181
	11~20 years				0.65	0.46~0.92	0.014				1.06	0.72~1.56	0.778
	≥21 years				0.74	0.50~1.10	0.142				1.16	0.78~1.72	0.472
Education years	<16 years				1.00	reference					1.00	reference	
	≥16 years				1.18	0.91~1.54	0.201				0.80	0.58~1.09	0.156
Under treatment	Without treatment				1.00	reference					1.00	reference	
	With treatment				0.88	0.52~1.47	0.621				0.90	0.62~1.31	0.582
Income change	No change				1.00	reference					1.00	reference	
	Increased				1.14	0.80~1.63	0.454				0.97	0.67~1.42	0.893
	Decreased				1.57	1.10~2.26	0.014				0.91	0.58~1.43	0.670
	No answer				1.29	0.93~1.81	0.131				1.13	0.73~1.74	0.578
Roommate	No change				1.00	reference					1.00	reference	
	Increased/decreased				1.41	0.89~2.23	0.142				2.12	1.29~3.48	0.003
Type of work	General clerk				1.00	reference					1.00	reference	
	Professional				1.08	0.81~1.44	0.608				0.74	0.54~1.00	0.050

OR, odds ratio; 95% CI, 95% confidence interval; T1, Survey in October 2018; T2, Survey in October 2019.



In this study, male made up a higher proportion of professional workers than did female, which is common. Professional workers may have higher autonomy (23). Being a professional worker is a buffering factor between long working hours and high stress, given that ORs for high stress among male were lower among those who were professional workers when high stress was evaluated based only on criterion A. Similar results were observed in the previous study: among IT company workers aged 40 years or younger, there were no significant differences in mental and physical status between overtime work (>45 h/month overwork) and non-overtime work groups in both sexes (25). IT professionals often find themselves coerced into accepting high workloads under high pressure to shorten the time to market, as well as to learn new skills because of rapid advances in technology (26, 27). However, elevated job strain can be lessened by providing job autonomy and skill variation to employees (28). Considering professionals have higher job autonomy than do other occupations, high job autonomy could mitigate the negative effects of increased working hours on stress levels.

Among female, both increased and decreased working hours caused a greater increase in stress than when working hours were stable. Women's working hours could have been reduced involuntarily, resulting in high stress. Furthermore, employers might have cut their working hours due to poor job performance related to distress associated with work–family conflict (29, 30). Indeed the interaction between conditions at work and at home plays an important role in determining the health of women employees, whereas the health of employed men is determined more selectively by working conditions (31). This difference is expected to be more evident in Japan, where women are still responsible for performing domestic chores according to traditional gender roles (32). In fact, among middle-aged Japanese working women, regular employees have poorer self-reported health than non-regular employees, a difference attributed to experiencing more strain related to work–family conflict (33). Additionally, in various countries, women face an increased risk of health problems due to long working hours and greater family responsibilities (34, 35). Hence, work–family conflict could induce high levels of stress in women employees. To reduce such conflict, employers could willingly adopt flexible work schedules, which could promote a better balance between work and personal life (36).

Incidence of high stress might directly and indirectly be related to economic status. In women, reduction of income could be related to increasing stress, and lead to dissatisfaction at work; this situation can adversely affect employees' mental and physical health and their overall wellbeing (37). This is also true in men; ORs for high stress among men were significantly higher for those whose number of roommates increased or decreased. Studies show that being separated is associated with a high prevalence of psychological distress in both men and women (38). One reason high stress was also observed in male whose roommates had increased could be related to male gender roles at home. In Japan, gender roles are still characterized by the model of a strong man being the breadwinner and by women's low level of participation in the workforce (39). Marriage has been shown to enhance negative effects of unemployment on men's mental health but act as a buffer among women; thus, it is reasonable to suppose that marriage can stimulate

men's sense of responsibility, which could predispose them to high stress (40).

When evaluating the high-stress state based only on criterion A, the incidence in female and male was still 13.1 and 12.7%, respectively. A previous study also showed a subtle difference in prevalence between criteria A and B and using only criterion A. In a financial company comprising 7,356 male and 7,362 female employees, the prevalence of high stress based on criteria A and B of the BJSQ was 5.6% for male and 15.0% for female. When evaluated based on criterion A, the prevalence was 4.5% for male and 13.2% for female (19). Combined with the results of previous studies, our results suggest that over the course of 1 year, Japanese employees can progress to high stress levels severe enough to cause physical reactions. Studies have indicated that workers in Japan working more than 50 h per week have an increased risk of occupational accidents (41), and workers in the EU who work more than 55 h per week have an increased risk of stroke, atrial fibrillation, and several other diseases (42–44). Notably, in this study, the increase in stress occurred in all categories for male, although there was no difference among the categories of the changes in working hours. The effect on objective outcome may be different when stress increases in situations with increased working hours and in other situations. Further studies are needed to evaluate long-term outcomes in Japan.

In this study, we investigated working hours to identify groups prone to high stress among homogeneous groups not in a high stress state, especially regarding changes in working hours. In recent years, efforts have been made to reduce the working hours in Japan (16); however, the amount of reduction varies by industry, and in some occupations, the workload increased due to the COVID-19 pandemic (45). From a preventive perspective, it might be important to not only manage working hours according to job demands, but also create a positive workplace by, for example, providing co-worker support and job autonomy, and allowing flexible work styles. It is also crucial to consider how to manage high-stress situations (46). For such a study, it is also important to evaluate the continuous state of high stress and changes in the previous stress state based on a homogeneous group.

Although this study provides new insights into the incidence of high stress over 1 year, and how changes in stress depend on changes in working hours by gender, several limitations should be mentioned. First, recall bias may have occurred because working hours per week were self-reported; those identified as highly stressed in the second survey were more likely to report longer working hours than they actually performed. Second, there is the possibility of selection bias; responses to stress in a population that can respond to two web questionnaires may contain bias. However, because the sampling was based on the distribution of the population by age, gender, and industry, the results were consistent with high stress rates in other studies. Third, this study evaluated average working hours during the last 6 months, which made it impossible to follow in more detail how working hours changed. Fourth, our results regarding the effect of changes in working hours on stress levels may not be applicable to the current working environment where many employees have been obliged to work from home, changed their commute time, and transportation methods due to the COVID-19 pandemic. However, working from home has a negative effect on employees' physical and mental health (47). It is important to

identify other variables, besides working hours, that can contribute to high stress. Lastly, we did not show a causal relationship between changes in working hours and stress, because we did not perform any interventions to increase or decrease working hours. Thus, how stress changes after intentional increases in working hours remains to be seen.

## Data availability statement

The datasets presented in this article are not readily available because they contain information that could compromise the privacy of research participants, based on the “Ethical Guidelines for Medical and Health Research involving Human Subjects” by the Japanese government. Requests to access the datasets should be directed to corresponding author.

## Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board of the Jikei University School of Medicine, Tokyo, Japan, in 2018 [No. 30-153(9174)]. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

TY and KT: conceptualization. TY: data collection. TA and KT: methodology. MO and TA: statistical analyses and writing—original draft. KT: supervising. All authors critically revised the manuscript, contributed to the interpretation of the data, and approved the final manuscript.

## References

- Clough BA, March S, Chan RJ, Casey LM, Phillips R, Ireland MJ. Psychosocial interventions for managing occupational stress and burnout among medical doctors: a systematic review. *Syst Rev.* (2017) 6:144. doi: 10.1186/s13643-017-0526-3
- Fishta A, Backé EM. Psychosocial stress at work and cardiovascular diseases: an overview of systematic reviews. *Int Arch Occup Environ Health.* (2015) 88:997–1014. doi: 10.1007/s00420-015-1019-0
- Gavelin HM, Domellöf ME, Åström E, Nelson A, Launder NH, Neely AS, et al. Cognitive function in clinical burnout: a systematic review and meta-analysis. *Work Stress.* (2022) 36:86–104. doi: 10.1080/02678373.2021.2002972
- Johnson DA, Lisabeth L, Lewis TT, Sims M, Hickson DA, Samdarshi T, et al. The contribution of psychosocial stressors to sleep among African Americans in the Jackson heart study. *Sleep.* (2016) 39:1411–9. doi: 10.5665/sleep.5974
- Leka S, Jain A, Zwetsloot G, Cox T. Policy-level interventions and work-related psychosocial risk management in the European Union. *Work Stress.* (2010) 24:298–307. doi: 10.1080/02678373.2010.519918
- Bannai A, Ukawa S, Tamakoshi A. Long working hours and psychological distress among school teachers in Japan. *J Occup Health.* (2015) 57:20–7. doi: 10.1539/joh.14-0127-OA
- Kivimäki M, Nyberg ST, Batty GD, Fransson EI, Heikkilä K, Alfredsson L, et al. Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. *Lancet Lond Engl.* (2012) 380:1491–7. doi: 10.1016/S0140-6736(12)60994-5
- Chirico F. Job stress models for predicting burnout syndrome: a review. *Ann Ist Super Sanita.* (2016) 52:443–56. doi: 10.4415/ANN\_16\_03\_17
- Grosch JW, Caruso CC, Rosa RR, Sauter SL. Long hours of work in the U. S: associations with demographic and organizational characteristics, psychosocial working conditions, and health. *Am J Ind Med.* (2006) 49:943–52. doi: 10.1002/ajim.20388
- Lee K, Suh C, Kim JE, Park JO. The impact of long working hours on psychosocial stress response among white-collar workers. *Ind Health.* (2017) 55:46–53. doi: 10.2486/indhealth.2015-0173
- Kikuchi H, Odagiri Y, Ohya Y, Nakanishi Y, Shimomitsu T, Theorell T, et al. Association of overtime work hours with various stress responses in 59,021 Japanese workers: Retrospective cross-sectional study. *PLoS ONE.* (2020) 15:e0229506. doi: 10.1371/journal.pone.0229506
- Kawakami N, Tsutsumi A. The Stress Check Program: a new national policy for monitoring and screening psychosocial stress in the workplace in Japan. *J Occup Health.* (2016) 58:1–6. doi: 10.1539/joh.15-0001-ER
- Mishiba T. The background and current state of implementing a legal system for stress checks in Japan. *Ind Health.* (2022) 60:183–95. doi: 10.2486/indhealth.2021-0090
- Kawada T, Otsuka T. Relationship between job stress, occupational position and job satisfaction using a brief job stress questionnaire (BJSQ). *Work Read Mass.* (2011) 40:393–9. doi: 10.3233/WOR-2011-1251
- Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q.* (1979) 24:285–308. doi: 10.2307/2392498
- Ministry of Health, Labour and Welfare. *Report of Monthly Labour Survey.* Tokyo: Roumugyousei Co., Ltd. (2022).
- Iida A. Gender inequality in Japan: the status of women, and their promotion in the workplace. *Corvinus J Int Aff.* (2018) 3:43–52. doi: 10.14267/cojourn.2018v3n3a5

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1076024/full#supplementary-material>

18. Yamauchi T, Sasaki T, Takahashi K, Umezaki S, Takahashi M, Yoshikawa T, et al. Long working hours, sleep-related problems, and near-misses/injuries in industrial settings using a nationally representative sample of workers in Japan. *PLoS ONE*. (2019) 14:e0219657. doi: 10.1371/journal.pone.0219657
19. Tsutsumi A, Shimazu A, Eguchi H, Inoue A, Kawakami N, A. Japanese stress check program screening tool predicts employee long-term sickness absence: a prospective study. *J Occup Health*. (2018) 60:55–63. doi: 10.1539/joh.17-0161-OA
20. Tsutsumi A, Inoue A, Eguchi H. How accurately does the brief job stress questionnaire identify workers with or without potential psychological distress? *J Occup Health*. (2017) 59:356–60. doi: 10.1539/joh.17-0011-BR
21. Hsu YY, Bai CH, Yang CM, Huang YC, Lin TT, Lin CH. Long hours' effects on work-life balance and satisfaction. *BioMed Res Int*. (2019) 2019:5046934. doi: 10.1155/2019/5046934
22. Padkapayeva K, Gilbert-Ouimet M, Bielecky A, Ibrahim S, Mustard C, Brisson C, et al. Gender/sex differences in the relationship between psychosocial work exposures and work and life stress. *Ann Work Expo Health*. (2018) 62:416–25. doi: 10.1093/annweh/wxy014
23. Lopes H, Lagoa S, Calapez T. Work autonomy, work pressure, and job satisfaction: An analysis of European Union countries. *Econ Labour Relat Rev*. (2014) 25:306–26. doi: 10.1177/1035304614533868
24. Mazzola JJ, Schonfeld IS, Spector PE. What qualitative research has taught us about occupational stress. *Stress Health*. (2011) 27:93–110. doi: 10.1002/smi.1386
25. Nishikitani M, Nakao M, Karita K, Nomura K, Yano E. Influence of overtime work, sleep duration, and perceived job characteristics on the physical and mental status of software engineers. *Ind Health*. (2005) 43:623–9. doi: 10.2486/indhealth.43.623
26. Mano RS, Mesch GS. E-mail characteristics, work performance and distress. *Comput Hum Behav*. (2010) 26:61–9. doi: 10.1016/j.chb.2009.08.005
27. Pawlowski SD, Robey D. Bridging user organizations: knowledge brokering and the work of information technology professionals. *MIS Q*. (2004) 28:645–72. doi: 10.2307/25148658
28. Bakker AB, Demerouti E. Multiple levels in job demands-resources theory: Implications for employee well-being and performance. In: Diener E, Oishi S, Tay L, editors. *Handbook Well-Being*. Salt Lake City, UT: DEF Publishers (2018).
29. Bashir U, Ismail Ramay M. Impact of stress on employees job performance: a study on banking sector of Pakistan. *Int J Mark Stud*. (2010) 2:122–6. doi: 10.5539/ijms.v2n1p122
30. Dyrbye LN, Shanafelt TD, Johnson PO, Johnson LA, Satele D, West CP, et al. cross-sectional study exploring the relationship between burnout, absenteeism, and job performance among American nurses. *BMC Nurs*. (2019) 18:57. doi: 10.1186/s12912-019-0382-7
31. Krantz G, Berntsson L, Lundberg U. Total workload, work stress and perceived symptoms in Swedish male and female white-collar employees. *Eur J Public Health*. (2005) 15:209–14. doi: 10.1093/eurpub/cki079
32. Belarmino M, Roberts MR. Japanese gender role expectations and attitudes: a qualitative analysis of gender inequality. *J Int Womens Stud*. (2019) 20:272–88.
33. Honjo K, Iso H, Ikeda A, Yamagishi K, Saito I, Kato T, et al. Cross-sectional association between employment status and self-rated health among middle-aged Japanese Women: the influence of socioeconomic conditions and work-life conflict. *J Epidemiol*. (2020) 30:396–403. doi: 10.2188/jea.JE20190005
34. Dembe AE, Yao X. chronic disease risks from exposure to long-hour work schedules over a 32-year period. *J Occup Environ Med*. (2016) 58:861. doi: 10.1097/JOM.0000000000000810
35. Gilbert-Ouimet M, Trudel X, Talbot D, Vézina M, Milot A, Brisson C. Long working hours associated with elevated ambulatory blood pressure among female and male white-collar workers over a 25-year follow-up. *J Hum Hypertens*. (2022) 36:207–17. doi: 10.1038/s41371-021-00499-3
36. Kelly EL, Moen P, Tranby E. Changing workplaces to reduce work-family conflict: schedule control in a white-collar organization. *Am Sociol Rev*. (2011) 76:265–90. doi: 10.1177/0003122411400056
37. Faragher EB, Cass M, Cooper CL. *The Relationship between Job Satisfaction and Health: A Meta-Analysis*. In: Cooper CL, editor. London: Palgrave Macmillan UK. (2013).
38. Gutiérrez-Lobos K, Wölfl G, Scherer M, Anderer P, Schmidl-Mohl B. The gender gap in depression reconsidered: the influence of marital and employment status on the female/male ratio of treated incidence rates. *Soc Psychiatry Psychiatr Epidemiol*. (2000) 35:202–10. doi: 10.1007/s001270050229
39. Tsutsui J. Female labor participation and the sexual division of labor: a consideration of the persistent male-breadwinner model. *Jpn Labor Rev*. (2016) 13:80–100.
40. Artazcoz L, Benach J, Borrell C, Cortès I. Unemployment and mental health: understanding the interactions among gender, family roles, and social class. *Am J Public Health*. (2004) 94:82–8. doi: 10.2105/AJPH.94.1.82
41. Anzai T, Yamauchi T, Ozawa M, Takahashi K. A generalized structural equation model approach to long working hours and near-misses among healthcare professionals in Japan. *Int J Environ Res Public Health*. (2021) 18:7154. doi: 10.3390/ijerph18137154
42. Kivimäki M, Nyberg ST, Batty GD, Kawachi I, Jokela M, Alfredsson L, et al. Long working hours as a risk factor for atrial fibrillation: a multi-cohort study. *Eur Heart J*. (2017) 38:2621–8. doi: 10.1093/eurheartj/ehx324
43. Kivimäki M, Jokela M, Nyberg ST, Singh-Manoux A, Fransson EI, Alfredsson L, et al. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603,838 individuals. *Lancet Lond Engl*. (2015) 386:1739–46. doi: 10.1016/S0140-6736(15)60295-1
44. Ervasti J, Pentti J, Nyberg ST, Shipley MJ, Leineweber C, Sørensen JK, et al. Long working hours and risk of 50 health conditions and mortality outcomes: a multicohort study in four European countries. *Lancet Reg Health Eur*. (2021) 11:100212. doi: 10.1016/j.lanepe.2021.100212
45. Gai R, Tobe M. Managing healthcare delivery system to fight the COVID-19 epidemic: experience in Japan. *Glob Health Res Policy*. (2020) 5:23. doi: 10.1186/s41256-020-00149-0
46. Kivimäki M, Nyberg ST, Fransson EI, Heikkilä K, Alfredsson L, Casini A, et al. Associations of job strain and lifestyle risk factors with risk of coronary artery disease: a meta-analysis of individual participant data. *CMAJ Can Med Assoc J*. (2013) 185:763–9. doi: 10.1503/cmaj.121735
47. Xiao Y, Becerik-Gerber B, Lucas G, Roll SC. Impacts of working from home during COVID-19 pandemic on physical and mental well-being of office workstation users. *J Occup Environ Med*. (2021) 63:181–90. doi: 10.1097/JOM.0000000000002097



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# The military occupational stress response scale: Development, reliability, and validity

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Soldiers in the military are exposed to numerous stressors, including some that are of an extreme nature. The main objective of this military psychology research study was to evaluate soldiers' occupational stress. Even though several tools have been developed to measure stress in this population, to date, none have focused on occupational stress. Hence, we developed the Military Occupational Stress Response Scale (MOSRS) to provide a tool to objectively measure soldiers' occupational stress responses. An initial pool of 27 items was assembled from the literature, existing instruments, and interviews with soldiers. Of those 27, 17 were included in the MOSRS. The scale was subsequently completed by soldiers from one military region, and exploratory factor analysis (EFA) and confirmatory factor analysis were conducted using Mplus8.3 and IBM SPSS 28.0 software, respectively. A total of 847 officers and soldiers were selected for scale testing, and 670 subjects were retained after data cleaning and screening according to the set criteria. After performing the Kaiser–Meyer–Olkin (KMO) and Bartlett's test, principal components analysis (PCA) was appropriate. The PCA yielded a three-factor model (physiological, psychological, and behavioral responses) with the items and factors strongly correlated. The confirmatory factor analysis revealed loads ranging from between 0.499 and 0.878 for each item. The Cronbach's  $\alpha$  coefficient of the MOSRS was between 0.710 and 0.900, and the Omega reliability was between 0.714 and 0.898, which were all higher than the critical standard value of 0.7, indicating that the scale has good reliability. Analysis of the discrimination validity of each dimension revealed that the scale has good discrimination validity. The MOSRS demonstrated sound psychometric characteristics with acceptable reliability and validity, suggesting that it could be used to assess occupational stress in military personnel.

## KEYWORDS

military personnel, occupational stress, stress response, reliability, validity

## 1. Introduction

The military profession exposes personnel to a large number of stressors, including some that are very extreme and more intense than those experienced in other human activities. While the research category of extreme combat stress reactions causing casualties has not attracted attention from psychologists, it has attracted great attention from psychiatrists. Military psychiatrists primarily treat and permit the wounded members to return to work. A review of the literature found that military stress research focuses heavily on the fields of combat stress and post-traumatic stress disorder (PTSD) and less on daily stress from military occupations.

Regarding the relationship between occupational stress and physical and mental health, numerous studies have been focused in the same direction, examining the close relationship between occupational stress and physical health. Kawakami and Tsutsumi (2010) summarized the relationship between occupational stress and physical and mental health in recent years and



found that different stress levels resulted in different stages of physical and mental health among various professions. The military is a high-risk, stressful career, and it is necessary to develop a pressure scale suitable for measuring the occupational effectiveness of soldiers.

The question of how to objectively and accurately evaluate these factors should form the basis of further study on the relationship between stress and work environment, performance, and physical and mental health. There is also a need to compare different occupational stress levels and take effective intervention measures to optimize the work stress level. A universally applicable, objective, and accurate assessment tool needs to be established to assess the stress experienced by military personnel.

Based on the study of occupational stress in military personnel in their home country and abroad, foreign military personnel most commonly use occupational stress questionnaires intended for the general population, such as the Occupational Stress Inventory—Revised (OSI-R) (Osipow and Spokane, 1998) and the Perceived Stress Scale (PSS) (Cohen et al., 1983). Luo et al. (2012a) have compiled The Psychological Stressors of Soldiers in the Southern Theater Command scale, however, it ignores the influence of military stressors.

This study takes military career stress as the entry point and aimed to provide scientific tools for measuring and evaluating military career stress and lay the foundation for the development of research on military career stress. Through investigation of the risk factors and protective factors affecting military occupational health, the military daily stress event database was established, existing occupational stress scales and theories were then borrowed, and tools for measuring daily occupational pressures were compiled. Its reliability and validity have also been preliminarily verified.

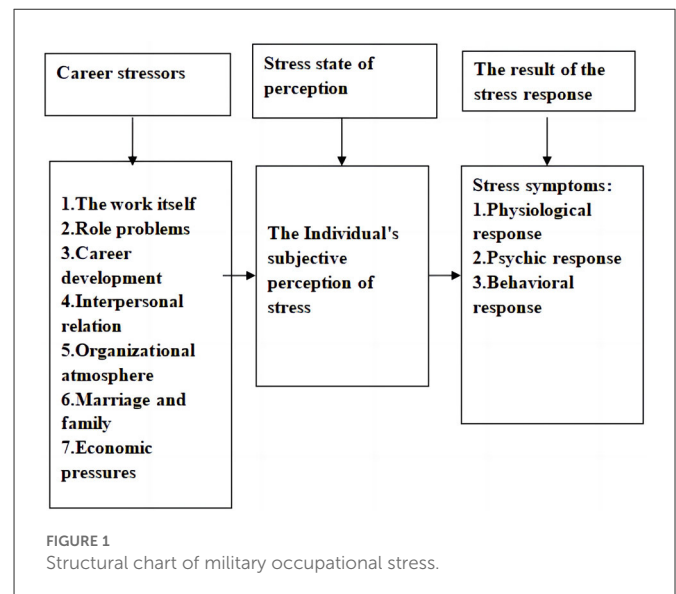
## 2. Methods

### 2.1. The military occupational stress hypothesis

In the previous general occupational stress model, occupational stressors include work itself, the role in the organization, career development, work of interpersonal relationships, and the organizational structure and atmosphere (Greenberg, 2006), based on the professional characteristics of soldiers. Based on a literature review, which actively gathered information on the advanced experiences and achievements of domestic and foreign military occupational stress research and measurement, this study puts forward a military occupational stress structure diagram, shown in Figure 1.

### 2.2. Scale question bank preparation

On the basis of the literature review, military stress events were investigated and in-depth interviews were conducted to establish a database of military occupational stress events. In the previous stage of the prediction scale preparation, 22 officers and soldiers (15 men and 7 women and 9 officers and 13 soldiers) were selected using the convenience sampling method for interviews. The entries and sentences of related stressors were extracted from the stress event



database and compiled based on the occupational stress structure of the military inside and outside of the military.

### 2.3. Objectives

A total of 847 soldiers were selected to test the scale, and 670 subjects were retained after cleaning and screening according to the standards set in the previous stage. Among them, 335 were randomly selected for exploratory factor analysis (EFA) (sample 1 data), and 335 were randomly selected for confirmatory factor analysis (sample 2 data). According to the data cleaning and screening criteria, subjects with response times of <500 s and those who answered linearly and regularly were excluded.

#### 2.3.1. Sample 1

A total of 335 subjects were included in sample 1. This data included information on the age of personnel, ranging from between 17 and 42 years ( $22.97 \pm 4.263$  years), and the length of military service, which ranged from 1 to 24 years ( $1.10 \pm 0.294$  years). The sample included 303 men (90.4%) and 32 women (9.6%) who were divided into the following groups: conscripts, noncommissioned officers, and officers, of which two did not fill in the category of rank. There were 161 conscripts (48.1%), 126 non-commissioned officers (37.6%), and 46 officers (13.7%). Their education level were divided into the following five categories: junior high school, senior high school, junior college, bachelor's degree, and master's degree or above, among which five people did not fill in the education level category. There were 43 junior high school students (12.8%), 158 senior high school students (47.2%), 73 junior college students (21.8%), 52 undergraduate students (15.5%), and 4 students with master's degrees or above (1.2%).

#### 2.3.2. Sample 2

Sample 2 included 335 subjects, including data on the age range of the personnel, which ranged between 17 and 34 years ( $22.69 \pm$



TABLE 1 Analysis of the characteristics of each item in the scale.

Item	Minimum	Maximum	Average	SD	Frequency				<i>t</i>	<i>r</i>
					0	1	2	3		
R1	0	3	1.46	0.79	42	117	156	20	13.277	0.596***
R2	0	3	0.99	0.79	99	147	83	6	17.899	0.716***
R3	0	3	0.94	0.81	112	141	73	9	13.931	0.644***
R4	0	3	0.85	0.81	132	129	67	7	18.687	0.736***
R5	0	3	0.85	0.81	129	135	62	9	15.735	0.669***
R6	0	3	1.04	0.85	104	125	95	11	17.110	0.708***
R7	0	3	1.47	0.84	51	101	157	26	10.728	0.551***
R8	0	3	0.57	0.74	191	100	41	3	14.283	0.675***
R9	0	3	0.51	0.68	199	102	33	1	15.723	0.690***
R10	0	3	0.39	0.61	224	93	16	2	14.301	0.692***
R11	0	2	0.51	0.71	205	88	42	0	17.586	0.710***
R12	0	2	0.48	0.66	205	99	31	0	19.396	0.711***
R13	0	3	0.51	0.72	207	86	41	1	17.596	0.698***
R14	0	3	0.90	0.97	156	74	87	18	9.562	0.489***
R15	0	3	0.79	0.79	142	124	65	4	12.420	0.614***
R16	0	3	1.04	0.81	97	137	93	8	10.947	0.560***
R17	0	3	1.57	0.88	54	72	174	35	7.541	0.399***

\*\*\**p* < 0.001.

TABLE 2 KMO and Bartlett's test.

Kaiser–Meyer–Olkin measure of sampling adequacy		0.918
Bartlett's test of sphericity	Approximate Chi-square ( $\chi^2$ )	2,817.855
	Df	136.000
	Sig.	0.000

3.412 years) and the length of military service, which was between 1 and 15 years ( $3.87 \pm 3.354$  years). There were 289 men (86.3%) and 46 women (13.7%) whose grades were categorized into conscripts, non-commissioned officers, and officers, one of which did not fill in the grade category. There were 178 conscripts (53.1%), 118 non-commissioned officers (35.2%), and 38 officers (11.3%). Their education levels were divided into the following five categories: junior high school, senior high school, junior college, bachelor's degree, and master's degree or above. There were 42 junior high school students (12.5%), 154 senior high school students (46.0%), 95 junior college students (28.4%), 40 undergraduate students (11.9%), and 4 students with master's degrees or above (1.2%).

### 3. Procedure

The effects of the occupational stress response were divided into physiological response, psychological response, and behavioral response. The items of the occupational stress response scale for military personnel were chosen as follows: some occupational stress response items were taken from existing theoretical research literature; items from existing stress response scales that were suitable

for the actual situation of the military arms were extracted or rewritten appropriately; and items were developed according to the results of the interview outline.

Microsoft Excel was used for data entry. After data entry, Statistical Package for the Social Sciences (SPSS) version 28.0 (IBM) was used to manage, describe, statistically analyze, and project the data of sample 1, and EFA was conducted. The confirmatory factor analysis was performed on the data of sample 2 using Mplus8.3.

### 4. Results

The scale was set to four points from 0 to 3. The higher the score, the greater the pressure value. There was no reversal clause. Descriptive statistical analysis was used to analyze the items in terms of minimum and maximum, average, standard deviation, kurtosis, and skewness.

As shown in Table 1, except for R11 and R12, the minimum and maximum values of the items were 0 and 3, respectively, which indicates that the questionnaire has a good range of items. On the concentration trend, the average value of the items was between 0.39 and 1.57; on the discrete trend, the standard deviation was between 0.609 and 0.966. According to correlation analysis, the correlation between the items and the total score was between 0.399 and 0.716, which met the requirements. According to the independent sample *t*-test, the decision value of each item was between 7.541 and 19.396, which is higher than 3 and meets the requirements.

As shown in Table 2, after performing the KMO and Bartlett's test at a *p*-value of < 0.01, the difference was extremely significant, with a KMO value of 0.918, close to 1, allowing for PCA.

Table 3 is designed to measure the correlation of the terms in the 3 components. Component 1 is the physiological response, component 2 is the psychological response, and component 3 is the behavioral response.

Confirmatory factor analysis showed that  $\chi^2 = 2.247$ , root mean square error of approximation (RMSEA) = 0.061, 95% confidence interval (CI) (0.051–0.071), comparative fit index (CFI) = 0.942, Tucker–Lewis index (TLI) = 0.932, standardized root mean square residual (SRMR) = 0.048, and model fit indicators have a good fit, indicating that the Military Occupational Stress Response Scale (MOSRS) has good structural validity.

As shown in Table 4, the average variance extracted (AVE) values of psychological and behavioral responses are not higher than the critical standard of 0.50. However, the composite reliability (CR) values were all higher than 0.70, which indicates good convergence validity.

As shown in Table 5, the correlation coefficient between the dimensions was between 0.389 and 0.607, and the square root of AVE was higher than the correlation coefficient between dimensions, which indicates that it has good discriminant validity.

As shown in Table 6, The Cronbach's  $\alpha$  coefficient of the dimension scale was between 0.710 and 0.900, and the Omega reliability was between 0.714 and 0.898, which are all higher than the critical standard of 0.7, indicating that the scale has good reliability.

## 5. Discussion

In this study, the factor structure of a new scale—the MOSRS—was explored through exploratory and confirmatory factor analyses. The results showed that the scale included the following three factors: a physiological response, a psychological response, and a behavioral response. Physiological responses mainly included physical symptoms and physical discomfort caused by occupational stress and were biased toward physiological and pathological symptoms. Psychological responses primarily included cognitive symptoms and negative emotions resulting from work stress, while behavioral responses mainly focused on behaviors and negative styles of coping with work stress.

PCA supported the three-factor model of the MOSRS and showed that the factor structure was clear and had high structural validity. The three-factor model was created based, in part, on the research of Schmitt (1987), who reported that the theoretical hypothesis should be considered in addition to any results obtained from the data when choosing the model type. In our study, all results including Cronbach's  $\alpha$  and Omega of the total scale, correlation, and discrimination validity were acceptable. Therefore, they may be used as effective indicators to measure occupational stress responses among military personnel.

TABLE 3 Rotated component matrix for principal components analysis (PCA) with varimax rotation of three-factor solution with 17 items ( $N = 335$ ).

Item	Component 1	Component 2	Component 3	Communalities
R1	0.152	<b>0.592</b>	0.253	0.437
R2	0.359	<b>0.673</b>	0.131	0.599
R3	0.259	<b>0.722</b>	0.022	0.589
R4	0.288	<b>0.719</b>	0.214	0.646
R5	0.265	<b>0.700</b>	0.112	0.573
R6	0.161	<b>0.771</b>	0.244	0.679
R7	0.111	<b>0.583</b>	0.216	0.399
R8	<b>0.780</b>	0.222	0.117	0.672
R9	<b>0.720</b>	0.340	0.062	0.638
R10	<b>0.812</b>	0.180	0.187	0.727
R11	<b>0.836</b>	0.222	0.131	0.766
R12	<b>0.823</b>	0.238	0.126	0.749
R13	<b>0.740</b>	0.263	0.173	0.647
R14	0.132	0.203	<b>0.583</b>	0.399
R15	0.385	0.172	<b>0.613</b>	0.554
R16	0.171	0.205	<b>0.736</b>	0.613
R17	−0.015	0.123	<b>0.706</b>	0.514
Eigenvalue	7.167	1.762	1.272	
Sums of squared loadings	42.16%	52.52%	60.01%	

The meaning of the bold values mean terms related to the factors.

TABLE 4 Confirmatory factor analysis of the military occupational stress response scale (MOSRS).

Item	Loading	SE	Z	p	Standardized factor loading	CR	AVE
<b>Psychological</b>						0.858	0.465
R1	1	–	–	–	0.678		
R2	1.163	0.095	12.185	<0.001	0.758		
R3	1.096	0.097	11.263	<0.001	0.685		
R4	1.102	0.099	11.116	<0.001	0.697		
R5	1.066	0.097	11.032	<0.001	0.687		
R6	1.137	0.102	11.202	<0.001	0.704		
R7	0.846	0.093	9.069	<0.001	0.546		
<b>Physiological</b>						0.890	0.578
R8	1	–	–	–	0.635		
R9	1.100	0.100	10.983	<0.001	0.692		
R10	0.983	0.091	10.808	<0.001	0.685		
R11	1.354	0.109	12.379	<0.001	0.834		
R12	1.362	0.107	12.774	<0.001	0.878		
R13	1.370	0.113	12.118	<0.001	0.806		
<b>Behavioral</b>							
R14	1	–	–	–	0.563	0.723	0.401
R15	0.944	0.110	8.545	<0.001	0.686		
R16	1.117	0.137	8.178	<0.001	0.754		
R17	0.667	0.102	6.513	<0.001	0.499		

SE, standard error; CR, composite reliability; AVE, average variance extracted.

TABLE 5 Analysis of correlation and discriminant validity of each dimension.

Factor	Mean	SD	Psychological	Physiological	Behavioral
Psychological	1.200	0.620	<b>0.682</b>		
Physiological	0.570	0.600	0.607***	<b>0.760</b>	
Behavioral	1.210	0.650	0.474***	0.389***	<b>0.633</b>

\*\*\* $p < 0.001$ . SD, standard deviation.

The meaning of the bold values mean the square root of AVE.

In the past, stress scales for soldiers have focused on external stressors including events and effects in the environment rather than on subjective and internal feelings (Fevre et al., 2017; Wang et al., 2018), such as one's work environment, marriage, and relationships with family and friends. In comparison, the scale we developed focuses solely on the stress response. However, this scale can be used separately and together with other stressor scales for a comprehensive assessment of military occupational stress. Richard and Susan (1984) believed that one of the key parts of an individual's response to a stressful event is "cognitive evaluation" (Vallerand and Reid, 1984), which is partly dependent on an individual's assessment of his/her ability to respond to the event themselves (Lazarus, 2014). The "black box" that lies between stressors and stressful feelings is known as cognitive evaluation, which ultimately influences an individual's response to stress, together with stressful feelings. It ignores individual differences in the stress response and individual and situational factors and only measures military occupational stressors. The MOSRS proposed in our study differs

TABLE 6 Reliability analysis of each dimension.

Factor	N	Cronbach $\alpha$	Omega	Split-half
Psychological	7	0.856	0.856	0.795
Physiological	6	0.889	0.890	0.840
Behavioral	4	0.710	0.714	0.653
Overall	17	0.900	0.898	0.810

from previous military occupational stress scales (Yao and Zhang, 2008; Luo et al., 2012b). In this study, the MOSRS scale was used to evaluate soldiers' responses to stress, that is, the subjective reaction that lies between being stimulated by a stressor and resulting in stressful feelings. The identification of these stress responses is the first step toward developing effective interventions to reduce the negative effects of stress on soldiers' military work performance.

Although the development of the scale has achieved good reliability and validity, which reflects occupational stressors and occupational stress responses, there are still some limitations of this study that we acknowledge and additional areas of research to be explored are as follows:

First, the subject group selected for this study was relatively homogenous, and only officers and soldiers of one military department participated. Hence, it is not known how generalizable our findings are to other populations. In the future, additional research using the MOSRS should be undertaken with other military arms and divisions to further evaluate the scale's value and effectiveness.

Second, after objectively and effectively evaluating the professional stresses faced by soldiers, measures should be taken to guide officers and soldiers in conducting effective stress management. Future studies, which are outside the scope of the current study, may develop military occupational stress assessment manuals and establish officers' and soldiers' occupational stress files, according to different occupational pressure levels. In addition, effective intervention measures may be implemented to maximize the potential of the military workforce in their careers, improve the officers' and soldiers' management of stress and their stress responses, and optimize their work performance and physical and mental health.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

- Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *J. Health Soc. Behav.* 24, 385–396. doi: 10.2307/2136404
- Fevre, M. L., Kolt, G. S., and Matheny, J. (2017). Eustress and distress: their interpretation in stress management interventions, and implications for research, practice, and education. *Food Chem. Toxicol. Int. J.* 47, 1703–1709.
- Greenberg, J. S. (2006). *Comprehensive Stress Management*. New York, NY: McGraw-Hill Humanities/Social Sciences/Languages.
- Kawakami, N., and Tsutsumi, A. (2010). Job stress and mental health among workers in Asia and the world. *J. Occup. Health* 52, 1–3. doi: 10.1539/joh.editorial1001
- Lazarus, R. S. (2014). Emotion and adaptation. *J. Nerv. Mental Dis.* 181, 17–23.
- Luo, X., Wang, Z., Yang, X., Wang, C., Yang, J., and Li, S. (2012a). Preparation and evaluation of the psychological stressor scale for servicemen in the Southern Theater Command. *Chin. J. Behav. Med. Brain Sci.* 21, 1042–1043.
- Luo, X., Wang, Z., Yang, X., Wang, C., Yang, J., and Li, S. (2012b). Compilation and evaluation of mental stressor scale for servicemen in South Theater. *Chin. J. Behav. Med. Brain Sci.* 21, 1042–1043.
- Osipow, S. H., and Spokane, A. R. (1998). *Occupational Stress Inventory-Revised*. Odessa, FL: Psychological 1–15.
- Richard, S. L., and Susan, F. (1984). *Stress Appraisal, and Coping*. Springer Publishing Company.
- Schmitt, T. A. (1987). Current methodological considerations in exploratory and confirmatory factor analysis. *J. Psychoeduc. Assess.* 29, 304–321. doi: 10.1177/0734282911406653
- Vallerand, R. J., and Reid, G. (1984). On the causal effects of perceived competence on intrinsic motivation: A test of cognitive evaluation theory. *J. Sport Psychol.* 6, 94–102. doi: 10.1123/jsp.6.1.94
- Wang, P., Xiong, Z., and Yang, H. (2018). Relationship of mental health, social support, and coping styles among graduate students: evidence from Chinese Universities. *Iranian J. Public Health* 47, 689.
- Yao, G., and Zhang, L. (2008). *The development of the occupational stress scale for military personnel*. Medical College of Jiangsu University.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

QW and ZY: conceptualization, methodology, software, investigation, formal analysis, and writing—original draft. RQ: data curation, visualization, and investigation. SC: resources and supervision. XZ: conceptualization, funding acquisition, resources, supervision, and writing—review and editing. ZH and WX: supervision and writing—review and editing. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# A within-person examination of the effect of mentors' daily ostracism on protégés' displaced aggression and in-role performance

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**Purpose:** Drawing on social information processing theory and social comparison theory, we test how mentors' daily ostracism triggers protégés' envy, thus leading to decreased in-role performance and increased displaced aggression.

**Design/methodology/approach:** Using an experience sampling study across three work weeks, the study provided theoretical and empirical examinations of dynamic, within-person processes related to mentors' ostracism.

**Findings:** Mentors' daily ostracism triggers protégés' envy, which mediates the effect of mentors' daily ostracism on protégés' displaced aggression and in-role performance. Our findings supported our hypothesis of the buffering effect of mentorship quality on the negative effect of mentors' ostracism on protégés' envy but did not show a significant moderating effect on the mediating effect of protégés' emotions between mentors' daily ostracism and protégés' behaviors.

**Research limitations/implications:** Our study focused on the victims of mentors' ostracism on a daily basis. We constructed an overarching theoretical model to investigate how, why, and when mentors' daily ostracism leads to protégés' emotional and behavioral variability.

**Practical implications:** The study provided how to cope with ostracism and envy.

**Originality/value:** We discuss the theoretical implications of our findings for research on mentors' ostracism, protégés' emotions, and protégés' behaviors.

## KEYWORDS

mentors' ostracism, envy, displaced aggression, in-role performance, mentorship quality, experience sampling methodology

## Introduction

Ongoing ostracism is a painful and common experience (Li et al., 2021b). Studies have explored general ostracism in the workplace that does not involve specific perpetrators (e.g., Howard et al., 2020; Wu et al., 2021) and particular types such as family ostracism (e.g., Ye et al., 2021). However, the perpetration of ostracism by mentors in the workplace remains underexplored. Mentors play an important role for employees and are central to training and career development programs (Allen et al., 2017). Protégés typically choose respected superiors as their mentors (Wu et al., 2019). Mentors may ostracize their protégés as punishment, which increases their sense of dominance in social exchanges (Zhong and Robinson, 2021), and the



emotional and behavioral consequences can be devastating. Thus, we define mentors' ostracism as the extent to which the protégés perceive themselves to be excluded, rejected, or ignored by their mentors. Protégés can be excluded from social connections with their mentors, such as being shut out of conversations or having their greetings ignored, or their mentors may avoid making eye contact with them (Ferris et al., 2008).

However, this issue has received comparatively little research attention. Ostracism can be viewed as a kind of social death and can significantly influence individuals' attitudes, well-being, and behavior (Li et al., 2021b), so the lack of research into protégés' responses is surprising. Mentors may ostracize protégés when they are having a bad day or are busy, or when their protégés do not complete a critical assignment, but protégés may simply perceive that ostracism occurs if they are sensitive to negative stimuli (Ferris et al., 2016). Our research is therefore valuable, and we explore how protégés encode and interpret mentors' ostracism as unfavorable social comparison information and how they interact with their mentors, in terms of their emotional perceptions (i.e., envy), and the behavioral consequences (i.e., displaced aggression and in-role performance).

Social information processing theory provides a framework for our study (Salancik and Pfeffer, 1978). Protégés can rely on informational cues from mentors to confirm their cognitive and behavioral responses through social interactions, which result from information processing and are affected by social information. Displaced aggression can then be a consequence, and can occur when frustrated individuals cannot directly focus their anger on the source of frustration, or if they have no opportunity to do so (Liu et al., 2015; Poon et al., 2020). Mentors possess more resources and skills than their protégés and are of higher status, so protégés will aim to win their support (Ghosh, 2014). Those frustrated by mentors' daily ostracism may redirect their aggression toward innocent individuals. Ostracized protégés are more likely to find themselves disadvantaged and may unwillingly have to regulate their aggressive impulses, which can lead to further aggressive behavior. Thus, mentors' ostracism can trigger displaced aggression in their protégés (Liu et al., 2015). This displaced aggression then becomes a compensatory behavioral choice for protégés in response to such ostracism. We also focus on in-role performance, defined as the effectiveness in successfully completing tasks and fulfilling responsibilities (Kwan et al., 2022b). Mistreatment has been found to interfere with employee performance (Foulek and Lanaj, 2021), and we hypothesize that ostracism may reduce in-role performance when protégés attempt to change the negative condition of being ostracized by mentors. The need to process information in response to mistreatment can lead to this drop in performance (Lemerise and Arsenio, 2000).

Envy has traditionally been explored from the perspectives of social comparison and social functioning (e.g., Koopman et al., 2020), but no studies explore how mentors' ostracism triggers protégés' envy in the social information process. Information that serves a social function can lead to emotional responses (Lemerise and Arsenio, 2000). We combine the theories of social information processing and social comparison (Festinger, 1954), and propose that protégés' envy has a mediating effect. Envy is an emotion that is often triggered through painful social comparison experiences and is associated with inferiority, hostility, and resentment (Smith and Kim, 2007; Lange et al., 2018; Li et al., 2021a). Envy arises "when a person lacks another's superior quality, achievement, or possession and either desires it or wishes that the other lacked it" (Parrott and Smith, 1993: 906). Ostracism by mentors can trigger unfavorable social comparisons and

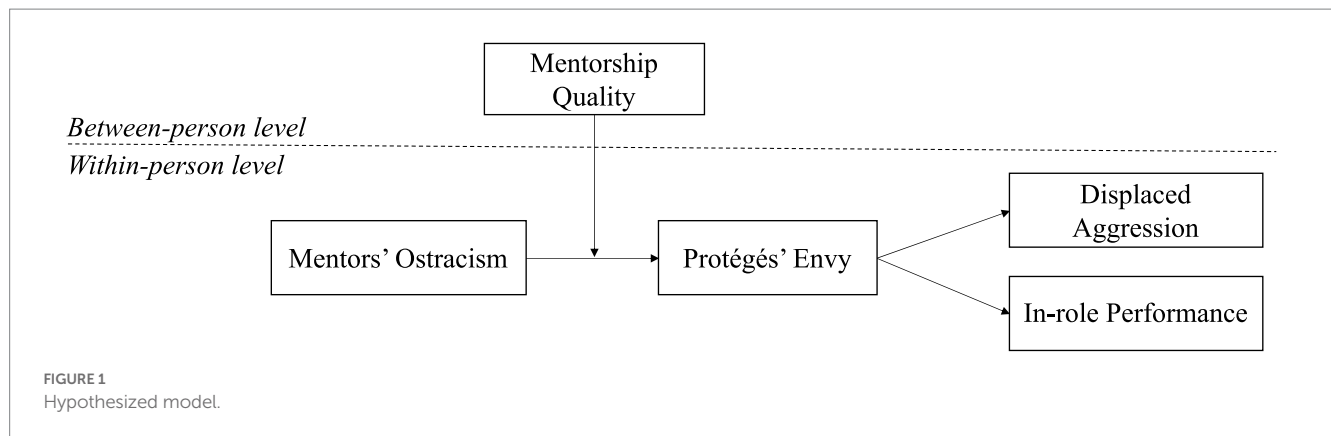
signals accompanying unfavorable information. Thus, we propose that mentors' ostracism provides an aversive informational cue to protégés and triggers more envy, and can include components such as frustration and pain (Lange et al., 2018). Mentors' ostracism is painful for protégés because it represents a denial of their needs, leading to them feel inferior and resentful.

In terms of boundary conditions, mentorship quality determines how effective mentoring is, in terms of the benefits that protégés gain from being mentored and their satisfaction with the relationship (Allen et al., 2017). High-quality mentorship increases mutual trust and information exchange, which are important when processing and interpreting information, and reduces the likelihood that envy or workplace behaviors (i.e., in-role performance and displaced aggression) will emerge. Mentorship quality also influences how social information is interpreted. Based on social comparison theory, we suggest that good-quality mentorship provides opportunities to confirm information about social comparison processes (Greenberg et al., 2007). Mentorship quality can then be considered a trade-off on the benefits and costs of dyadic relationship between mentors and protégés, and if ostracism occurs on a daily basis, its effect on protégés' emotions will be moderated.

The paper makes several contributions to research into mentorship, ostracism, envy, aggression, and performance (see Figure 1). First, we assess protégés who are ostracized by their mentors on a daily basis in terms of their processing of social information. We draw on the theories of social information processing and social comparison, and suggest that mentors' ostracism is a signal of potentially unflattering or damaging social information, which influences how protégés' encode and interpret it. "Daily experience sampling methods are ideal for capturing processes that change quickly" (Allen et al., 2017, p. 332), in addition to informing a detailed understanding of the interpersonal dynamics in the mentoring relationship. We thus provide novel evidence in the mentoring literature (Lanaj and Jennings, 2020). Second, ours is the first study to empirically investigate whether mentors' daily ostracism can lead to envy and negative behavior in protégés (i.e., reduced in-role performance and displaced aggression) using a within-person approach. We extend the literature by revealing the complex emotional state that can lead to envy after social information is received (Duffy et al., 2021; Li et al., 2021a). Third, we consider mentorship quality when examining the direct effects of ostracism on protégés and its indirect effects on their behavior *via* their envy. Thus, we contribute to the mentorship literature by demonstrating that the emotional and behavioral consequences of ostracism do not occur in a vacuum, but are affected by the mentor-protégé relationship, thus highlighting the importance of mentorship quality. We examine the daily effects of mentors' ostracism on the emotional and behavioral responses of their protégés when processing social information.

## Hypothesis development

Social information processing theory emphasizes that social information is affected by the context and consequences of past choices, in which behavior is considered in terms of what others think (Salancik and Pfeffer, 1978). Social information processing involves five steps that occur in response to a social situation cue before a behavioral response is made: encoding (e.g., figuring out what



happened); interpretation/representation (e.g., questioning why it happened—by accident or deliberately); a response search (e.g., evaluating the situation); a response decision (e.g., balancing the benefits and costs); and enactment following the accepted model of social behavior (Crick and Dodge, 1994).

Ostracism can be regarded as nonverbal information and can occur if a mentor does not engage with a protégé when it is socially appropriate to do so. Protégés may then perceive this as negative social information, which can lead to painful emotions and destructive behaviors.

## Mentors' ostracism, protégés' envy, displaced aggression, and in-role performance

Unfavorable social comparison information can lead individuals to consider what they lack relative to superior others (Duffy et al., 2012). Envy is a painful form of upward social comparison, and avoiding pain is a fundamental human drive (Tai et al., 2012). If protégés are hurt by the ostracism of their mentors they can become envious, as this unfavorable social comparison information focuses the attention of protégés on the discrepancy between mentors' superiority and their own inferiority. Ostracism can occur even if from the mentors' perspective there is no malicious intention, as it can still threaten protégés' sense of control (Williams, 2009), and the emotion of envy can then emerge (Crusius et al., 2020). Mentors' ostracism can influence protégés' perceptions of a situation and how they attribute meaning to it (Lemerise and Arsenio, 2000), thus increasing their awareness of discrepancies in mentoring. As a form of interpersonal mistreatment, ostracism can replace respect and propriety in dyadic communications. Protégés perceive mentors' ostracism as signaling a discrepancy between their actual state and their expectations of support, leaving them open to negative emotions and feelings of envy. As an input in the processing of social information, ostracism can be a stimulus that individuals become sensitive to (Yang and Treadway, 2018). Protégés then perceive the mistreatment that they are subject to and will be aware of the discrepancy, leading to increased envy (Koopman et al., 2020).

In terms of social information processing theory, ostracized protégés can be viewed as experiencing a lack of resources and information, because their mentors are more experienced and have more advantages in the workplace. They can then experience losses of career-related and psychosocial support from their mentors (Allen

et al., 2017), which can trigger resentment and inferiority and consequently increase the feeling of envy (Smith and Kim, 2007). Ostracized protégés may be hurt by their mentors' silence and are likely to experience negative emotions (Ferris et al., 2016) that can include envy. In social terms, ostracism suggests the denial of protégés' needs, implying that it hinders access to information. Such information may signal better strategies for success, and if individuals lack information that is useful for gaining advantages, they are likely to experience envy (Koopman et al., 2020). Mentors' daily ostracism is ongoing, dynamic, and time-dependent, and varies for the fluctuating situational factors on a daily basis. Thus, we propose the following:

*Hypothesis 1: Mentors' daily ostracism is positively related to protégés' envy.*

Envy is a self-referential emotion that can emerge through upward social comparisons (Crusius et al., 2020). Ostracized protégés may feel that they do not deserve their mentors' support, and can lose their sense of control when encoding and reasoning their mentors' ostracism through nonverbal social information processing. They may then be motivated to assert their superiority by being aggressive toward inferiors (i.e., engaging in displaced aggression) or disengaging from their work, thus decreasing their in-role performance. Envy is a painful emotion accompanied by other negative affective components, such as a sense of inferiority and frustration (Lange et al., 2018). The frustration-aggression hypothesis suggests that frustration may impel an individual to vent their aggression on others (Poon et al., 2020). Protégés who are ostracized by their mentors may then release their negative emotions by being aggressive toward innocent colleagues.

Displaced aggression is a form of behavior associated with negative emotions (e.g., Liu et al., 2015). Protégés who exhibit displaced aggression may be seeking to fulfill their psychological needs, through effectively interacting with the environment and compensating for their perceived lack of competence. Envy in protégés can be provoked by their mentors' ostracism, but as they are prevented from retaliating against the source of the provocation (their mentors) they may subsequently be aggressive toward innocent targets. This lack of a direct focus can then lead to displaced aggression, which can satisfy their psychological needs. Protégés suppress their impulse for revenge against their mentors because they require a mutual and reciprocal relationship and expect long-term mentoring support. Thus, envious protégés reason on and interpret the information that

lies behind their mentors' ostracism and balance the cost of targeting innocent others, leading to displaced aggression.

In-role performance is the effective performance of formally prescribed job responsibilities (Kwan et al., 2022a). Mentors' ostracism induces a negative psychological state in protégés, which makes them feel inferior and less confident at work, thus reducing their in-role performance (Li et al., 2021a). According to social information processing theory, envy is present within an individual's impulsive system. Thus, it can be a response to mentors' ostracism when encoding information and can emerge in the negative emotional state resulting from being ostracized, which triggers displaced aggression and reduces in-role performance. Thus, we propose the following:

*Hypothesis 2:* Protégés' envy mediates the positive relationship between mentors' daily ostracism and protégés' displaced aggression.

*Hypothesis 3:* Protégés' envy mediates the negative relationship between mentors' daily ostracism and protégés' in-role performance.

## The cross-level moderating effect of mentorship quality

Mentorship quality is defined in social information processing theory as "an overall evaluation of the mutual benefit of and satisfaction with the relationship" (Kwan et al., 2022a, p. 350), and can thus alleviate the effect of ostracism on protégés' envy through three channels. First, high-quality mentorship increases the access that protégés have to social information by maintaining a positive and significant interpersonal relationship with their mentors (Yang and Treadway, 2018). To maintain high-quality mentorship, ostracized protégés suppress their negative emotions and actions. In contrast, low-quality mentorship makes protégés more susceptible to ostracism and in turn more likely to be envious. Second, protégés who receive high-quality mentorship have a mutually respectful, trusting, and loyal relationship with their mentors. A positive and healthy workplace environment can buffer the destructive effect of ostracism on protégés' emotional and behavioral responses. Third, high-quality mentorship enables protégés to proactively acquire social information, such as the performance pressure or anxiety felt by their mentors, leading to increased understanding and tolerance of any ostracism. The high quality of the mentorship leads them to seek excuses for the ostracism and suppress their envy, mitigating the negative consequences of the resulting discrepancy (Koopman et al., 2020). Thus, we propose the following:

*Hypothesis 4:* The relationship between mentors' daily ostracism and protégés' envy is stronger when mentorship quality is low (vs. high).

The buffering effect of mentorship quality on the relationship between mentors' ostracism and protégés' envy can emerge, and can further trigger increased displaced aggression and decreased in-role performance. Drawing on Edwards and Lambert's (2007) moderated mediation procedure and the theoretical arguments presented in

Hypotheses 1–4 we build a moderated mediation model with the following hypotheses:

*Hypothesis 5a:* The relationship between mentors' daily ostracism and protégés' displaced aggression via protégés' envy is stronger when mentorship quality is low (vs. high).

*Hypothesis 5b:* The relationship between mentors' daily ostracism and protégés' in-role performance via protégés' envy is stronger when mentorship quality is low (vs. high).

## Methods

### Participants and procedures

To test our model, we conducted a study using an experience sampling methodology (ESM) as recommended by Fisher and To (2012), that provided theoretical and empirical examinations of dynamic, within-person processes related to mentors' ostracism. The data were collected in an electronics factory located in Xiamen, Fujian Province, China. Four assistants helped us to collect daily data and 70 frontline workers initially took part in our survey. They worked with their mentors almost every day and most of them had been with the company for less than 2 years, and thus they needed their mentors' help to ensure that their productivity was satisfactory. All of the participants were assured that their information would be kept confidential. They were surveyed 3 times daily on 10 consecutive workdays, and were informed that rewards would be given randomly every day and that they would earn up to 100 yuan after they completed the daily surveys.

The survey took place over 3 weeks. In the first week, we collected demographic information and mentorship quality data from the 70 frontline workers. The daily portion of the study was conducted for 10 consecutive workdays over the following 2 weeks. The study involved three surveys per day: the first in the morning (7:00 a.m. to 9:00 a.m.); the second in the afternoon (3:00 p.m. to 5:00 p.m.); and the third in the evening after they left work (7:00 p.m. to 9:00 p.m.). The morning survey assessed mentor ostracism, and the control variables were positive and negative affect. The afternoon survey assessed protégés' envy. The evening survey assessed in-role performance and displaced aggression. Of the 70 protégés who opted in, 55 completed the survey for at least 3 full days (i.e., morning, afternoon, and evening surveys), and thus comprised the final sample (78.57% retained). Most participants were male (60.0%), and more than 90% had a bachelor's degree or higher.

### Level-2 measure

#### Mentorship quality

The protégés rated mentorship quality on a 5-item scale originally developed by Allen and Eby (2003) and later applied in a Chinese setting by Kwan et al. (2011). A sample item is "The mentoring quality between my mentor and me is very effective." Cronbach's alpha was 0.93. All responses were on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree).

## Level-1 measures

Although the key measures were originally developed in English, we used a Chinese version for in-role performance. For the other measures, one author translated the English items into Chinese and another back-translated the Chinese items into English. All of the key wordings remained in the back-translation.

### Mentors' daily ostracism (morning)

The protégés rated mentors' ostracism with a 10-item scale adapted from Ferris et al. (2008). A sample item is "Today, my mentor ignored me at work." Cronbach's alpha was 0.96.

### Protégés' daily envy (afternoon)

The protégés rated envy using a 5-item scale adapted from Vecchio (2005), and based on the general concept of envy (Li et al., 2021a). A sample item is "I do not know why, but I seem to be the underdog at work." Cronbach's alpha was 0.91.

### Daily in-role performance (afternoon)

The protégés rated daily in-role performance using the 5-item scale originally developed by Williams (1988) and later applied by Kwan et al. (2022a) to a Chinese context. A sample item is "Today, I fulfilled the responsibilities specified in my job description." Cronbach's alpha was 0.94.

### Daily displaced aggression (evening)

The protégés rated their displaced aggression using the 8-item scale originally developed by Denson et al. (2006) and subsequently modified by Liu et al. (2015). A sample item is "When someone or something makes me angry, I am likely to take it out on another person." Cronbach's alpha was 0.96.

### Control variables

We considered several control variables. First, we controlled positive affect and negative affect, as measured with a scale developed by Watson et al. (1988), because these are closely related to envy and being envied (Lee et al., 2018). Cronbach's alpha was 0.96 for both positive and negative affect. Second, we controlled gender, which was coded as 1 for male and 2 for female. A meta-analytic review revealed that gender is significantly related to ostracism, and that males report more ostracism (Howard et al., 2020).

## Analytic approach

Given the multilevel structure of our data (days and people), we applied multilevel path analysis in Mplus 7.4 to test the hypothesized relationships. First, we verified that there was sufficient within-individual variability to justify a multilevel analysis, as the percentages of total variance ranged from 0.26 to 0.48 (e.g., Podsakoff et al., 2019; Puranik et al., 2019). We then proceeded to conduct a multilevel path analysis, and simultaneously modeled all of the variables in Figure 1.

Second, we centered the predictors both within and between individuals. The within-individual predictors were group-mean centered, and the between-individual predictors grand-mean centered (e.g., Lanaj et al., 2021), which enabled us to study within-individual

relationships by controlling for between-individual confounders (Dimotakis et al., 2011). All of the within-individual relationships were modeled as random slopes and control variables with fixed slopes to reduce model complexity (e.g., Lanaj et al., 2021). To test the moderation effect, we centered mentorship quality by the grand mean and calculated the product of mentors' ostracism and mentorship quality.

Third, we tested the indirect effects and used a bootstrap procedure with 20,000 iterations to estimate the bias-corrected confidence intervals (CIs) for each indirect effect based on the Monte Carlo method, to assess the mediation effect (Preacher and Selig, 2012). Finally, to confirm our hypothesized conditional indirect effect of mentor ostracism on protégés' daily displaced aggression *via* their emotions (i.e., envy and being envied), we checked the significance of the difference in this indirect effect at higher and lower levels of mentorship quality (+/− SD; Hayes, 2015).

## Results

In Table 1, we report the means, standard deviations, and correlations of the variables. Before testing the hypotheses, we ran a multilevel confirmatory factor analysis of the five focal variables shown in Figure 1 (mentors' ostracism, protégés' envy, displaced aggression, in-role performance, and mentorship quality). The theoretical model exhibited good fit,  $\chi^2(188) = 358.863$ ,  $p < 0.01$ ; CFI = 0.969; TLI = 0.960; RMSEA = 0.042; SRMR<sub>within</sub> = 0.032; SRMR<sub>between</sub> = 0.036, supporting the construct distinctiveness of our variables.

In Hypothesis 1 we proposed that mentors' daily ostracism is positively related to protégés' envy, as in Table 2 ( $\gamma = 0.14$ ,  $p < 0.01$ ). We further proposed that their envy is negatively related to daily in-role performance ( $\gamma = -0.13$ ,  $p < 0.01$ ) and positively related to daily displaced aggression ( $\gamma = 0.14$ ,  $p < 0.01$ ). Hypotheses 2 and 3 proposed the mediating effect of protégés' envy. The results show that mentors' ostracism was positively associated with daily displaced aggression *via* protégés' envy (estimate = 0.045, 95% CI [0.0174, 0.0766]) and mentors' ostracism was negatively associated with daily in-role performance *via* protégés' envy (estimate = −0.043, 95% CI [−0.0767, −0.0146]). Thus, Hypotheses 2 and 3 were supported.

We examined whether mentorship quality, as a between-level variable, would moderate the within-individual direct effect of mentors' ostracism and protégés' emotions, and the indirect effect of ostracism on protégé behavior through their emotions. Mentorship quality had a cross-level buffering moderating effect on the relationship between mentors' ostracism and protégés' envy ( $b = -0.16$ ,  $p < 0.01$ ). Figure 2 also shows the significance of the moderating effect, thus supporting Hypotheses 4.

The indirect effect of mentors' ostracism on daily displaced aggression *via* protégés' envy was significant at higher levels of mentorship quality (estimate: 0.022; 95% CI [0.0069, 0.0659]) and at lower levels (estimate: 0.039; 95% [0.0068, 0.0653]), which indicated no significant difference in the indirect effect (estimate: −0.017; 95% CI [−0.0710, 0.0098]). The same pattern emerged for the indirect effect of mentors' ostracism on in-role performance *via* protégés' envy. This effect was significant at higher levels of mentorship quality (estimate: −0.022; 95% CI [−0.0628, −0.0063]) and at lower levels (estimate: −0.039; 95% [−0.0631, −0.0062]), and so we found no significant difference in the indirect effect (estimate: 0.017; 95% CI



TABLE 1 Means, standard deviations, and correlations among variables.

	Mean	SD	1	2	3	4	5	6	7
<b>Level-1 variables</b>									
1 Positive affect	3.65	0.81	(0.96)						
2 Negative affect	2.13	0.87	−0.21**	(0.96)					
3 Mentors' ostracism	2.38	0.88	−0.14**	0.28**	(0.96)				
4 Protégés' envy	2.28	0.83	−0.14**	0.33**	0.23**	(0.91)			
5 Displaced aggression	1.98	0.84	−0.13**	0.32**	0.45**	0.30**	(0.96)		
6 In-role performance	3.82	0.80	0.19**	−0.21**	−0.02	−0.22**	−0.19**	(0.94)	
<b>Level-2 variables</b>									
7 Mentorship quality	3.50	0.60	0.70**	−0.43**	−0.17**	−0.40**	−0.43**	0.66**	(0.93)

Level-1  $n = 515$ ; level-2  $n = 55$ . Level-1 exogenous variables were centered at each person's mean.

\* $p < 0.05$ ; \*\* $p < 0.01$ .

TABLE 2 Multilevel path analysis results for the hypothesized model.

Predictor	Protégés' envy				Displaced aggression				In-role performance			
	$\gamma$	SE	$\gamma$	SE	$\gamma$	SE	$\gamma$	SE	$\gamma$	SE	$\gamma$	SE
Intercept	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02
<b>Level-1 predictors</b>												
1 Positive affect	−0.05	0.05	−0.09	0.05	−0.03	0.05	−0.04	0.05	0.15	0.04	0.14**	0.04
2 Negative affect	0.29**	0.05	0.27**	0.05	0.15**	0.04	0.15**	0.04	−0.12**	0.04	−0.12*	0.04
3 Mentors' ostracism	0.14**	0.04	0.16**	0.04	0.33**	0.04	0.34**	0.04	0.06	0.04	0.06	0.04
4 Protégés' envy					0.15**	0.04	0.14**	0.04	−0.14**	0.04	−0.13*	0.04
<b>Level-2 predictors</b>												
Mentorship quality			−0.04	0.03			−0.02	0.02			0.06**	0.02
<b>Cross-level moderator</b>												
Mentors' ostracism* mentorship quality			−0.16**	0.06			−0.08	0.05			−0.01	0.05

Level-1  $n = 515$ ; level-2  $n = 55$ . Level-1 exogenous variables were centered at each person's mean. SE, standard error. \* $p < 0.05$ . \*\* $p < 0.01$ .

[−0.0098, 0.0738]). Thus, the results did not support Hypotheses 5a and 5b.

## Discussion

### Theoretical implications

In this study, we focused on the victims of ostracism from mentors and empirically explored how this ostracism affects the envy and behavior of their protégés from their perspective. First, the effect of ostracism from mentors is underexplored, and ours is the first study to extend mentoring literature by applying a daily experience sampling method in researching its emotional and behavioral consequences within mentoring context, that responds the call for exploring emotional reaction to ostracism (Wang and Li, 2022). We draw on the theories of social information processing and social comparison, and focus on a specific type of workplace ostracism. We contribute to the conventional assumption that mentors are the perpetrators (Howard et al., 2020) by extending the research beyond supervisor ostracism (e.g., Kwan et al., 2018) and

family ostracism (e.g., Ye et al., 2021) to the consequences of daily ostracism from mentors.

Second, we contribute to research into envy in the workplace by exploring the mediating mechanism of protégés' envy by considering the meta-analytical review on empirical research of envy (Li et al., 2021a), which underlies the effect of mentors' daily ostracism on protégés' displaced aggression and in-role performance. Based on social information processing theory, this finding provides the first empirical support for the effect of envy on the relationship between mentors' ostracism and their protégés' behavior. Thus, we inform the understanding of how negative emotions (e.g., envy) are involved in the social information processing framework, leading to deviant behaviors in the workplace.

Third, we found that mentorship quality moderates the relationship between mentors' daily ostracism and protégés' envy, and has a stronger positive relationship for protégés experiencing lower-rather than higher-quality mentorship. These findings are consistent with research suggesting that the quality of leader-member exchange influences the emotion of envy (e.g., Vecchio, 2005; Li et al., 2021a). However, we did not find that mentorship quality moderates the indirect effect of mentors' daily ostracism



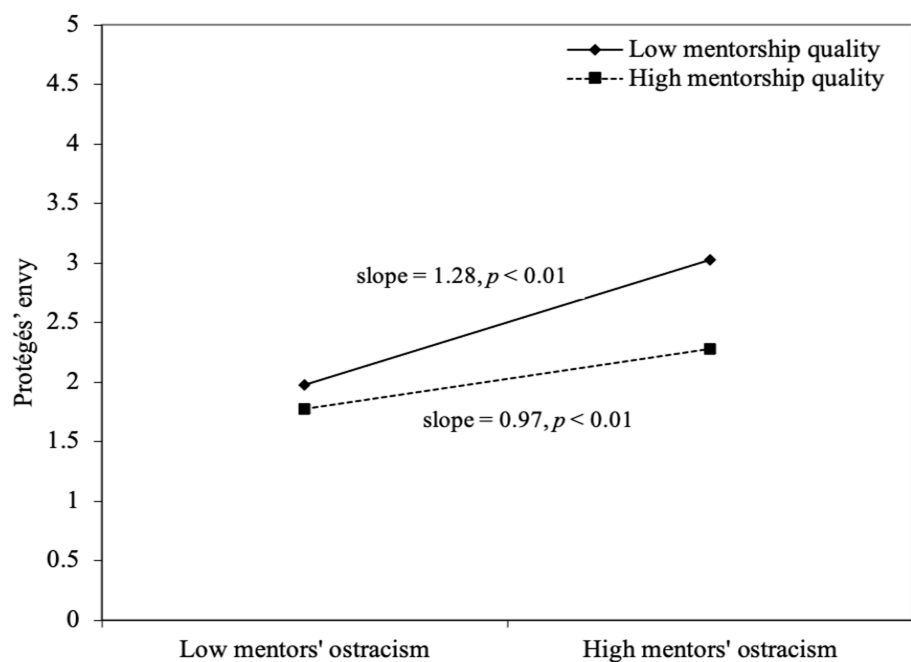


FIGURE 2  
Moderating effect of mentorship quality on mentors' ostracism and protégés' envy.

on protégé behavior through their envy. Other mediating factors may be moderated by mentorship quality, and further research should assess these when examining the relationships among mentorship quality, ostracism from mentors, and their protégés' behavior.

## Practical implications

Our finding that mentors' daily ostracism has a negative effect on protégés' envy and behavior (i.e., displaced aggression and in-role performance) has various implications. First, organizations should provide training programs for mentors and protégés to help them to build healthy and positive mentoring relationships (Hu et al., 2021), and should not condone the use of ostracism as a punishment. Mentors should keep in mind that ostracizing their protégés may negatively affect them and they should instead ensure that communication with their protégés is effective.

Second, envy is a negative emotion that can lead to undesirable behavior in the workplace and in life in general. Protégés should learn how to regulate their negative emotions rather than be consumed by them (Lee et al., 2018). Our research reveals that mentors' daily ostracism is highly likely to lead to envy in their protégés, so mentors should aim to alleviate such negative emotions by refraining from ostracizing their protégés. In addition, by ignoring such ostracism, protégés can focus more on their own performance at work. Various emotion regulation approaches can be taken to address feelings of envy, such as situation modification, attentional deployment, cognitive change, and response modulation.

Third, as we found that mentorship quality has a significant role in terms of ostracism and envy, organizations should attempt to

improve the quality of mentorship (Hu et al., 2021) to alleviate any envious feelings held by protégés. Transactional or socio-emotional viewpoints suggest that mentorship quality depends on both parties and requires effort from mentors and protégés.

## Limitations and directions for future research

This study has several limitations and potential directions for future research. First, our data were collected from the same source, leading to concerns about common method variance. Thus, our theoretical model can be tested using other sources, such as measuring ostracism from the perspective of mentors and displaced aggression from those of family members.

Second, our measure of ostracism may not be fully generalizable. We selected frontline workers in an electronics factory as our sample to ensure that mentors and protégés interacted on a daily basis and that there was variance in their daily behavior. Whether our findings can be generalized to other types of organizations (e.g., frontline employees in hospitality businesses) should be explored. Further research can thus be based on samples from various companies and industries. In terms of causal inference, we regarded ostracism that occurs in the morning as one broad interaction unit, but mentor-protégé dyads may experience various interactions with distinct levels of ostracism. Future research can apply an episodic design to capture the dynamics of mentors' ostracism.

Third, we only consider envy as the emotional mechanism, while other emotions may be involved. For example, ostracized protégés may feel anger or anxiety toward their mentors. Further research into

the emotional reactions that result from mentors' ostracism would be of benefit.

Fourth, we did not collect any data to capture the quality of the relationships between mentors and protégés on a daily basis. Future research should consider relationship quality and other control variables.

Finally, our study's sample size was small, and was limited to a single factory. We suggest that other research teams can extend our research by applying the theoretical model and the daily experience sampling method, which reflects variability on a daily basis, to better understand the effects of ostracism.

## Conclusion

Based on social information processing theory, we introduce a dynamic theoretical framework that extends mentoring literature by integrating theories of ostracism, envy, in-role performance, and displaced aggression as daily constructs. The study shows mentors' daily ostracism triggers protégés' envy, and subsequently leading to decreased in-role performance and increased displaced aggression. The study also shows that mentorship quality can lessen the effect of mentorship quality on protégés' envy. We hope that this study will open the door for more research on employees' behaviors and emotions at work on a day-to-day basis.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

- Allen, T. D., and Eby, L. T. (2003). Relationship effectiveness for mentors: factors associated with learning and quality. *J. Manage.* 29, 469–486. doi: 10.1016/s0149-2063\_03\_00021-7
- Allen, T. D., Eby, L. T., Chao, G. T., and Bauer, T. N. (2017). Taking stock of two relational aspects of organizational life: tracing the history and shaping the future of socialization and mentoring research. *J. Appl. Psychol.* 102, 324–337. doi: 10.1037/apl0000086
- Crick, N. R., and Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychol. Bull.* 115, 74–101. doi: 10.1037/0033-2909.115.1.74
- Crusius, J., Gonzalez, M. F., Lange, J., and Cohen-Charash, Y. (2020). Envy: an adversarial review and comparison of two competing views. *Emot. Rev.* 12, 3–21. doi: 10.1177/1754073919873131
- Denson, T. F., Pedersen, W. C., and Miller, N. (2006). The displaced aggression questionnaire. *J. Pers. Soc. Psychol.* 90, 1032–1051. doi: 10.1037/0022-3514.90.6.1032
- Dimotakis, N., Scott, B. A., and Koopman, J. (2011). An experience sampling investigation of workplace interactions, affective states, and employee well-being. *J. Organ. Behav.* 32, 572–588. doi: 10.1002/job.722
- Duffy, M. K., Lee, K., and Adair, E. A. (2021). Workplace envy. *Annu. Rev. Organ. Psych. Organ. Behav.* 8, 19–44. doi: 10.1146/annurev-orgpsych-012420-055746
- Duffy, M. K., Scott, K. L., Shaw, J. D., Tepper, B. J., and Aquino, K. (2012). A social context model of envy and social undermining. *Acad. Manage. J.* 55, 643–666. doi: 10.5465/amj.2009.0804
- Edwards, J. R., and Lambert, L. S. (2007). Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychol. Methods* 12, 1–22. doi: 10.1037/1082-989X.12.1.1
- Ferris, D. L., Brown, D. J., Berry, J. W., and Lian, H. (2008). The development and validation of the workplace ostracism scale. *J. Appl. Psychol.* 93, 1348–1366. doi: 10.1037/a0012743
- Ferris, D. L., Yan, M., Lim, V. K. G., Chen, Y. Y., and Fatimah, S. (2016). An approach-avoidance framework of workplace aggression. *Acad. Manage. J.* 59, 1777–1800. doi: 10.5465/amj.2014.0221
- Festinger, L. (1954). A theory of social comparison processes. *Hum. Relat.* 7, 117–140.
- Fisher, C. D., and To, M. L. (2012). Using experience sampling methodology in organizational behavior. *J. Organ. Behav.* 33, 865–877. doi: 10.1002/job.1803
- Foulk, T. A., and Lanaj, K. (2021). With great power comes more job demands: the dynamic effects of experienced power on perceived job demands and their discordant effects on employee outcomes. *J. Appl. Psychol.* 107, 263–278. doi: 10.1037/apl0000905
- Ghosh, R. (2014). Antecedents of mentoring support: a meta-analysis of individual, relational, and structural or organizational factors. *J. Vocat. Behav.* 84, 367–384. doi: 10.1016/j.jvb.2014.02.009
- Greenberg, J., Ashton-James, C. E., and Ashkanasy, N. M. (2007). Social comparison processes in organizations. *Organ. Behav. Hum. Decis. Process.* 102, 22–41. doi: 10.1016/j.obhdp.2006.09.006
- Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivar. Behav. Res.* 50, 1–22. doi: 10.1080/00273171.2014.962683
- Howard, M. C., Cogswell, J. E., and Smith, M. B. (2020). The antecedents and outcomes of workplace ostracism: a meta-analysis. *J. Appl. Psychol.* 105, 577–596. doi: 10.1037/apl0000453
- Hu, Y. L., Wang, M. M., Kwan, H. K., and Yi, J. (2021). Mentorship quality and mentors' work-to-family positive spillover: The mediating role of personal skill development and the moderating role of core self-evaluation. *Int. J. Hum. Resour. Man* 32, 1899–1922. doi: 10.1080/09585192.2019.1579244
- Koopman, J., Lin, S.-H., Lennard, A. C., Matta, F. K., and Johnson, R. E. (2020). My coworkers are treated more fairly than me! A self-regulatory perspective on justice social comparisons. *Acad. Manage. J.* 63, 857–880. doi: 10.5465/amj.2016.0586
- Kwan, H. K., Chen, H., and Chiu, R. K. (2022a). Effects of empowering leadership on followers' work-family interface. *Int. J. Hum. Resour. Manag.* 33, 1403–1436. doi: 10.1080/09585192.2020.1762701

## Ethics statement

The studies involving human participants were reviewed and approved by the Shanghai University of Engineering Science. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

ML and YQ are responsible for idea generation and conducted material preparation, data collection, and analysis. ML wrote the first draft. LW and YQ revised the manuscript. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Kwan, H. K., Li, M., Wu, X., and Xu, X. (2022b). The need to belong: how to reduce workplace ostracism. *Serv. Ind. J.* 42, 716–737. doi: 10.1080/02642069.2021.1873295
- Kwan, H. K., Liu, J., and Yim, F. H.-K. (2011). Effects of mentoring functions on receivers' organizational citizenship behavior in a Chinese context: A two-study investigation. *J. Bus. Res.* 64, 363–370. doi: 10.1016/j.jbusres.2010.04.003
- Kwan, H. K., Zhang, X., Liu, J., and Lee, C. (2018). Workplace ostracism and employee creativity: an integrative approach incorporating pragmatic and engagement roles. *J. Appl. Psychol.* 103, 1358–1366. doi: 10.1037/apl0000320
- Lanaj, K., Gabriel, A. S., and Chawla, N. (2021). The self-sacrificial nature of leader identity: understanding the costs and benefits at work and home. *J. Appl. Psychol.* 106, 345–363. doi: 10.1037/apl0000505
- Lanaj, K., and Jennings, R. E. (2020). Putting leaders in a bad mood: the affective costs of helping followers with personal problems. *J. Appl. Psychol.* 105, 355–371. doi: 10.1037/apl0000450
- Lange, J., Weidman, A. C., and Crusius, J. (2018). The painful duality of envy: evidence for an integrative theory and a meta-analysis on the relation of envy and schadenfreude. *J. Pers. Soc. Psychol.* 114, 572–598. doi: 10.1037/pspi0000118
- Lee, K., Duffy, M. K., Scott, K. L., and Schippers, M. C. (2018). The experience of being envied at work: how being envied shapes employee feelings and motivation. *Pers. Psychol.* 71, 181–200. doi: 10.1111/peps.12251
- Lemerise, E. A., and Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Dev.* 71, 107–118. doi: 10.1111/1467-8624.00124
- Li, M., Xu, X., and Kwan, H. K. (2021a). The antecedents and consequences of workplace envy: a meta-analytic review. *Asia Pac. J. Manag.* 1–35. doi: 10.1007/s10490-021-09772-y
- Li, M., Xu, X., and Kwan, H. K. (2021b). Consequences of workplace ostracism: a meta-analytic review. *Front. Psychol.* 12, 1–14. doi: 10.3389/fpsyg.2021.641302
- Liu, Y., Wang, M., Chang, C. H., Shi, J., Zhou, L., and Shao, R. (2015). Work-family conflict, emotional exhaustion, and displaced aggression toward others: the moderating roles of workplace interpersonal conflict and perceived managerial family support. *J. Appl. Psychol.* 100, 793–808. doi: 10.1037/a0038387
- Parrott, W. G., and Smith, R. H. (1993). Distinguishing the experiences of envy and jealousy. *J. Pers. Soc. Psychol.* 64, 906–920. doi: 10.1037/0022-3514.64.6.906
- Poon, K.-T., Chen, Z., Teng, F., and Wong, W.-Y. (2020). The effect of objectification on aggression. *J. Exp. Soc. Psychol.* 87, 103940–103914. doi: 10.1016/j.jesp.2019.103940
- Preacher, K. J., and Selig, J. P. (2012). Advantages of Monte Carlo confidence intervals for indirect effects. *Commun. Methods Meas.* 6, 77–98. doi: 10.1080/19312458.2012.679848
- Podsakoff, N. P., Spoelma, T. M., Chawla, N., and Gabriel, A. S. (2019). What predicts within-person variance in applied psychology constructs? An empirical examination. *J. Appl. Psychol.* 104, 727–754. doi: 10.1037/apl0000374
- Puranik, H., Koopman, J., Vough, H. C., and Gamache, D. L. (2019). They want what I've got (I think): the causes and consequences of attributing coworker behavior to envy. *Acad. Manage. Rev.* 44, 424–449. doi: 10.5465/amr.2016.0191
- Salancik, G. R., and Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. *Adm. Sci. Q.* 23, 224–253. doi: 10.2307/2392563
- Smith, R. H., and Kim, S. H. (2007). Comprehending envy. *Psychol. Bull.* 133, 46–64. doi: 10.1037/0033-2909.133.1.46
- Tai, K., Narayanan, J., and McAllister, D. J. (2012). Envy as pain: rethinking the nature of envy and its implications for employees and organizations. *Acad. Manage. Rev.* 37, 107–129. doi: 10.5465/amr.2009.0484
- Vecchio, R. P. (2005). Explorations in employee envy: feeling envious and feeling envied. *Cognit. Emot.* 19, 69–81. doi: 10.1080/02699930441000148
- Wang, X., and Li, M. (2022). Hurting all the way: the emotional antecedent and consequence of social rejection. *Front. Psychol.* 13:885384. doi: 10.3389/fpsyg.2022.885384
- Watson, D., Clark, L. A., and Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *J. Pers. Soc. Psychol.* 54, 1063–1070. doi: 10.1037/0022-3514.54.6.1063
- Williams, L. J. (1988). *Affective and nonaffective components of job satisfaction and organizational commitment as determinants of organizational citizenship and in-role behaviors* Indiana University, Bloomington.
- Williams, K. D. (2009). "Ostracism: a temporal need-threat model" in *Advances in experimental social psychology*, Vol. 41, ed. M. P. Zanna (San Diego, CA: Elsevier Academic Press), 275–314.
- Wu, C. H., Kwan, H. K., Liu, J., and Lee, C. (2021). When and how favour rendering ameliorates workplace ostracism over time: moderating effect of self-monitoring and mediating effect of popularity enhancement. *J. Occup. Organ. Psychol.* 94, 107–131. doi: 10.1111/joop.12328
- Wu, X., Lyu, Y., Kwan, H. K., and Zhai, H. (2019). The impact of mentoring quality on protégés' organization-based self-esteem and proactive behavior: the moderating role of traditionality. *Hum. Resour. Manage.* 58, 417–430. doi: 10.1002/hrm.21968
- Yang, J., and Treadway, D. C. (2018). A social influence interpretation of workplace ostracism and counterproductive work behavior. *J. Bus. Ethics* 148, 879–891. doi: 10.1007/s10551-015-2912-x
- Ye, Y., Zhu, H., Chen, Y., Kwan, H. K., and Lyu, Y. (2021). Family ostracism and proactive customer service performance: an explanation from conservation of resources theory. *Asia Pac. J. Manag.* 38, 645–667. doi: 10.1007/s10490-019-09677-x
- Zhong, R., and Robinson, S. L. (2021). What happens to bad actors in organizations? A review of actor-centric outcomes of negative behavior. *J. Manage.* 47, 1430–1467. doi: 10.1177/0149206320976808



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# What are the predictors and costs of nurse absenteeism at select multicenter government hospitals? A cross-sectional study

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**Objectives:** The purposes of this study were to determine the prevalence and cost of absenteeism in nurses as well as the factors that affect absenteeism.

**Methods:** This is a cross sectional study where a self-administered questionnaire response were obtained from 442 nurses for the previous working in 4 hospitals and 3 primary health care centers in Saudi Arabia. Analyses compared those with zero absences with those with one or more absences per month. Attributable risk was calculated as the difference in the absence percentages among nurses with high-risk exposure and low risk exposure.

**Results:** The average absence of nurses is 0.62 days per month. This results in an annual loss of around \$4 million. The greatest absence frequency was significantly associated with work psychosocial factors. The modifiable factors included the clarity of work responsibilities, rating of managers, work facilities, work environment, transportation difficulties, and work satisfaction. Cost-effectiveness modules for absence intervention programs were built for these factors.

**Conclusions:** This study demonstrated that nurse absenteeism is a costly issue related to work and psychosocial factors. Preventive programs to improve the quality of work life are likely to be cost effective.

## KEYWORDS

predictors, cost, nurse, absenteeism, occupational

## Introduction

Nurses play a central role in frontline patient care. They are the largest group of health care professionals in Saudi Arabia (1). Nurse absenteeism is frequent, costly, and affects work productivity (2–4). It has significant impacts on the quality of patient care and staffing instability (5–8).

Canadian studies showed that the “adequacy of nursing staffing and proportion of registered nurses are inversely related to the death rate of acute medical patients within 30 days of hospital admission” (9, 10). Another study reported that a 10% increase in the number of patients assigned to a nurse leads to a 28% increase in adverse health events such as infections, medication errors, and other injuries (11).

Absenteeism can be defined as not coming to work when scheduled. Numerically, absenteeism equals the “sum of the periods when the employees of a given organization are absent from work, as opposed to absence motivated by unemployment, prolonged disease or a legal leave from work” (12).

Total days away from work may be due to personal illness, or scheduled vacations. However, absences may be caused by unexpected and otherwise unexplained reasons. The

category of unanticipated volitional absence is likely to include potentially preventable absences (13–15). A systematic review showed that the following factors reduce absenteeism: job satisfaction, organizational commitment, attendance records, involvement, and retention factors. Burnout and job stress were shown to increase absenteeism (8).

While many studies focus on health care absenteeism worldwide, few focus on nursing staffs and predictors of absenteeism in Saudi Arabia. A sample of 405 nurses working at Medina in Saudi Arabia indicated that the most common predictive factors associated with absenteeism were a lack of overtime payment (75.6%) and social reasons among 77.8% of nurses (16). Another study was conducted among 110 nurses working in Hail, Saudi Arabia with a majority of them male, married, and aged 35–39 years. The factors influencing absenteeism included health problems (40%), the working environment (24.5%), and personal and family problems (24.5%) (17). Absenteeism showed no relationship with the work environment among Swiss nursing homes (18).

This study focuses on absenteeism of nursing staff working in the eastern province of Saudi Arabia, and identifies factors associated with absenteeism. Our objectives were to:

- Estimate the prevalence of absenteeism among nurses,
- Analyze the direct cost of absenteeism among nurses, and
- Analyze the factors that affect absenteeism among nurses.

## Methods

### Study setting and design

A cross-sectional study was designed to measure the factors associated with absenteeism among nursing staffs in the Eastern Province of Saudi Arabia. The data were collected using a self-administered questionnaire (paper based) designed by the authors. Three research supervisors at the Imam Abdulrahman Bin Faisal University of Saudi Arabia validated the contents of the questionnaire, and its concurrent validity.

A summary rating scale of psychosocial predictors with reported absence (work environment, clarity of responsibilities, work satisfaction, rating of managers and relation type with co-workers) was used, with four choices per item as follows: (1) *excellent*, (2) *good*, (3) *fair*, (4) and *don't know*. The internal consistency of the overall scale of the predictors was assessed using Cronbach's alpha with a 95% confidence interval (CI), and it was determined to be good (Cronbach's alpha = 0.83; 95% CI: 0.80–0.86). This indicates that the instrument was reliable in measuring what it should.

The items in the questionnaire included (a) personal factors (e.g., age, gender, nationality, marital status, number of children, and availability of transportation to work); (b) work factors [e.g., job title, years of experience, work area (department), work facilities (work environment), rating, and shift work]; (c) work psychosocial factors (e.g., work satisfaction, relation to coworkers, and superior rating); (d) absences (number in the past 30 days, total days, sickness, and other causes); and (e) absence causes, consequences, and work pressure factors (according to the nurses).

Further, documents of absenteeism were reviewed from three main hospitals (Dammam, Qatif, and Dhahran).

The sample size was estimated using EpiInfo ver7. A minimum sample size of 420 participants was required for a 95% confidence interval with a power of the study of 80%.

### Inclusion criteria

Any nurse in direct contact with patients and having signed a job contract with the Ministry of Health was eligible to participate in the study.

### Exclusion criteria

Nurse interns, students, trainees, nurses working in administrative jobs, and nurses with <1 year of experience were excluded from the study.

### Data collection

A cluster sample (convenience sample) of 476 nurses was recruited from four different hospitals and three primary health care centers (PHCs). Data were collected from April to June 2017. Thirty-four nurses were excluded since they had administrative jobs, or interns, or students, or trainees or <1 year of work experience.

The questionnaire asked each nurse for an estimate of the average number of absences per month; these absences were described as “reported absences” which was used as an outcome variable of absenteeism. More detailed information is available for three participating hospitals (Dammam, Qatif, and Dhahran) in which personnel records are available for review.

Preventive programs for selected modifiable risk factors were recommended (e.g., public transportation, pre-employment work description, a manager training program, work environment improvement) in which a hypothetical predicted cost of each preventive program was estimated. Then, the net benefit value was calculated by subtracting the attributable cost of each absence factor from the predicted cost of each preventive program with multiple predicted effectiveness. Cost-effectiveness modules were built based on the results to estimate the benefit of each program.

### Data analysis

The data were entered and analyzed using IBM SPSS Statistics version 22.0 (SPSS Inc., Chicago, Ill., USA). The analysis compared those with zero absences with those with one or more absences per month. Reported absences was used as an outcome variable of absenteeism. Frequencies and percentages were calculated for the categorical variables, and the associations were assessed using Chi squares. Multivariate model that compares the factors that may predict absenteeism was done. We investigated the results of the logistic regression analysis to evaluate the relationships among multiple factors, assuming linearity and that the observations were independent of one another. A *p*-value of < 0.05 was considered as statistically significant.



TABLE 1 Personal factors associated with absence.

Variable		N	Absence (days/month)				$\chi^2$ p-value	Attributable risk
			0		$\geq 1$			
Age	20–25	59	24	41%	35	59%	<0.001	37%
	26–30	234	152	65%	82	35%		
	> 30	149	117	78%	32	22%		
Nationality	Saudi	335	201	60%	134	40%	<0.001	31%
	Non-Saudi	107	97	91%	10	9%		
Transportation difficulties	Yes	212	122	58%	90	42%	<0.001	17%
	No	230	172	75%	58	25%		
Gender	Male	36	22	61%	14	39%	0.26	7%
	Female	406	272	67%	134	33%		
Marital Status	Single	107	76	71%	31	29%	0.26	6%
	Married	335	217	65%	118	35%		
Children	0	100	66	66%	34	34%	0.47	0%
	$\geq 1$	335	221	66%	114	34%		

The direct annual absence cost in US dollars was calculated by multiplying the total number of nurses in the Eastern Province by the mean absence per nurse per month for twelve months by the mean salary divided by working day of the nurses. We also calculated the attributable risk for each factor as the difference between the absence percentages of nurses with high-risk predictor factors and those with low risk predictor factors. The attributable risk of each absence factor was multiplied by the reported absence cost to calculate the attributable cost.

## Ethical considerations

The study protocol was approved by the Ethical Committee of the General Directorate of Health Affairs in the Eastern Province and also by Imam Abdulrahman Bin Faisal University Ethical Committee, written consent was obtained from each participant. All the procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## Results

442 nurses (92% females and 8% males) were included in the analysis of this study. The majority (76%) were Saudi, while the remaining (24%) were non-Saudi. Most of the nurses (53%) were 26–30 years old and married (78%). Sixty-seven percent of nurses were assistants or technicians, and the majority (53%) worked either in wards or in emergency rooms.

Table 1 summarizes the personal factors associated with reported absences. Younger nurses (aged 20–25 years) were frequently absent. Among those aged at least 30 years, only 22%

were absent, whereas 59% of those under the age of 25 years were more frequently absent within the past month ( $P < 0.001$ ). Nurses of Saudi nationality were considerably more likely to be absent than non-Saudi nurses (40 vs. 9%,  $P < 0.001$ ).

The other personal factors included in Table 1, namely gender, marital status, and number of children, were not associated with the absences (the  $P$ -values were statistically insignificant).

The work factors associated with reported absences are illustrated in Table 2. Less educated (with a diploma in nursing) and less experienced nurses were considerably more likely to be absent from work. For example, 40% of nurse technicians (diploma in nursing) were absent compared to 26% of nurse specialists (with a bachelor's degree in nursing;  $P < 0.001$ ). Moreover, nurses with at least 10 years of experience were absent only 19% of the time, whereas those with <5 years of experience were absent 45% of the time ( $P < 0.001$ ). The emergency departments showed the highest rate of absenteeism (55%;  $P = 0.02$ ). Quality of work facilities contributed significantly to absenteeism ( $P < 0.001$ ). Nurses with excellent facilities were absent 25% of the time, while those with fair facilities were absent 29% of the time ( $P < 0.001$ ). Shift work and absence policy were not statistically significantly associated with absenteeism.

Work environment, clarity of responsibility, work satisfaction, and facility rating were significantly associated with nurse absenteeism (Table 3). Nurses with an excellent work environment tended to have a lower rate of absenteeism (23%) than those with a fair environment (35%;  $P < 0.001$ ). Degree of clarity with regard to work responsibilities also had a large impact; only 18% of nurses with well-defined responsibilities were absent from work, whereas this rate was as high as 52% for those with fairly defined responsibilities ( $P < 0.001$ ). Nurses who were very satisfied with work were absent less frequently (16%) than those who were fairly satisfied with work (45%;  $P < 0.001$ ). Organizational factors contributed significantly to absenteeism. Nurses who liked their managers showed lower rates of absenteeism (24%) than those who

TABLE 2 Work factors associated with absence.

Variable		N	Absence (days/month)				$\chi^2$ p-value	Attributable risk
			0		$\geq 1$			
Job title	Nurse assistant	44	27	62%	17	38%	<0.001	25%
	Nurse technician	245	147	60%	98	40%		
	Nurse specialist	146	108	74%	38	26%		
	Nurse senior specialist	7	7	100%	0	0%		
Experience (by year)	1–5	196	108	55%	88	45%	<0.001	26%
	6–10	129	90	70%	39	30%		
	> 10	117	95	81%	22	19%		
Work area	Ward	194	122	63%	72	37%	<0.001	23%
	Clinic	89	61	68%	28	32%		
	Emergency Room	48	22	45%	26	55%		
	Other	111	90	81%	21	19%		
Work facilities rating	Excellent	43	32	75%	11	25%	<0.001	4%
	Good	175	121	69%	54	31%		
	Fair	161	114	71%	47	29%		
	Do not know	63	27	43%	36	57%		
Working time	Shift	282	181	64%	101	36%	0.27	7%
	Fixed time	160	114	71%	46	29%		
Type of absence policy	Excellent	29	19	67%	10	33%	0.31	3%
	Good	101	63	62%	38	38%		
	Fair	151	97	64%	54	36%		
	Do not know	161	113	70%	48	30%		

disliked their managers (42%;  $P < 0.001$ ). Relations with coworkers had little impact ( $P = 0.12$ ).

Multiple logistic regression modules (Table 4) were implemented for the variables thought to be affected by nationality. The  $p$ -values for work satisfaction, rating of managers, and clarity of work responsibilities were  $< 0.05$ . This means that these variables are not confounders for absenteeism. However, the  $p$ -value for transport difficulties and work environment exceeded 0.05, indicating that they are cofounders in association with absenteeism.

## Perception of the causes and consequences of absenteeism

Most nurses indicated that health issues and work stress (43%) were the main causes of absence, followed by social obligations, job dissatisfaction (36%), and other factors (delayed performance, overtime, turnover). Forty-two percent of Saudi nurses indicated that social obligations were a cause of absenteeism whereas 22.0% of non-Saudi nurses felt the same way. The largest group (48%) of nurses indicated that a heavy workload was the main factor contributing to work stress, followed by supervision style (44%),

improper work environment (33%), and forced work (28%). Most nurses (52%) indicated that absenteeism could be reduced through recognition of work, better work conditions, and more coordination with coworkers, followed by other factors.

## Cost of absenteeism by cause

Thirty-three percent of the nurses were absent at least one day per month. Our study found a reported mean absence rate of 0.62 days per employee per month, amounting to a total of 266 days lost per month among 442 nurses. The absence documents indicated a mean of 0.2, 0.2, and 0.9 days of absence per employee per month for Dhahran, Qatif, and Dammam, respectively, yielding an average mean of approximately 0.5 days (0.43 absences per employee per month), which is close to the mean of our study (0.62 absences per employee per month).

Considering an absence mean of 0.62, an average nurse salary of \$1353 per month, 20 working days per month, and the total number of nurses in the eastern province of Saudi Arabia (7991), we calculated that nurse absenteeism costs the General Directorate of Health Affairs in the Eastern Province of Saudi Arabia ~\$4,021,998 per year (19, 20).

TABLE 3 Psychosocial factors associated with absence.

Variable		N	Absence (days/month)				$\chi^2$ p-value	Attributable risk
			0		$\geq 1$			
Work environment	Excellent	44	34	77%	10	23%	<0.001	12%
	Good	174	127	73%	47	27%		
	Fair	164	107	65%	57	35%		
	Do not know	60	29	48%	31	51%		
Clarity of responsibilities	Very well clear	148	121	82%	27	18%	<0.001	34%
	Well clear	150	101	67%	49	33%		
	Fairly clear	128	61	48%	67	52%		
	Do not know	16	11	69%	5	31%		
Work satisfaction	Very well satisfied	86	72	84%	14	16%	<0.001	29%
	Well satisfied	175	124	71%	51	29%		
	Fairly satisfied	132	73	55%	59	45%		
	Do not know	49	24	49%	25	51%		
Rating of managers	Excellent	123	93	76%	30	24%	<0.001	18%
	Good	187	125	67%	62	33%		
	Fair	108	63	58%	45	42%		
	Do not know	24	11	46%	13	54%		
Relation type with co-workers	Excellent	169	117	69%	52	31%	0.12	10%
	Good	219	147	67%	72	33%		
	Fair	51	30	59%	21	41%		
	Do not know	3	0	0%	3	100%		

Each absence factor contributes to the cost depending on its attributable risk value. For instance, attributable risk associated with the manager rating is 18%. Thus, attributable risk from this factor contributes \$723,959 ( $0.18 \times 4,021,998$ ) to the total cost. The cost of each absence factor depending on its attributable risk. Quality of work is the most modifiable absence factor, and it contributes substantially to the cost. Some of the other modifiable factors are work satisfaction, clarity of work responsibilities, manager rating, and work environment. Moreover, transportation is a modifiable factor with an attributable risk of 17%.

Based on the attributable cost associated with each factor, cost-effectiveness modules were generated in accordance with the hypothetical cost and effectiveness of each program recommended to reduce absenteeism. For example, if \$50 is spent on each nurse for the pre-employment job description course, assuming a predicted effectiveness of 50%, a net value of \$35 will be saved annually ( $0.5 \times 171 - 50$ ). When projected to all nurses of the eastern province (7991), \$279,685 will be saved annually by modifying this single factor. According to the predicted cost-effectiveness module, the optimum effectiveness of the manager training program is 30%. This will save ~\$7.5 per nurse annually, amounting to a total of \$59,933.

Figure 1 illustrates the combined cost-effectiveness modules for all four recommended programs. The optimum effectiveness of a manager training program is 30%. This was confirmed with

calculation as it would save around \$7.5/nurse annually for a total of US\$59.93. Also in Figure 1, the pre-employment job description course had a predicted cost-effectiveness of 50%. By contrast, public transportation and work environment improvement programs are of greater cost to achieve a benefit. Improving the work environment yields the greatest benefit but results in the lowest predicted effectiveness.

## Discussion

This study found that the average absence of nurses is 0.62 days per month. This results in an annual loss of around \$4 million. The greatest absence frequency was significantly associated with work psychosocial factors while quality of work was the most modifiable factor. In addition, our study showed the importance of potentially remediable psychosocial workplace factors. This study had identified a clear relationship between nurse-supervisor rapport and the likelihood of largely volitional absences.

Our study sample was large ( $n = 442$ ) and representative of nurses in the eastern province of Saudi Arabia. The sample represents 5.5% of the total number of nurses (7991) who work in governmental health institutes in the eastern province of Saudi Arabia. The documented rate of absence was 0.43 day per employee per month, which is very close to the mean of our study (0.62).

TABLE 4 Multiple logistic modules for different factors vs. nationality.

	Factor	Estimate	SE	p-value	OR	95% CI
Module 1	Nationality (Saudi)					
	Work Satisfaction	0.416	0.130	0.001	1.51	1.17–1.95
Module 2	Nationality (Saudi)					
	Rating of managers	0.460	0.134	0.001	1.58	1.22–2.06
Module 3	Nationality (Saudi)					
	Transport difficulty	0.881	0.478	0.065	2.41	0.94–6.15
Module 4	Nationality (Saudi)					
	Work environment	0.258	0.135	0.056	1.29	0.99–1.68
Module 5	Nationality (Saudi)					
	Clarity of work responsibilities	0.352	0.138	0.011	1.42	1.08–1.86

SE, standard error; OR, odds ratio; CI, confidence interval.

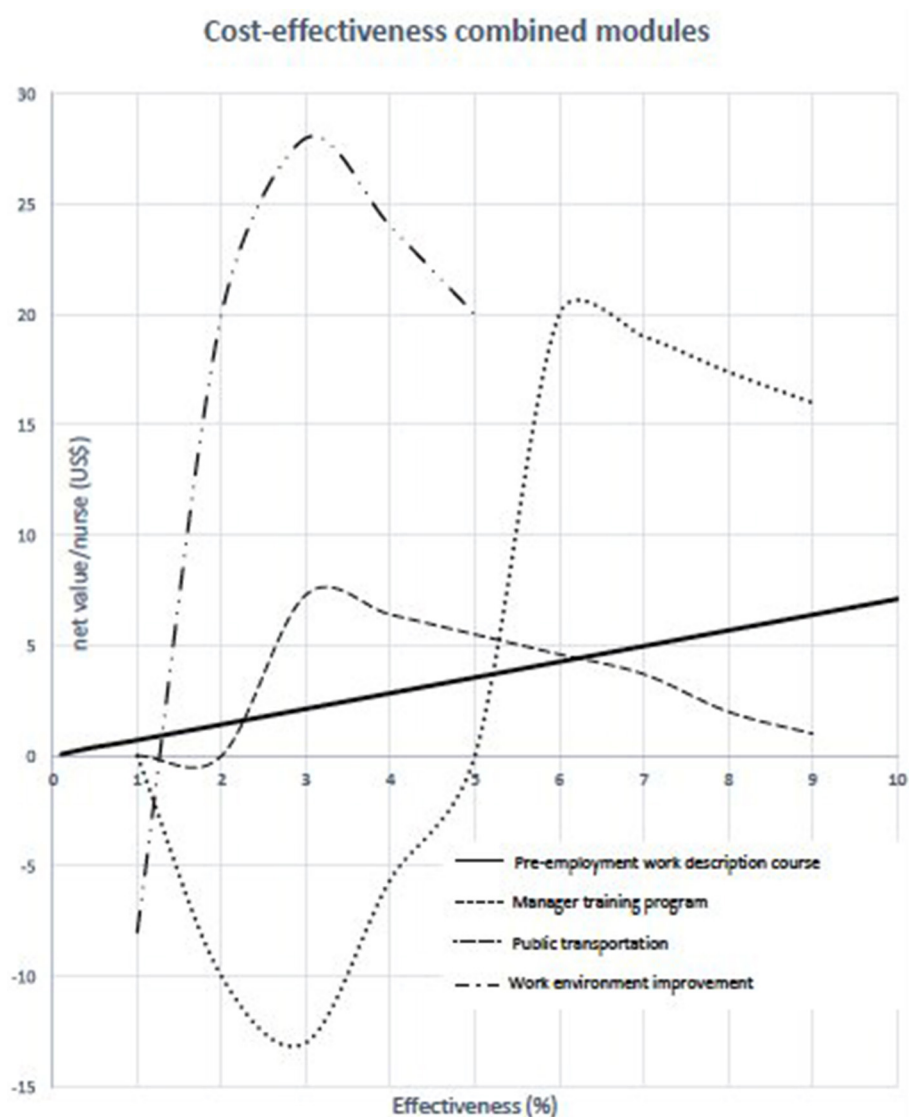


FIGURE 1  
The combined cost-effectiveness modules.

The studied personnel records specifically identified unjustified (i.e., volitional) absences as determined by the supervisor. This distinction is not available in other published studies (21, 22).

Unlike in other studies, this study demonstrated that nurse absenteeism was not significantly associated with some personal factors, such as marital status, number of children (childcare responsibilities), and gender (being a male), that lead to higher rate of absenteeism (23–27). Our results were also consistent with those of other studies that show that absenteeism occurs more frequently among younger, less experienced, and less educated nurses (16, 17).

A very strong association was noted between absenteeism and nationality. This was probably due to the greater social obligations perceived by the Saudi nurses (42%) compared to their non-Saudi (22%) counterparts and the same finding was reported in another study (28). Another reason for absenteeism was that the hospital policy may be unfairly biased toward local nurses. This belief could be overcome by devising and implementing a strict and fair policy that is equally applied to all nurses (17, 24–26).

The quality of work life (job satisfaction, job environment, facilities, and good superiors) was significantly associated with absenteeism. This was consistent with another studies that showed “attitudes (job satisfaction, organizational commitment, and work/job involvement)” and leadership style and feeling respect from supervisors will reduced nurse absenteeism (29–32). Most nurses reported facing a heavy workload and improper work conditions, leading to greater work stress and absenteeism. Finally, most nurses noted that better work conditions and recognition of their work as well as coordination with coworkers could reduce absenteeism (30–32). All these factors signify that the quality of the work environment and demands are important predictors of absenteeism.

Our study demonstrated that the average nurse was absent 0.62 days per month, resulting in a loss of productive work of 266 days per month among the 429 nurses studied. The number of lost days per employee per year is 7.4, which is higher and costly than the international average of 7 by almost half a day (19, 20).

In this study educational programs for nurse supervisors and improvement of their communication skills had a predicted effectiveness rate is 30%. Moreover, providing pre-employment job descriptions entails minimal cost, but promises a high cost-effectiveness rate. Public transportation and work environment improvement programs may lead a higher cost with regard to achieving benefits in the first year, but their costs are likely to be discounted in subsequent years.

## Strengths of this study

- This study demonstrated that nurses' absenteeism is a costly issue related to work and psychosocial factors.
- We presented the combined cost-effectiveness modules for all recommended programs.

## Limitations of this study

- The reliability of the study may be lower than expected due to self-reported absence, however the absence documents were

reviewed from three hospitals, and the mean absence was found to be close to the mean of our study.

- The use of scales in this study may be positively biased as respondents appear to have had the option to choose between *excellent*, *good*, *fair*, and *do not know*, and this may suggest that negative options may have been chosen.
- Our samples were of the cluster type and were heterogeneous but were analyzed together, which may influence the accuracy of our analysis, possibly leading to analysis bias.

## Conclusions

The study demonstrated that nurse absenteeism in the hospitals and PHCs of the studied areas was highly prevalent and costly. Nationality and quality of work factors were associated with absenteeism. Some absence predictors are modifiable and can be corrected with highly cost-effective programs such as pre-employment courses, provision of transportation, and manager training. Qualitative elements of absenteeism among nurses would have provided a lot richer data and greater depth to the study and these are proposed to consider in future research.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by the Imam Abdulrahman Bin Faisal University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

HA: collection of data, statistical analysis, and literature review. NH: literature review and manuscript editing. SA-O: study design, literature review, and writing manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



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## References

- Almalki M, FitzGerald G, Clark M. The nursing profession in Saudi Arabia: an overview. *Int Nurs Rev.* (2011) 58:304–11. doi: 10.1111/j.1466-7657.2011.00890.x
- Alamgir H, Ngan K, Drebit S, Guiyun Li H, Keen D. Predictors and economic burden of serious workplace falls in health care. *Occup Med.* (2011) 61:234–40. doi: 10.1093/occmed/kqr025
- Warren CL, White-Means SI, Wicks MN, Chang CF, Gourley D, Rice M. Cost burden of the presenteeism health outcome: diverse workforce of nurses and pharmacists. *J Occup Environ Med.* (2011) 53:90–9. doi: 10.1097/JOM.0b013e3182028d38
- Nascimento A, Jesus É. Nursing work environment and patient outcomes in a hospital context: a scoping review. *J Nurs Adm.* (2020) 50:261–6. doi: 10.1097/NNA.0000000000000881
- Kang JH, Kim CW, Lee SY. Nurse-perceived patient adverse events depend on nursing workload. *Osong Public Health Res Perspect.* (2016) 7:56–62. doi: 10.1016/j.phrp.2015.10.015
- Hinno S, Partanen P, Vehviläinen-Julkunen K. Nursing activities, nurse staffing and adverse patient outcomes as perceived by hospital nurses. *J Clin Nurs.* (2011) 21:1584–93. doi: 10.1111/j.1365-2702.2011.03956.x
- Souza P, Cucolo DE, Perroca MG. Nursing workload: influence of indirect care interventions. *Rev Esc Enferm USP.* (2019) 53:e03440. doi: 10.1590/s1980-220x2018006503440
- Davey MM, Cummings G, Newburn-Cook CV, Lo EA. Predictors of nurse absenteeism in hospitals: a systematic review. *J Nurs Manag.* (2009) 17:312–30. doi: 10.1111/j.1365-2834.2008.00958.x
- Tourangeau AE, Giovannetti P, Tu JV, Wood M. Nursing-related determinants of 30-day mortality for hospitalized patients. *Can J Nurs Res.* (2002) 33:71–88.
- Tourangeau AE, Doran DM, McGillis Hall L, O'Brien Pallas L, Pringle D, Tu JV, et al. Impact of hospital nursing care on 30-day mortality for acute medical patients. *J Adv Nurs.* (2007) 57:32–44. doi: 10.1111/j.1365-2648.2006.04084.x
- Weissman JS, Rothschild JM, Bendavid E, Sprivulis P, Cook EF, Evans RS, et al. Hospital workload and adverse events. *Med Care.* (2007) 45:448–55. doi: 10.1097/01.mlr.0000257231.86368.09
- Kowalczyk K, Krajewska-Kulak E. Influence of selected sociodemographic factors on psychosocial workload of nurses and association of this burden with absenteeism at work. *Med Pr.* (2015) 66:615–24. doi: 10.13075/mp.5893.00076
- Atefi N, Lim Abdullah K, Wong LP, Mazlom R. Factors influencing job satisfaction among registered nurses: a questionnaire survey in Mashhad, Iran. *J Nurs Manag.* (2015) 23:448–58. doi: 10.1111/jonm.12151
- Lu H, Zhao Y, While A. Job satisfaction among hospital nurses: A literature review. *Int J Nurs Stud.* (2019) 94:21–31. doi: 10.1016/j.ijnurstu.2019.01.011
- Curtis EA, Glacken M. Job satisfaction among public health nurses: a national survey. *J Nurs Manag.* (2014) 22:653–63. doi: 10.1111/jonm.12026
- Alharbi FL, Almuzini TB, Aljohani AA, Aljohani KA, Albowini AR, Aljohani ME, et al. Causes of absenteeism rate among staff nurses at medina maternity and child hospital. *Egypt J Hosp Med.* (2018) 70:1784–8. doi: 10.21608/ehm.2018.10320
- Alreshidi NM, Alaseeri RM, Garcia M. Factors influencing absenteeism among nursing staff in the primary health care centers in hail: a preliminary study for enhancing staff commitment. *Health Sci. J.* (2019) 13:658–66. Available online at: <https://www.itmedicalteam.pl/articles/factors-influencing-absenteeism-among-nursing-staff-in-the-primary-health-care-centers-in-hail-a-preliminary-study-for-enhancing-s.pdf>
- Dhaini S, Zúñiga F, Ausserhofer D, Simon M, Kunz R, De Geest S, et al. Absenteeism and presenteeism among care workers in swiss nursing homes and their association with psychosocial work environment gerontology. *Gerontology.* (2016) 62:386–95. doi: 10.1159/000442088
- Anonymous. Registered Nurse. *Salary (Saudi Arabia).* PayScale. Seattle, WA: PayScale. (2017). Available online at: [http://www.payscale.com/research/SA/Job=Registered\\_Nurse\\_\(RN\)/Salary](http://www.payscale.com/research/SA/Job=Registered_Nurse_(RN)/Salary) (accessed December 8, 2022).
- Anonymous. MOH statistics. *Statistical Yearbook 1436. Ministry of Health, KSA. Riyadh: Ministry of Health, KSA.* (2017). Available online at: <https://ghdx.healthdata.org/record/saudi-arabia-health-statistical-yearbook-2017> (accessed December 8, 2022).
- Mitchell RJ, Bates P. Measuring health-related productivity loss. *Pop Health Manag.* (2011) 14:93–8. doi: 10.1089/pop.2010.0014
- Zhang W, Bansback N, Anis AH. Measuring and valuing productivity loss due to poor health: a critical review. *Soc Sci Med.* (2011) 72:185–92. doi: 10.1016/j.socscimed.2010.10.026
- Burmeister EA, Kalisch BJ, Xie B, Doumit MA, Lee E, Ferraresion A, et al. Determinants of nurse absenteeism and intent to leave: an international study. *J Nurs Manag.* (2019) 27:143–53. doi: 10.1111/jonm.12659
- Baydoun, M, Dumit, M, and Daouk-Örry, L. What do nurse managers say about nurses' sickness absenteeism? A new perspective. *J Nurs Manag.* (2016) 24:97–104. doi: 10.1111/jonm.12277
- Daouk-Örry L, Anouze AL, Otaki F, Dumit NY, Osman I. The JOINT model of nurse absenteeism and turnover: a systematic review. *Int J Nurs Stud.* (2014) 51:93–110. doi: 10.1016/j.ijnurstu.2013.06.018
- Brewer CS, Kovner CT, Greene W, Tukov-Shuser W, and Djuki M. Predictors of actual turnover in a national sample of newly licensed registered nurses employed in hospitals. *J Adv Nurs.* (2011) 68:521–38. doi: 10.1111/j.1365-2648.2011.05753.x
- Jamieson I, Tava C. Leaving from and returning to nursing practice: contributing factors. *Nursing Praxis NZ.* (2009) 25:15–27. Available online at: <https://pubmed.ncbi.nlm.nih.gov/19928648/>
- Niitsuma M, Katsuki T, Sakuma Y, Sato C. The relationship between social skills and early resignation in Japanese novice nurses. *J Nurs Manag.* (2011) 20:659–67. doi: 10.1111/j.1365-2834.2011.01256.x
- Siu OL. Predictors of job satisfaction and absenteeism in two samples of Hong Kong nurses. *J Adv Nurs.* (2002) 40:218–29. doi: 10.1046/j.1365-2648.2002.02364.x
- Hayajneh YA, AbuAlRub RF, Athamneh AZ, Almahzomy IK. Turnover rate among registered nurses in Jordanian hospitals: an exploratory study. *Int J Nurs Pract.* (2009) 15:303–10. doi: 10.1111/j.1440-172X.2009.01758.x
- Schreuder JAH, Roelen CAM, Van Zweeden NF, Jongsma D, Van Der Klink JJJ, Groothoff JW. Leadership styles of nurse managers and registered sickness absence among their nursing staff. *J Nurs Manag.* (2011) 19:585–95. doi: 10.1111/j.1365-2834.2010.01198.x
- Schreuder JAH, Roelen CAM, Van Zweeden NF, Jongsma DJJL, Van Der Klink JJJ, Groothoff JW. Leadership styles of nurse managers and registered sickness absence among their nursing staff. *Health Care Manage Rev.* (2010) 36:58–66. doi: 10.1097/HMR.0b013e3181edd96b



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# Organizational facilitators and barriers for participation in workplace health promotion in healthcare: A qualitative interview study among nurses

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**Background:** There is evidence for the positive effects of workplace health promotion (WHP) for nurses. Although this highly stressed target group also actively desires WHP, the number of participants is low. Individual reasons play a role in the decision to engage in WHP activities, yet it is interesting to consider which organizational factors a company could address to improve participation. In this regard, the question arises of what organizational factors facilitate participation in WHP activities from the perspective of nurses in inpatient care facility (ICF), outpatient care service (OCS), and acute care hospitals (ACH).

**Method:** Sixteen semi-structured interviews were conducted in different care settings between May and September 2021. Questions about everyday working life, WHP activities, and organizational framework conditions were asked.

**Result:** The results show that there is a wide range of influencing factors at the organizational level, some overall settings, and others setting-specific. High workload and the fit of WHP activities with shift times were particularly inhibiting overall settings. A negative association with the employer worked as a barrier in ICF and ACH.

**Conclusion:** When implementing WHP activities, it can be useful to consider organizational facilitators and barriers to promote sustainable and attractive WHP activities and higher participation rates in the different settings of nursing.

## KEYWORDS

workplace health promotion, participation, nurses, barrier, WHP activity, organizational framework conditions, facilitator

## 1. Introduction

Workplace health promotion is a promising approach on policy, company, and individual levels to counteract work-related stress and make jobs attractive. There are indications that workplace health promotion (WHP) can improve the health and work ability of employees (Hupfeld et al., 2021). The Luxembourg Declaration defines WHP as the joint action of society and workplace to improve the health of employees (the European Network for Workplace Health Promotion set itself the task of supporting employers, employees, and society in safeguarding and promoting wellbeing and health in the workplace through the Luxembourg Declaration). Improvements can be made here through the enhancement of work organization and

environment, improving active participation, and supporting personal development (European Network for Workplace Health, 1997). Especially for professions with high occupational stress (high mental and physical workload), such as nurses (Meyer et al., 2022), WHP, therefore, can be a promising approach to improve the work situation and personal health. Among companies and statutory health insurers, there is a strong collaborative commitment to WHP because jobs in this sector are characterized by significant physical and mental stress (Bauer et al., 2020). Nurses in geriatric care in Germany, for example, were sick for 28.5 days on average in 2021. This is almost 10 days more than the average number of sick days for German employees in 2021 (19.7 days; Meyer et al., 2022). The sickness notifications of health insurance show mainly disease in the area of musculoskeletal disorders, mental illnesses, and respiratory diseases (Drupp and Meyer, 2020). However, it is not possible to deduce from this whether this is due to working conditions or a consequence of stress.

Looking at the effectiveness of WHP across all occupational groups, there are indications that WHP can be a worthwhile use of resources for employers and employees to improve work-related health. Positive effects could be demonstrated for 68.6% of the behavioral- and environmental-related prevention interventions analyzed in a narrative review (Goldgruber and Ahrens, 2009). A Cochrane review indicates that programs using pedometers can reduce the body mass index (Freak-Poli et al., 2013). In two reviews, small to medium effects are reported for the efficacy of environmental-related activities to improve the *nutritional behavior* of employees with regard to diet-related outcomes such as fruit and vegetable consumption (Geaney et al., 2013; Allan et al., 2017). For *nicotine and tobacco* use, a Cochrane review indicates clear evidence of effectiveness for group therapy approaches in the work context, personal individual counseling, drug treatment, and combined interventions (Cahill and Lancaster, 2014). Short-term *alcohol* prevention interventions seem to have potential in a review, but there is still a considerable need for research (Schulte et al., 2014). Interventions that work with cognitive behavioral therapy approaches and combine more than one therapeutic approach (for example, cognitive behavioral therapy and teaching problem-solving strategies) appear to be effective in relieving stress and improving relaxation in a review (Wan Mohd Yunus et al., 2018). Another meta-analysis, based on a total of eight qualitatively convincing RCTs, finds small but nonetheless significant positive effects for *depression prevention* interventions at the whole-firm level (Hosang et al., 2014). With regard to the benefit for employers, a comprehensive review of 47 return-on-invest (ROI) studies on WHP shows a mean ROI of 2.7 (Baxter et al., 2014). In addition to the interest of employees and indications of a benefit for employers, health insurance funds are also pursuing this approach. Having a look at the effect of WHP activities on nurses, only a very limited amount of studies are published (Schaller et al., 2022). Yet, the compilation of studies on lifestyle-based, health-promoting interventions for nurses consistently reports positive effects on outcomes such as physical activity behaviors, mobility, and endurance (Chan and Perry, 2012). A meta-analysis based on available RCTs for mindfulness-based interventions in nurses suggests that the interventions are suitable for reducing anxiety and depression in the short and long term in this target group. Qualitative studies also indicate other positive aspects of impact, including improved wellbeing (e.g., increased inner calm) and increased work performance (e.g., more efficient work processes due to improved team communication; Guillaumie et al., 2017). A quantitative systematic review of interventions for promoting nurses'

wellbeing at work suggests that the interventions can also achieve lasting effects (Romppanen and Häggman-Laitila, 2017).

Despite the burden on nurses and the indications of positive effects, nurses have lower participation rates in WHP activities than other professions (Chiou et al., 2014). Furthermore, a study on German nurses shows a self-reported willingness of 75% to actually use a prevention program (Ehegartner et al., 2020). More than every second facility manager reports that existing WHP activities are only insufficiently used (Isfort et al., 2018). In addition to individual reasons for non-participation, it might be promising to consider the organizational factors a company can address in order to increase the uptake of WHP activities among employees (Rojatz et al., 2015).

Having a look at organizational factors influencing participation in WHP activities overall professions, there are some findings. In this context, a lack of management support, a lack of qualified trainers, related costs, lack of space, and evidence of program outcomes were reported as potential challenges over all professions in the United States (Weinstein and Cheddie, 2021). Furthermore, a systematic review of countries in the "Organisation for Economic Co-operation and Development" (OECD) indicates that the working environment and organizational structures, management support for the activity, and the coordination of the activity with existing structures and processes can play a role in the success of WHP projects (Rojatz et al., 2015). Incentives and leadership support can significantly impact participation. Higher levels of organizational support were also shown to raise better participation in biometric screening and health assessment (Grossmeier et al., 2020). The quality of the intervention concept and the material and resources of the target group can make a matter as well (Rojatz et al., 2015). Across the process, continuously raising awareness, participation and empowerment of employees, as well as regular internal communication can be key success factors in terms of acceptance and sustainability of WHP activities (Bauer et al., 2020). If the information is not provided clearly and unambiguously, impersonally, or at an inappropriate time, this can also have an influence on participation (Stummer et al., 2008). If the WHP activity is experienced as mandatory, this is also perceived rather negatively and is more likely to be rejected (Stummer et al., 2008). Other perceived barriers are the cost to the target group, the fact that participation causes absenteeism, and the inconvenient timing of the offerings (Simek et al., 2014). Lack of target group orientation, possible motivation problems, and general project management recommendations can also have an influence (Weinreich and Weigl, 2002). Lack of participation autonomy, lack of professionalism in the activity, and missing sense can also affect the interest in the WHP activity (Stummer et al., 2008).

In the setting of nursing, there are fewer results on organizational factors influencing participation in WHP activities. Limited time resources of nurses due to the fulfillment of the patient care mission under conditions of staff shortage seems to make it harder to make time free for participation in WHP (Krupp et al., 2020). Results of a German study in the nursing setting indicate that counting the WHP activity time spent as working time and having the employer cover the costs can have an influence on participation in WHP activities (Dietrich et al., 2015). Furthermore, from the perspective of many nurses, it does not seem consistent or "honestly meant" by the employer to offer behavioral preventive WHP activities, but at the same time not be able to reduce the burden in the everyday workday (Krupp et al., 2020). Factors such as the small size of the company (short distances, personal ties, and direct contact), lack of economic

pressure, personal approach, and opportunities for participation seem to have a positive effect on participation in WHP in outpatient care service (Kahnt et al., 2020).

If one examines the field of nursing, the setting-specific differences can also become an interesting point. There are findings that WHP activities are predominantly available in large facilities such as hospitals and are often not accessible to staff in medium-sized nursing homes or outpatient care facilities (BKK Dachverband, 2017).

Regarding the little research in the field of nursing on organizational factors influencing the participation of employees in WHP activities and even less evidence on how this is perceived from the perspective of nurses, it would be interesting to investigate this topic. As organizational factors can be adjusted by companies, findings in this area can help to design activities in such a way that they improve the chances of increasing the participation rate and satisfaction among nurses.

In regard to this research gap, we investigate the following research question: *What organizational factors facilitate participation in WHP activities from the perspective of nurses in different settings?*

## 2. Materials and methods

### 2.1. Context of the study

The interviews were conducted within the BAGGer project (workplace activities for health promotion and violence prevention, 2020–2022). The aim of the project, which was funded by the German Federal Ministry of Health (BMG), was to promote health and improve the working situation of nurses. In order to understand why or why not nurses participate in WHP activities, the following study aims to find out which facilitators and barriers can be found in different settings of nursing. The study was registered in the German Clinical Trials Register (DRKS-ID: DRKS00024961) and approved by the German ethics committee of the German Sport University Cologne (reference numbers No. 050/2021). In this qualitative study, we followed the consolidated criteria for reporting qualitative research (COREQ; Tong et al., 2007).

### 2.2. Participants

Participants were recruited *via* the care facilities participating in the BAGGer project, which were located in North Rhine-Westphalia, Germany. Inclusion criteria for participants were: (1) a professional nurse, (2) minimum age of 18 years, and (3) working in an acute care

hospital, inpatient care facility, or outpatient care service. Exclusion criteria were: (1) professional nurses mainly assigned to administrative working tasks and (2) apprentices. The person in charge of employee health provided information within the care facilities about the search for interview participants and acted as a contact person. Interested nurses could then get in touch with this contact person so that a random composition of the sample was generated. In the first contact between the research team and the participants, the participants were informed by email about the background of the study and aspects of data protection. In addition, an interview date was arranged by the interviewers (JL, HB) by email or telephone. All the requested persons participated and gave their written consent.

The sample comprised 16 participants (four men and 12 women). Ages ranged from 25 to 54 years (mean  $39 \pm 11$  years). The average experience in nursing was 14 years ( $\pm 9$  years) with a minimum of 4 years and a maximum of 36 years. Three nurses had an immigrant background. Interview duration ranged from 36 to 171 min (mean  $78 \pm 33$  min).

The sample composition of participants per setting is presented in Table 1.

### 2.3. Interview guide

A problem-centered interview guide based on Witzel (2000) consisting of open-end questions was developed. Questions on the topics of career, everyday work, health, workplace violence, and company were collected and collaboratively formulated by the research team. As organizational barriers and facilitators to WHP can lie in a wide variety of areas of everyday work, we decided to ask questions broadly. The topics and their content aspects are presented in Table 2. Comprehensibility and estimated interview duration were the first pilots tested in our internal project group and the second tested with a nurse working in an acute care hospital. As there were limited resources in our study and the internal as well as external pilot studies showed that the questions were easy to understand, there was no need for further pretesting. The pilot test data were not included in the main study.

### 2.4. Data collection

Interviews were conducted between May and September 2021 and took an average of 78 min (ranging from 36 to 171 min). At the beginning of the interview, the participants were told that ~1 h

TABLE 1 Table showing sample description and interview length per setting.

	Acute care hospital (n=5)	Inpatient care facility (n=6)	Outpatient care service (n=5)
Age [years] mean <sup>a</sup> ( $\pm$ SD); minimum-maximum	33 ( $\pm 6$ ); 27–42	34 ( $\pm 11$ ); 25–52	51 ( $\pm 3$ ); 47–54
Gender: female [n; %]	3 (60%)	4 (67%)	5 (100%)
Experience in the care sector [years] mean ( $\pm$ SD); minimum-maximum	12 ( $\pm 3$ ); 4–16	11 ( $\pm 7$ ); 5–20	20 ( $\pm 12$ ); 4–36
Length of employment at current facility [years] mean ( $\pm$ SD); minimum-maximum	9 ( $\pm 4$ ); 4–15	7 ( $\pm 6$ ); 0.2–15	3 ( $\pm 2$ ); 1–6
Interview duration [min] mean ( $\pm$ SD); minimum-maximum	69 ( $\pm 7$ ); 59–87	63 ( $\pm 30$ ); 36–119	104 ( $\pm 42$ ); 58–171

SD, Standard deviation; n, number. <sup>a</sup>The average age of geriatric nurses in Germany is 43.2 years, while the average age of healthcare and nursing staff is 41.6 years (Destatis Statistisches Bundesamt, 2018).



TABLE 2 Topics and content aspects of the interview guide.

Topic	Content aspects
Everyday working life	- Influence of everyday working life on participation in WHP activities
Health	- Existing WHP activities in the company - Reasons for participation - Appropriate content and social design of WHP activities - Anchoring of health in the corporate culture and communication - Importance of WHP in the company - Commitment of the management to the topic - Communication of health-promoting activities and changes
Workplace violence	Prevention, trainings and support programmes for violence prevention
Company	Perception of the employer

would be estimated for the interview and they could take a break if they wanted to. The spoken language was German. The interviews and pilot tests were conducted by telephone to minimize the number of contacts because of the COVID-19 pandemic. The two interviewers had master's degrees in health economics (JL) and health-promoting organizational development (HB), were trained in qualitative research and were Ph.D. candidates. Participants were asked to go to a quiet room where they were alone. The participants did not know the researcher, only that they were interested in workplace-related health. This minimized the researchers' ability to influence the study. Due to the principle of data saturation, the data set was evaluated after the first 15 interviews (single interviews, no repeat interviews). Since there were still open questions about the setting of the inpatient care facilities, additional interview partners were sought. After one more interview, no new information seemed to emerge from the interviews. During all the interviews, field notes were taken and missing demographic data were only asked for after the interview was completed to avoid disrupting the flow of the interview. Interviews were recorded with an audio recording device and professionally transcribed according to [Dresing and Pehl \(2018\)](#).

## 2.5. Data analysis

For analyzing the transcripts, a structuring content analysis following Kuckartz was performed. Internationally, the methodology is very similar to the framework method for analyzing qualitative data ([Gale et al., 2013](#)). Data management was carried out using MAXQDA Standard 2020 software from VERBI GmbH, Berlin. Based on a screening of six transcripts, the interview guide, and the topics of interest, a first coding system with main categories was created and discussed by three researchers. Afterward, the interviews were coded according to this coding system. The main codes and text passages were then sighted by a research team of five. Subcategories and characteristics were derived and discussed by this research team. Afterward, the entire data set was completely coded with subcategories and characteristics. The results were not returned to the participants because it was not a participatory evaluation, and the data were analyzed *via* a setting-specific approach.

## 3. Results

The following main categories were deduced: (1) *awareness of WHP activities in the company*, (2) *participation in WHP activities*, (3) *organizational conditions for the participation in WHP activities*, (4) *wishes of the employees*, and (5) *communication and information on the WHP activities*. Each main category was divided into subcategories (refer to [Table 3](#)) and then examined for *inhibiting*, *promoting*, and *explanatory* characteristics.

In the following, the results of the content analysis of the interviews with nurses from acute care hospitals (ACH), inpatient care facility (ICF), and outpatient care service (OCS) are presented in relation to the respective main and subcategories.

### 3.1. Awareness of WHP activities in the company

The main category “*awareness of WHP activities in the company*” included information on WHP activities of the employer on-site, digitally, or in cooperation with external service providers perceived by the employees from their perspective. Seven subcategories were identified: *Stress related*, *movement oriented*, *nutrition*, *addiction*

TABLE 3 Category system with defined main categories and subcategories.

Main category	Subcategories
1. Awareness of WHP activities in the company	Stress related
	Movement oriented
	Nutrition
	Addiction
	Violence related
	Teambuilding activities
	No known WHP activities
2. Participation in WHP activities	Reasons for non-participation
	Reasons for participation
3. Organizational conditions for the participation in WHP activities	Timing
	Distance
	Team-internal agreements
	Work activity/environment
	Workload
	Leadership support
	Corporate culture
	Value health
	COVID-19
4. Wishes of the employees	Content of the WHP activity
	Framework
	Participation
	No interest
5. Communication and information on the WHP activities	Perceived communication channels
	Wishes for communication channels



*related, violence related, team building, and no known WHP activities.* A wide range of experiences emerged. Some nurses reported having no WHP activities at all, and some reported having several topic areas at once.

The subcategory *stress related* was defined as WHP activities in the area of stress management and strengthening of mental resources. In this context, companies provided contact persons for problems and confidants, both in the professional context, e.g., in dealing with conflicts but also privately, when emergency childcare was required.

Interviewee (I): “Then there is also a specialist colleague at the company who also helps with problems with psychological disorders or stress or depression or problems with violence. You can go and see her and make an appointment. So you can say that you will get help in any case, that's the way to go.” (OCS nurse)

In addition, there were activities for optimizing sleep, active relaxation training such as yoga and access to passive relaxation, e.g., through massage activities.

The subcategory *movement oriented* included WHP activities in the area of movement promoting work and physically active employees. It was mentioned that ergonomic work was supported by work equipment and that training in back-friendly working methods, e.g., kinesthetic, also existed. In addition, there were activities for physical balance in the form of exercise courses, e.g., gymnastics and team sports.

The subcategory *nutrition* was defined as WHP activities in the area of healthy nutrition in everyday working life. WHP activities were found in the area of optimization of the on-site nutritional activities, common nutritional activities, and educational activities on healthy nutrition. While the interviewees in ACH were particularly aware of the efforts made by the organizations with regard to cafeteria offerings, those in ICF and OCS were more aware of individual training courses on healthy eating and common cooking activities.

The subcategory *addiction* included information about WHP activities in the area of addiction prevention. There was only one statement in OCS telling about the idea of the company to set up a smoke-quitting WHP activity but no real activity is planned yet.

In the subcategory *violence related*, the most mentioned characteristics were training courses on de-escalation/dealing with violence in the area of ACH and OCS. ICF focused mainly on informal talks with the team or leadership. OCS emphasized this too, next to the training activities. Furthermore, there were structural aids given (emergency button, guidelines for action). Overall settings, there were professional contact persons visible.

I: “Yes, we already have many training courses on the subject [of violence prevention], also many different ones, first of all how best to deal with such a situation. Then also simply further training in which you are shown how to protect yourself, how you can also put the patient out of action in the situation [...] without hurting yourself and the patient.” (ACH nurse)

In the subcategory *teambuilding*, activities can be found that serve team-building purposes. Hereby, in ACH, only full-day events for team building were mentioned, thus, it was called “team days.” In ICF, communal eating as a team-building event was mentioned. In OCS,

the most versatile activities were mentioned, such as communal eating, parties, meetings, and outgoing activities.

“That's when we did various team-building activities, had discussions, ate, had a barbecue in the evening, talked about work, that kind of thing.” (ACH nurse)

The subcategory *no known WHP activities* collected statements on not perceiving WHP activities. In all settings, there were some interviewees mentioning not knowing any WHP activity in their company:

Researcher (R): “So what opportunities and offerings do you know of there?” B: “Actually, none at the moment.” (ACH nurse)

## 3.2. Participation in WHP activities

The main category *participation in WHP activities* was defined as statements about the reasons for participation or non-participation in WHP activities. Two subcategories were defined: *reasons for non-participation* and *reasons for participation*. The interviews were searched for inhibiting, promoting, and explaining characteristics.

The subcategory *reasons for non-participation* included reasons for the interviewee not to participate in WHP activities for *organizational* reasons. Overall settings, a long journey to the facility where activities took place was a barrier to participating in WHP activities. For ACH and OCS, time fit to shift work was often an issue. In ACH and OCS, it was mentioned that WHP activities were not suitable for the own work environment (for example, work on a closed station). In ACH and ICF, due to COVID-19, there were not any WHP activities offered. Furthermore, in ACH, it was mentioned that the WHP activities were not attractive for the professions.

“If something takes place where I'm there or right after work, I might attend. But I cannot drive back there and back again after three hours.” (OCS nurse)

“This is just a limited selection and temporally also not suitable for many or for me often not.” (ACH nurse)

The subcategory *reasons for participation* included reasons for the interviewee to participate in WHP activities for *organizational* reasons. There were comments by nurses in OCS participating because of the design of the WHP activities. Good communication about the activities and the good affordability were positively assessed. Conspicuous in the expressions of the ICF nurses was the group dynamics they experienced. No comments on this topic were found by nurses working in ACH.

“Most of the offers are also really free or discounted. And I really can't make any accusations about that. It's really well communicated and it's also really financially and everything is possible for every employee.” (ICF nurse)

### 3.3. Organizational conditions for participation in WHP activities

The main category *organizational conditions for participation in WHP activities* was defined as the general conditions in the context of work that play a role in participation in WHP activities. Nine subcategories were defined: *timing*, *distance*, *team-internal arrangements*, *work activity/environment*, *workload*, *leadership support*, *corporate culture*, *value health and COVID-19*, and *others*. The interviews were analyzed on inhibiting and promoting characteristics.

The subcategory *timing* described the interviewees' perception of how the noticed WHP activities can be used in the context of shift work. It was separated into *promoting* and *inhibitory* factors. Participating in a WHP activity during work hours was mentioned as promoting factor in ICF and OCS. In all interviewees from OCS and ACH, it was found inhibiting that the scheduling of the WHP activities was not compatible with shift work. There were no findings for ICF in this regard.

"But the problem is, these are often series events where you then have to sign up for all of the appointments. These appointments are often not compatible with nursing." (ACH nurse)

The subcategory *distance* described the interviewees' perception of the role of spatial distance in the participation of WHP activities. In both the settings ACH and OCS, nurses reported that a large distance between the WHP activities and the place of work inhibited participation if the WHP activity was scheduled differently from the shift work.

"[...] I live 30 kilometres away. And if something takes place [...] where I'm there or right after work, I could participate. But I can't drive there again after three hours and come back. If I live in the city, I would, I could also come back." (OCS nurse)

No statements were given on inhibitory factors by nurses in ICF. Overall settings, no promoting factors for participation in WHP activities due to a large distance were found.

The subcategory *workload* described how the amount of work or understaffing influenced participation in WHP activities. It was separated into promoting and inhibitory factors. Only inhibiting factors were found for this topic. Across all settings, the workload was clearly reported to be very heavy. This was due to more and more multimorbid patients, a higher documentation workload and understaffing for various reasons. In addition to the negative influence of this on personal health behavior and the organization of breaks, interviewees explicitly reported that this inhibited any health activity after the end of the shift due to stress. With regard to participation in WHP activities, a nurse in ICF made the explicit reference that participation in WHP activities was inhibited due to the highly demanding workload and a shortage of staff.

"when I do a shift that I now do with two colleagues, when I do it with five or six colleagues. And everyone can really go about their work in a relaxed manner. And at the end of the day, they are not completely exhausted and somehow only want to go home. Then he or she would definitely spend another two hours in the back course." (ICF nurse).

The subcategory *leadership support* described the influence of the manager on nurses in the participation in WHP activities. It was separated into promoting and inhibitory factors. In the setting of ACH and OCS, some experiences became visible where employees experienced that their leadership affirmed health-promoting behavior. The focus in this subcategory yet laid on the promotion of WHP activities by leadership. Among all settings, there were some experiences both on leadership support for participation and some not experiencing that.

"[...] We sit together every 14 days and see if there is anything new. And if there are new activities, then I'm informed that there are" (ACH nurse)

"R: [...] how is the issue of employee health addressed by your direct leadership? I: Not at all." (OCS nurse)

The subcategory *corporate culture* described the attitude that prevailed in the company at various levels of the members. The results varied among the settings. Some positive comments were found regarding the general corporate culture. The interviewees reported that despite the staff shortage, they felt that they were being looked after. It was mentioned that there was a family atmosphere and that there was understanding and open communication, especially in the case of OCS.

"That is a very big factor, they always take care, they always make sure that everyone is doing well." (ICF nurse)

Good job security and satisfaction with the workplace and the structures were also mentioned across all settings but not in every interview. Some interviewees reported that there was a good sense of community and that the atmosphere was characterized by trust. In some cases, it was reported that there was a clear sense of humanity in the hospital despite the economic pressure.

"That is certainly the case, that, the team spirit is very, very big. And as much as the (hospital name), the management level has to think economically, yes, but despite that, people still play a big role." (ACH nurse)

Other experiences from the hospital were a miserable atmosphere, a perception of replaceability, and a lack of appreciation from the employer.

"[...] a colleague says I'm quitting because I can't do it anymore, they don't ask what we can do to get you to stay. [...] On the contrary, one is then offended that he leaves. [...] I'm speaking not just about my clinic, I think it's the same in other large clinics." (ACH nurse)

Some ICF and ACH nurses described that, after all, they only associated negativity, stress, and pressure with the employer.

"I think if I had the feeling: 'I have to get out of here and I want to go home,' I wouldn't do a back course in the hospital afterwards. Because afterwards I think, 'He still wants something from me or

he's talking about work or something else. I think there would be strategically more favourable possibilities." (ACH nurse)

The subcategory *value health* described the perceived anchoring of the value of health in the corporate philosophy. Here, there were very different characteristics across all settings. It went from a clear perceptibility of the value of health in the company to only a superficial presentation where this value is not visible.

"I rate the [importance of employee health] as not very high." (ACH nurse)

"Should you ever have to cover, you have a compensation day directly next week. [...] in any case, health is very important here." (ICF nurse)

The subcategory *COVID-19* collected information on the influence of COVID-19 on WHP activities in the facility. Overall settings, it became visible that COVID-19 had an inhibiting influence on health-promoting activities, and the opportunities for digitalization were partially missed. In some cases, the facilities slowly started activities again.

Other comments that appeared in this main category were the mention of a problematic structure for nutritional services and too few places for participation in education courses in the hospital. Across all settings, comments were made that no real breaks could be taken. In addition, it was noted by ACH and ICF nurses that WHP activities may not have received much recognition.

"Yes, I also don't know whether that would necessarily be appreciated if there was somehow a training program for back health or something like that." (ICF nurse)

### 3.4. Employee wishes for WHP activities

The main category *employee wishes* included the desirable design of the WHP activity from the point of view of the interviewees. Four subcategories were defined: *content*, *framework*, *participation*, and *no interest*. The subcategories, then, were searched for inhibiting, promoting, and explaining characteristics.

The subcategory *content* collected wishes on the design of the content. As far as the desired topics are concerned, across all settings, WHP activities were desired in the area of smoking prevention, exercise (ergonomic work, support for aids, and exercise activities/physiotherapeutic support), nutrition activities, de-escalation training, mental activities (supervision, relaxation training), and team-building activities (outdoors). Partly behavior-oriented activities were desired, but partly improved structures were also desired, such as more participation places in de-escalation courses, improved infrastructure in the catering activities, and provision of aids.

"For example, I would like to have physiotherapy. Doing exercises. Rhythmic gymnastics, a little dance, a little different. For ten minutes, for fifteen minutes, that we move a little bit, laugh a little bit." (ICF nurse)

Regarding the content of the WHP activities, there were no specific topic requests for WHP activities for the hospital nurses. In OCS, the nurses wished for group activities and events in person instead of digitally. In ICF, the nurses expressed the desire for WHP activities to be fun and useful.

"And the fun factor is also important, yes. You should make the offer for the sake of wanting to and not for the sake of having to, yes." (ICF nurse)

The subcategory *framework* was defined as the design of the framework of the WHP activity (type, scope, and series of appointments). In this context, the desire for more numerous, more flexible WHP activities adapted to shift work became clear across all settings. The wishes for the localization of the WHP activities were not uniform, as some wanted it at the workplace and others explicitly not at the place of work. Ideas for enabling a WHP activity participation were the use of a rotation principle or the request of possible time periods. In OCS, the integration of WHP activities into working hours or compensatory time off was mentioned. The idea for discounts on work clothes and external health care providers such as gyms was also mentioned in all settings. Good communication of WHP activities and more slots to participate in de-escalation training were addressed in one hospital. The subcategory *participation* described wishes concerning the participatory design of WHP activities. In hospitals, the wish for asking around for suitable time slots was mentioned.

"That you simply get an opinion from the hospital, from all colleagues [...]" "Okay, this and this and this are the times [...]" "I would like to participate in that and I could also participate in that". And then to see: "Okay, which are the times that are mentioned most often and what kind of possibilities do we have to implement that?" (ACH nurse)

The subcategory *no interest* collected information on interviewees not having an interest in WHP activities and therefore not having any wishes. Comments on not wanting to stay longer at work, not being motivated to participate, and seeing a deeper source of the problems were found in OCS and ICF.

R: "Which topics would you be more interested in?"

I: "End of work (laughter). I don't have any desires there, or I don't lack anything. When my shift is done, then you can't attract me with anything anymore, I think." (ICF nurse)

### 3.5. Communication and information on the WHP activities

The main category *communication and information of the WHP activities* described communication channels through which the WHP activities were perceived or employees could obtain information in the company. This is divided into two subcategories: *perceived communication channels* and *wishes for communication channels*.

The subcategory *perceived communication channels* described the communication channels and information platforms on which WHP activities were noticed. Here, the communication of the WHP activities *via* Whatsapp, email, notices, and the personal or telephone approach was perceived across all settings. Furthermore, in the OCS setting, information was handed over *via* the inbox or a company app. In the ACH, the intranet and a training booklet were named communication media.

Overall, in all settings, the posting of notices and receiving emails were explicitly positively evaluated.

“So, I have to say, that's really very transparent and very positive. And everyone can really see it. [...] in the offices, in the info points, things are really regularly posted everywhere on well-designed posters. Emails are sent, really with the dates and the telephone numbers.” (ICF nurse)

Personal communication and the use of communication apps in ICF and OCS were explicitly rated positively. In ICF, team meetings and information *via* telephone were considered positive.

“However, there were also cases where employees did not read all emails or not all information was shared in the intranet: “So, I know that not all employees read any emails.” (ACH nurse)

The subcategory wishes for communication channels collects information on how wishes and ideas on WHP activities could be better communicated. Here, it appears that OCS wished for written communication *via* email or notice board. ICF also favored emails and direct personal communication. In the hospital, the widest range of favored communication channels was mentioned (notice board, team meeting emails, and personal communication).

“I think it would be good/. Also the people who offer such an activity[...] that these people simply go into the team meeting and say: “I offer this and that. This is what it looks like.”[...]. I think that would achieve even more when you go into these team meetings. But a personal approach is always better than an e-mail.” (ACH nurse)

## 4. Discussion

### 4.1. Summary of findings

The aim of this qualitative study was to identify organizational factors that promote or inhibit participation in WHP activities from the perspective of nurses. The results show that there is a wide range of barriers and facilitators at the organizational level, some overall settings, and others setting-specific. The high workload and the fitting of WHP activities with shift times are particularly striking.

The type and frequency of WHP activities vary widely across settings, from none offered at all to many offered. Relaxation training, ergonomic training, sports courses, improved nutrition services, nutrition courses, training courses on de-escalating violence, professional contact person for violent incidents, and different

team-building events. In OCS, good communication, good affordability, and the design of the WHP activities are stated as facilitating participation in WHP activities. OCS nurses like the group feeling. Participating during work time promotes participation in OCS and ICF. For ACH and OCS nurses, a large distance between home and the WHP activities in regard to the different shift times is an inhibiting issue. The wish for numerous, flexible WHP activities becomes clear. High workload overall settings are stated to inhibit as well as a negative association with the employer in ICF and ACH. With regard to the communication of WHP activities, the sending of emails and posting of notices are desired and positively evaluated across all settings.

### 4.2. The study aims at the context

In our study, the type of perceived WHP activities varies greatly across all settings from no activities at all to several different activities. Active/passive relaxation training, ergonomic/sports training, nutrition activities, activities for de-escalating violence, and professional and different team-building events are named as existing. There are wishes for implementing smoking prevention and activities in the common topics of exercise (ergonomic work, support for aids, and exercise activities/physiotherapeutic support), nutrition activities, de-escalation training, mental activities (supervision, relaxation training), and team-building activities (outdoors).

A German study on nurses points attention to a topic not found in our study: communication training (Ehgartner et al., 2020). Reduction of stress, recovery, and solving conflicts yet are announced here too (Mojtahedzadeh et al., 2021). For German nurses, practical preventive measures are required primarily in the areas of back health, strengthening, and again relaxation (Ehgartner et al., 2020). The diversity of interests is perhaps less about settings and more about whether it addresses behaviors nurses care about (Hammerback et al., 2015). In any case, in our study, the wish for numerous, flexible WHP activities becomes clear. In other professions, it was found that a broad array of program activities can raise participation levels in WHP (Robroek et al., 2009).

With regard to framework conditions, good communication, good affordability, and the design of the WHP activities facilitate participation in WHP activities.

Nurses of outpatient care service (OCS) seem to like the group feeling. For ACH and OCS nurses, a large distance between home and the WHP activities in regard to the different shift times is an inhibiting issue. The literature confirms the fundamental challenge of different working hours in the shift system and the work outside the company for WHP in OCS. It seems difficult to design activities in such a way that they can be used equally by all employees (Neumann et al., 2022). Another United States study on nurses emphasizes this finding for the setting of ICF. Difficulty with a time release, making time, and scheduling issues appear to be influencing participation rates (Zhang et al., 2016).

The goal of fulfilling the healthcare mandate seems to have a structural dominance over other long-term goals, such as maintaining the health and working ability of nurses over all settings (Krupp et al., 2020). In our study, participating during work time was promoting participation in OCS and ICF. United States study results support this



finding, as release time for participation and management support are identified as the most important factors for WHP in the nursing setting (Havermans et al., 2016; Zhang et al., 2016). In our study, management support is partly experienced, but it is subjectively not brought in connection with the participation, so there is still an open question here. However, the United States study on nurses finds that support from multiple levels such as managers seems to be important for participation in WHP activities for nurses (Zhang et al., 2016). In other professions, it is even stated to be the most influencing factor (Rojatz et al., 2015).

The reason why manager support and WHP are not brought together here may have methodological reasons. In our qualitative study, it may be that the nurses are not that aware of the connection between WHP and the promotion of WHP by their managers. However, this could perhaps be measured quantitatively as is the case in other studies. Nevertheless, there is further research needed on how managers can support their teams by communicating and promoting WHP topics.

The topic “high workload” is stated as inhibiting participation in WHP activities overall settings as well as a negative association with the employer in ICF and ACH. Other results from Germany show that a high work density with a simultaneous shortage of nurses often pushes the implementation of WHP activities into the background (Krupp et al., 2020). In terms of the quality of association with the employer, other international nursing studies find that participation is significantly associated ( $p < 0.05$ ) with higher satisfaction with the job, work, lower stress, exhaustion, and cynicism (Ledikwe et al., 2018).

In the literature, there are other influencing factors for WHP in nursing that have not been mentioned by our interviewees or have not been put into a subjective context. Positive influence on ICF nurses can be found in employee awareness, engagement, and WHP being integrated into everyday organizational structures by the top management. Furthermore, a participatory culture, providing financial resources and the presence of a functional committee to promote good communication and motivate employee participation, seems to be facilitating (Zhang et al., 2016). Next to the establishment of a health committee, administrative support and integration of activities in the organization are found to be facilitating for healthcare workers (Ledikwe et al., 2018). The “patient” priority and a limited appreciation of their own wellbeing are barriers for healthcare workers (Ledikwe et al., 2017). In other professions, organizational structures, available resources, reorganizations, the presence of multiple company locations, and a poor psychosocial environment are listed as influencing factors for WHP (Rojatz et al., 2015).

With regard to the communication of WHP activities, ICF and OCS experience mostly personal communication and communication *via* apps, ICF team meetings, and telephone contact. ACH mentions communication *via* intranet and having a training booklet. The sending of emails and posting of notices are desired and positively evaluated across all settings. A study on ICF nurses reports that a lack of communication is experienced as a barrier to participation in WHP. Employees and middle managers report frustration with the team members primarily talking to each other, rather than trying to get more front-line staff involved (although they think they do). A German qualitative study enhances the enabling of participation and communication and the creation of transparency for the success of WHP (Brand et al., 2017).

### 4.3. Strengths and limitations

The results of our study provide insight into which organizational factors may be promoting and inhibiting participation in WHP activities from the perspective of nurses. This creates a basis not only for initial adjustments in practice but also for in-depth research to explore further interrelationships. Despite the new insights presented, the study's weaknesses must also be pointed out. As our participants were selected through contacts in care organizations who participated in the WHP-BAGGer project, this can be a sample that is already better positioned than other care facilities. With regard to the age of the participants, it can be seen that no interviewee was younger than 25 years (the lower limit of the sample was 18 years). This could have several reasons. Possibly, these persons were not interested in participating in an interview study or think, they don't have enough experience to talk about this topic in an interview. However, due to the fact that the contact person at the facility initiated contact with potential interview partners, we do not have any concrete information on this. The interviews were conducted by telephone, which had the advantage that the participants were in a familiar environment. Nevertheless, an audio-only track conveys less information about the interviewee than a face-to-face conversation. Interview fatigue could have played a role. We always recorded possible observations during the interview and could not detect any signs of fatigue. In fact, the interviewees were very talkative. The data saturation was stated as no more new topics (code saturation) were mentioned, but it is still questionable whether full meaning saturation was achieved, as some questions could have used more depth (Hennink et al., 2017). In terms of other methods, it would have been interesting to examine an exchange of perspectives, such as a focus group, between people who are involved in the management of WHP and the target group's reasons for or against participation. Furthermore, an expansion of quantitative research on the basis of a large sample on these topics would be interesting to test for significant correlations.

At the present time, health insurers and employers are interested in expanding WHP due to positive indications for it. Employees are also interested in WHP activities, but participation rates are low. Our qualitative results provide information on what can be useful to increase participation. A meta-analysis in other professions indicates larger intervention effects among workers with higher program compliance, which emphasizes the importance of sustained participation with regard to effectiveness (Coenen et al., 2020). Designing WHP activities deserves attention to achieve a better insight into what works for whom in which context and to make sure that successful WHP programs are sustainable in practice (Robroek et al., 2021). To develop this, structured process evaluations to monitor the implementation alongside effect evaluations are needed (Havermans et al., 2016).

### Data availability statement

The data presented in this study are available on request from the corresponding author.

### Ethics statement

The studies involving human participants were reviewed and approved by German Ethics Committee of the German Sport



University Cologne (reference numbers no. 050/2021). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

HB, JL, and AS: conceptualization and methodology. HB: formal analysis, writing—original draft, and visualization. HB and JL: investigation. AS: resources, funding acquisition, and supervision. JL and AS: writing—review and editing. HB and AS: project administration. All authors contributed to the article and approved the submitted version.

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## References

- Allan, J., Querstret, D., Banas, K., and de Bruin, M. (2017). Environmental interventions for altering eating behaviours of employees in the workplace: a systematic review. *Obes. Rev.* 18, 214–226. doi: 10.1111/obr.12470
- Bauer, S., Geiger, L., Niggemann, R., and Seidel, J. (2020). Präventionsbericht 2020: Leistungen der gesetzlichen Krankenversicherung: Primärprävention und Gesundheitsförderung Leistungen der sozialen Pflegeversicherung: Prävention in stationären Pflegeeinrichtungen. GKV-Spitzenverband.
- Baxter, S., Sanderson, K., Venn, A. J., Blizzard, C. L., and Palmer, A. J. (2014). The relationship between return on investment and quality of study methodology in workplace health promotion programs. *Am. J. Health Promot.* 28, 347–363. doi: 10.4278/ajhp.130731-LIT-395
- BKK Dachverband (2017). *Gesundheit und Arbeit – Blickpunkt Gesundheitswesen: BKK Gesundheitsatlas 2017*. Berlin: MWV Medizinisch Wissenschaftliche Verlagsgesellschaft.
- Brand, S. L., Thompson Coon, J., Fleming, L. E., Carroll, L., Bethel, A., and Wyatt, K. (2017). Whole-system approaches to improving the health and wellbeing of healthcare workers: a systematic review. *PLoS One* 12:e0188418. doi: 10.1371/journal.pone.0188418
- Cahill, K., and Lancaster, T. (2014). Workplace interventions for smoking cessation. *Cochrane Database Syst. Rev.* 2:CD003440. doi: 10.1002/14651858.CD003440.pub4
- Chan, C. W., and Perry, L. (2012). Lifestyle health promotion interventions for the nursing workforce: a systematic review. *J. Clin. Nurs.* 21, 2247–2261. doi: 10.1111/j.1365-2702.2012.04213.x
- Chiou, S.-T., Chiang, J.-H., Huang, N., and Chien, L.-Y. (2014). Health behaviors and participation in health promotion activities among hospital staff: which occupational group performs better? *BMC Health Serv. Res.* 14:474. doi: 10.1186/1472-6963-14-474
- Coenen, P., Robroek, S. J. W., van der Beek, A. J., Boot, C. R. L., van Lenthe, F. J., Burdorf, A., et al. (2020). Socioeconomic inequalities in effectiveness of and compliance to workplace health promotion programs: an individual participant data (IPD) meta-analysis. *Int. J. Behav. Nutr. Phys. Act.* 17:112. doi: 10.1186/s12966-020-01002-w
- Destatis Statistisches Bundesamt. (2018). “Pressemitteilung Nr. 448 vom 19. November 2018: Durchschnittsalter von Erwerbstätigen nach ausgewählten Berufsgruppen: Ergebnis des Mikrozensus 2017” in *Erwerbstätige im Durchschnitt 44 Jahre alt*. Wiesbaden.
- Dietrich, U., Rößler, M., Bellmann, M., and Kirch, W. (2015). Betriebliches Gesundheitsmanagement in der Altenpflege. *Präv Gesundheitsf* 10, 3–10. doi: 10.1007/s11553-014-0458-x
- Dresing, T., and Pehl, T. (2018). “Praxisbuch interview, Transkription & Analyse” in *Anleitungen und Regelsysteme für qualitativ Forschende*. (Marburg: Eigenverlag).
- Drupp, M., and Meyer, M. (2020). “Belastungen und Arbeitsbedingungen bei Pflegeberufen – Arbeitsunfähigkeitsdaten und ihre Nutzung im Rahmen eines Betrieblichen Gesundheitsmanagements” in *Pflege-Report 2019: Mehr Personal in der Langzeitpflege – aber woher?* eds. K. Jacobs, A. Kuhlmei, S. Greß, J. Klauber and A. Schwinger (Berlin, Heidelberg: Springer Berlin Heidelberg), 23–47.
- Ehgartner, V., Kirschneck, M., Frisch, D., Schuh, A., and Kus, S. (2020). Arbeitsfähigkeit von Pflegekräften in Deutschland – welchen Präventionsbedarf hat das Pflegepersonal: Ergebnisse einer Expertenbefragung. *Gesundheitswesen* 82, 422–430. doi: 10.1055/a-0905-3007
- European Network for Workplace Health (1997). *Luxembourg declaration on workplace health promotion in the European union*. Available at: [https://www.enwhp.org/resources/toolip/doc/2022/01/26/1\\_luxembourg\\_declaration\\_2018.pdf](https://www.enwhp.org/resources/toolip/doc/2022/01/26/1_luxembourg_declaration_2018.pdf)
- Freak-Poli, R. L. A., Cumpston, M., Peeters, A., and Clemen, S. A. (2013). Workplace pedometer interventions for increasing physical activity. *Cochrane Database Syst. Rev.*:CD009209. doi: 10.1002/14651858.CD009209.pub2
- Gale, N. K., Heath, G., Cameron, E., Rashid, S., and Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med. Res. Methodol.* 13:117. doi: 10.1186/1471-2288-13-117
- Geaney, E., Kelly, C., Greiner, B. A., Harrington, J. M., Perry, I. J., and Beirne, P. (2013). The effectiveness of workplace dietary modification interventions: a systematic review. *Prev. Med.* 57, 438–447. doi: 10.1016/j.ypmed.2013.06.032
- Goldgruber, J., and Ahrens, D. (2009). Gesundheitsbezogene Interventionen in der Arbeitswelt. *Prävention und Gesundheitsförderung* 4, 83–95. doi: 10.1007/s11553-008-0155-8
- Grossmeier, J., Castle, P. H., Pitts, J. S., Saringer, C., Jenkins, K. R., Imboden, M. T., et al. (2020). Workplace well-being factors that predict employee participation, health and medical cost impact, and perceived support. *Am. J. Health Promot.* 34, 349–358. doi: 10.1177/0890117119898613
- Guillaumie, L., Boiral, O., and Champagne, J. (2017). A mixed-methods systematic review of the effects of mindfulness on nurses. *J. Adv. Nurs.* 73, 1017–1034. doi: 10.1111/jan.13176
- Hammerback, K., Hannon, P. A., Harris, J. R., Clegg-Thorp, C., Kohn, M., and Parrish, A. (2015). Perspectives on workplace health promotion among employees in low-wage industries. *Am. J. Health Promot.* 29, 384–392. doi: 10.4278/ajhp.130924-QUAL-495
- Havermans, B. M., Schelvis, R. M. C., Boot, C. R. L., Brouwers, E. P. M., Anema, J. R., and van der Beek, A. J. (2016). Process variables in organizational stress management intervention evaluation research: a systematic review. *Scand. J. Work Environ. Health* 42, 371–381. doi: 10.5271/sjweh.3570
- Hennink, M. M., Kaiser, B. N., and Marconi, V. C. (2017). Code saturation versus meaning saturation: how many interviews are enough? *Qual. Health Res.* 27, 591–608. doi: 10.1177/1049732316665344
- Hosang, G. M., Shiles, C., Tansey, K. E., McGuffin, P., and Uher, R. (2014). Interaction between stress and the BDNF Val66Met polymorphism in depression: a systematic review and meta-analysis. *BMC Med.* 12:7. doi: 10.1186/1741-7015-12-7
- Hupfeld, J., Wanek, V., and Schreiner-Kürt, K. (2021). *Leitfaden Prävention: Handlungsfelder und Kriterien nach § 20 Abs. 2 SGB V*.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Isfort, M., Rottländer, R., Weidner, F., Gehlen, D., Hylla, J., and Tucman, D. (2018). *Pflege-Thermometer 2018. Eine bundesweite Befragung von Leitungskräften zur Situation der Pflege und Patientenversorgung in der stationären Langzeitpflege in Deutschland*. Available at: <http://www.dip.de>
- Kahnt, F., Wihofsky, P., and Ohm, H.-P. (2020). Betriebliches Gesundheitsmanagement in der ambulanten Pflege. *Präv Gesundheitsf* 15, 21–26. doi: 10.1007/s11553-019-00734-3
- Krupp, E., Hielscher, V., and Kirchen-Peters, S. (2020). “Betriebliche Gesundheitsförderung in der Pflege-Umsetzungsbarrieren und Handlungsansätze” in *Pflege-Report 2019*. eds. K. Jacobs, A. Kuhlmeier, S. Greß, J. Klauber and A. Schwinger (Berlin, Heidelberg: Springer), 113–122.
- Ledikwe, J. H., Kleinman, N. J., Mpho, M., Mothibedi, H., Mawandia, S., Semo, B.-W., et al. (2018). Associations between healthcare worker participation in workplace wellness activities and job satisfaction, occupational stress and burnout: a cross-sectional study in Botswana. *BMJ Open* 8:e018492. doi: 10.1136/bmjopen-2017-018492
- Ledikwe, J. H., Semo, B.-W., Sebege, M., Mpho, M., Mothibedi, H., Mawandia, S., et al. (2017). Implementation of a National Workplace Wellness Program for health Workers in Botswana. *J. Occup. Environ. Med.* 59, 867–874. doi: 10.1097/JOM.0000000000001028
- Mojtahedzadeh, N., Neumann, F. A., Rohwer, E., Augustin, M., Zyriax, B.-C., Harth, V., et al. (2021). Betriebliche Gesundheitsförderung in der Pflege. *Präv Gesundheitsf* 16, 163–169. doi: 10.1007/s11553-020-00800-1
- Meyer, M., Wing, L., and Schenkel, A. (2022). “Krankheitsbedingte Fehlzeiten in der deutschen Wirtschaft im Jahr 2021” in *Fehlzeiten-Report 2022 Vol. 2022*. eds. B. Badura, A. Ducki, M. Meyer and H. Schröder (Berlin, Heidelberg: Springer), 287–368.
- Neumann, F. A., Mojtahedzadeh, N., Harth, V., Mache, S., Augustin, M., and Zyriax, B.-C. (2022). Gesundheitsverhalten und-förderung von ambulanten Pflegekräften. *Präv Gesundheitsf* 17, 32–43. doi: 10.1007/s11553-021-00842-z
- Robroek, S. J., Coenen, P., and Oude Hengel, K. M. (2021). Decades of workplace health promotion research: marginal gains or a bright future ahead. *Scand. J. Work Environ. Health* 47, 561–564. doi: 10.5271/sjweh.3995
- Robroek, S. J., van Lenthe, F. J., van Empelen, P., and Burdorf, A. (2009). Determinants of participation in worksite health promotion programmes: a systematic review. *Int. J. Behav. Nutr. Phys. Act.* 6:26. doi: 10.1186/1479-5868-6-26
- Rojatz, D., Merchant, A., and Nitsch, M. (2015). Zentrale Einflussfaktoren der betrieblichen Gesundheitsförderung. Ein systematischer Literaturreview. *Prävention Gesundheitsförderung* 10, 134–146. doi: 10.1007/s11553-015-0488-z
- Romppanen, J., and Häggman-Laitila, A. (2017). Interventions for nurses' well-being at work: a quantitative systematic review. *J. Adv. Nurs.* 73, 1555–1569. doi: 10.1111/jan.13210
- Schaller, A., Gernert, M., Klas, T., and Lange, M. (2022). Workplace health promotion interventions for nurses in Germany: a systematic review based on the RE-AIM framework. *BMC Nurs.* 21:65. doi: 10.1186/s12912-022-00842-0
- Schulte, B., O'Donnell, A. J., Kastner, S., Schmidt, C. S., Schäfer, I., and Reimer, J. (2014). Alcohol screening and brief intervention in workplace settings and social services: a comparison of literature. *Front. Psych.* 5:131. doi: 10.3389/fpsyg.2014.00131
- Simek, M., Nitsch, M., and Ropin, K. (2014). Praxisprojekte betrieblicher Gesundheitsförderung. *Prävention Gesundheitsförderung* 9, 138–143. doi: 10.1007/s11553-013-0423-0
- Stummer, H., Nöhammer, E., Schaffenrath-Resi, M., and Eitzinger, C. (2008). Interne Kommunikation und betriebliche Gesundheitsförderung. *Präv Gesundheitsf* 3, 235–240. doi: 10.1007/s11553-008-0136-y
- Tong, A., Sainsbury, P., and Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int. J. Qual. Health Care* 19, 349–357. doi: 10.1093/intqhc/mzm042
- Wan Mohd Yunus, W. M. A., Musiat, P., and Brown, J. S. L. (2018). Systematic review of universal and targeted workplace interventions for depression. *Occup. Environ. Med.* 75, 66–75. doi: 10.1136/oemed-2017-104532
- Weinreich, I., and Weigl, C. (2002). *Gesundheitsmanagement erfolgreich umsetzen: Ein Leitfaden für Unternehmen und Trainer*. Neuwied, Kriftel: Luchterhand.
- Weinstein, M., and Cheddie, K. (2021). Adoption and implementation barriers for worksite health programs in the United States. *Int. J. Environ. Res. Public Health* 18:12030. doi: 10.3390/ijerph182212030
- Witzel, A. (2000). “The problem-centered interview. Forum qualitative Sozialforschung/forum: qualitative social research,” *Qualitative Research: National, Disciplinary, Methodical and Empirical Examples. Vol. 1*. doi: 10.17169/FQS-1.1.1132
- Zhang, Y., Flum, M., Kotejshyer, R., Fleishman, J., Henning, R., and Punnett, L. (2016). Workplace participatory occupational health/health promotion program: facilitators and barriers observed in three nursing homes. *J. Gerontol. Nurs.* 42, 34–42. doi: 10.3928/00989134-20160308-03



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# Effects of thriving at work on employees' family role performance: A moderated mediation model

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**Objective:** Existing research has demonstrated that thriving at work has a positive effect on work performance, but little is known about how thriving at work affects family role performance. Based on the work-home resource model, this study examines the impact mechanism of thriving at work on family role performance.

**Methods:** This paper uses an experience sampling method to conduct a 5-day daily study of 151 married employees in Northwest China, and the data were analyzed using a multilevel linear model.

**Results:** We find that thriving at work positively affects family role performance partly through the mediating effect of work-family enrichment at the individual level. Moreover, family-supportive supervisor behavior moderates the relationship between thriving at work and work-family enrichment. Through work-family enrichment, family-supportive supervisor behavior also moderates the indirect relationship between thriving at work and family role performance. Specifically, the higher the level of family-supportive supervisor behavior, the stronger the indirect effect of thriving at work on family role performance through work-family enrichment.

**Conclusion:** Previous research has focused more on the effects of thriving at work within the work domain, suggesting that thriving at work can have a positive impact on work outcomes. However, only a few studies have examined the positive relationship between thriving at work and family role performance from the perspective of employees' positive psychological resources. This paper explores the positive effects of thriving at work on family role performance based on a resource flow perspective and identifies its potential boundary conditions. This study enriches the theoretical research on the relationship between thriving at work and family role performance. Additionally, it provides a new foothold and research perspective on improving work-family enrichment.

## KEYWORDS

thriving at work, family role performance, work-family enrichment, family-supportive supervisor behavior, work-home resource model

## Introduction

Work and family are two crucial parts of life. People work hard to achieve career development and improve their family's quality of life. However, in most cases, it is difficult for people to balance work and family. Therefore, achieving career development and family happiness simultaneously is not only a problem of individual concern but also an important issue that academia and managers have been concerned about for a long time (Jachimowicz et al., 2021; Lin et al., 2021). In the Chinese TV series *The Perfect Mate*, the heroine gave up the job she loves to take care of her family, then realized that being a housewife is not for her and goes back to her career, where her experiences at work make her more aware of how to run her family life, and finally lives the life she wants. In accordance with this TV series, existing research also confirms that the level of engagement demonstrated at work has an impact on work–family balance and family satisfaction through positive work events that individuals share with their spouses at home (Ilies et al., 2017). Therefore, it is possible to achieve both work and family life balance, but the key is to find mechanisms through which these two aspects can be mutually reinforced.

Thriving at work refers to the positive psychological state of learning and the vitality that accompanies an individual's work process (Spreitzer et al., 2005; Ren et al., 2022). Previous studies have focused more on the effects of thriving at work in the workplace. It is believed that thriving at work can effectively alleviate negative attitudes and behaviors that occur at work (Abid et al., 2016, 2018; Hildenbrand et al., 2018; Chang and Busser, 2020; Jiang et al., 2020, 2021; Kaiser et al., 2020; Abid and Contreras, 2022), enhance work-related performance and engagement (Abid et al., 2018; Frazier and Tupper, 2018; Marchiondo et al., 2018; Christensen-Salem et al., 2021; Jiang et al., 2021), and promote employee mental health levels (Walumbwa et al., 2018; Kleine et al., 2019; Zhai et al., 2020; Rehmat et al., 2021). In addition, some scholars have suggested that personal characteristics (Porath et al., 2012; Jiang, 2017; Walumbwa et al., 2018; Kleine et al., 2019; Chang et al., 2020; Elahi et al., 2020; Abid and Contreras, 2022) and job-related resources within the work domain (Mortier et al., 2015; Abid et al., 2016; Niessen et al., 2017; Walumbwa et al., 2018; Bensemmane et al., 2019; Zhang et al., 2019; Jiang et al., 2020) are predictive of thriving at work (see Figure 1 for details on the antecedent and outcome variables of thriving at work).

In recent years, some scholars have started to study the positive relationship between family life and thriving at work, but such studies are limited to the impact of family life and family-related policies on thriving at work, and fewer scholars have focused on the positive effect of thriving at work on family life (Carmeli and Russo, 2016). In today's society, people pay more attention to the quality of life, family needs, and the harmonious development of work and family (Tariq and Ding, 2018). Therefore, it is necessary to discuss and test the possible mechanisms through which the positive state of work (e.g., thriving at work) contributes to the quality of life of employees' families (Amstad et al., 2011; Jia et al., 2014).

Work–family enrichment is the extent to which an individual's experience in a work role contributes to improving the quality of their family's life (Greenhaus and Powell, 2006). Resources representing one domain help develop personal resources that drive increased outcomes in another domain (Ten Brummelhuis and Bakker, 2012). The work–home resources model uses personal resources as a link between resources in one domain and outcomes in another domain,

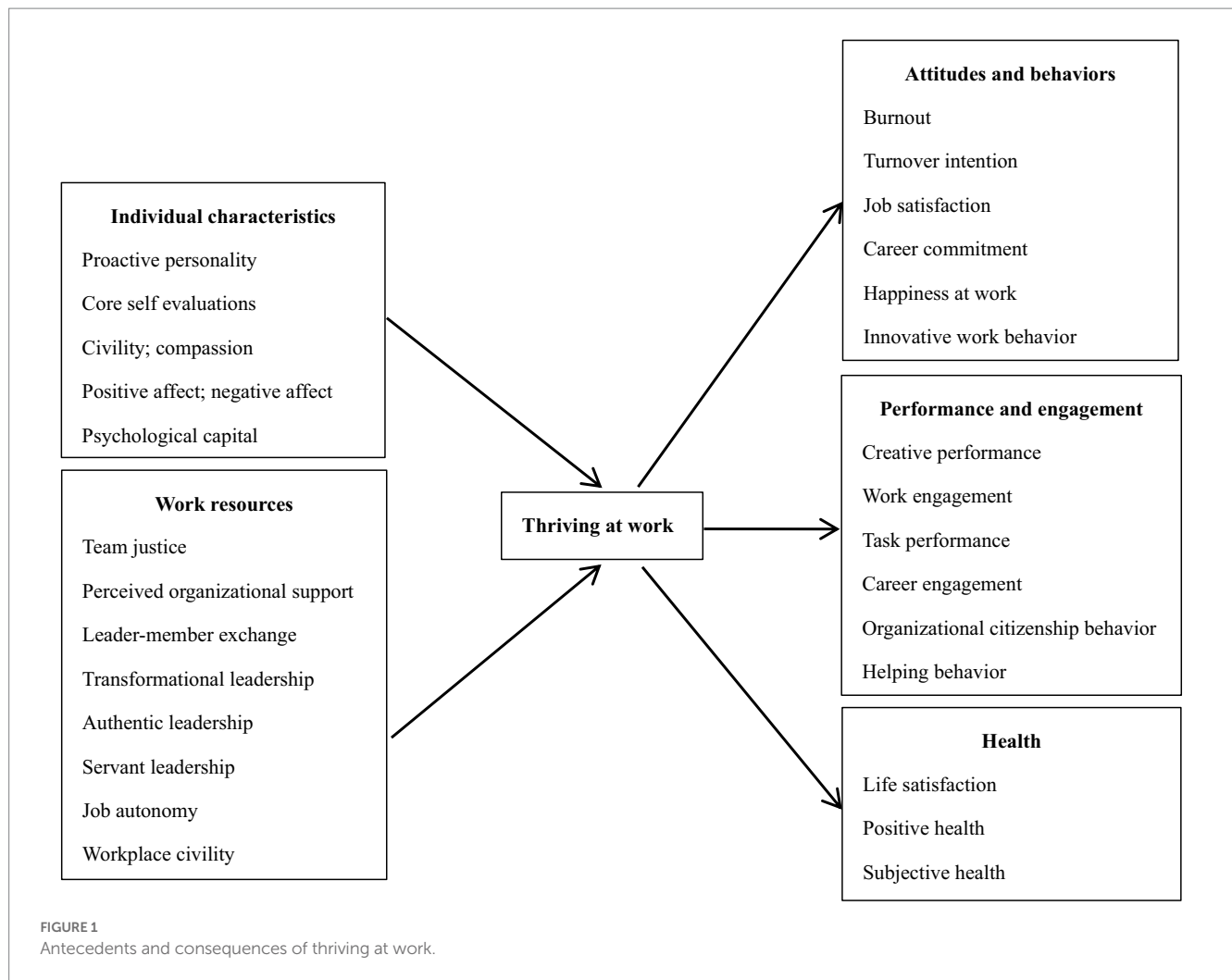
systematically explaining the causal logic behind work–home enrichment that are most likely to occur and the developmental processes (Ten Brummelhuis and Bakker, 2012; Ten Brummelhuis and Greenhaus, 2018). For example, work–family enrichment occurs when resources from the work domain increase personal resources and are used to improve outcomes in the family domain.

Enrichment is formed when the resources that individuals accumulate in their thriving at work allow them to perform better in their family life. The formation of resources is a key driver of the enrichment process as they are an asset that individuals need to draw upon when faced with problems (Wayne et al., 2007). Specifically, family role performance refers to the results of fulfilling role-based obligations and expectations when individuals participate in family activities (Chen et al., 2014; Derks et al., 2016). If thriving at work brings many positive resources to an individual, then these resources can be applied to the family to improve the quality of family life; thus, work–family enrichment should be one of the necessary conditions and critical links in this positive effect. Therefore, this study explores this issue and verifies the possible mediating role of work–family enrichment in the relationship between thriving at work and family role performance using a work–home resource model.

In addition, the ability of employees to thrive at work is often tied to their supervisor's interpretation and implementation of the organization's family support culture. A supervisor who cares about the needs of employees' families can create a family-supportive organizational environment for employees to feel supported by the organization, which can contribute to the acquisition and development of individual resources (Ten Brummelhuis and Bakker, 2012). A growing number of studies have also demonstrated that family-supportive supervisor behavior is one of the key situational factors that affect the positive spillover between work and family (Russo et al., 2018; Straub et al., 2019). Family-supportive supervisor behavior refers to family support behaviors that leaders demonstrate to employees to assist them to assume family role responsibilities and obligations, which are aimed at helping employees better fulfill their work and family responsibilities and improving the relationship between work and family (Hammer et al., 2009; Booth-LeDoux et al., 2020). Studies have revealed that when the behavior of a family-support supervisor is high, employees tend to be more energetic, better able to balance work and family, and have higher family happiness (Matthews et al., 2014; Zhang and Tu, 2018). Thus, family-supportive supervisor behavior plays an important role in how thriving at work influences family role performance through work–family enrichment. Based on the work–home resource model, we propose that family-supportive supervisor behavior moderates the indirect relationship between thriving at work and family role performance through work–family enrichment.

In summary, based on the work–home resource model, this research explores the mechanism of work–family enrichment and family-supportive supervisor behavior in the process of thriving at work, which affects family role performance. Recent studies have recognized that, as an emotion-cognitive state, individuals' thriving at work is volatile. Thus, employees' thriving at work may vary during the working day because of various internal and external factors (Niessen et al., 2012; Kleine et al., 2019). Therefore, this study intends to use an experience sampling method to explore how changes in employees' daily thriving at work affect their daily family role performance.





## Theory and hypotheses

### Thriving at work and family role performance

Thriving at work is a positive psychological state, so when employees invest more energy and learn new skills at work, they tend to feel a higher sense of achievement, which is conducive to self-efficacy and happiness in life. They then bring this positive emotional experience to the family, which increases sharing and communication with their partners and helps them to better perform their family functions (Ilies et al., 2017; Straub et al., 2019). Moreover, after a busy day at work, employees may feel that they have put in a lot of effort and performed to the best of their ability and are motivated to go home and focus more on family life and handling family matters (Kahn, 1990). Therefore, we infer that thriving at work is positively related to employees' family role performance.

The work-home resource model provides a theoretical basis for understanding the positive effects of thriving at work on employee family role performance. The model is a theory that systematically explains the positive interaction between work and family by describing the processes and conditions under which individual resources link resources in one domain to outcomes in the other. According to the work-home resource model (Ten Brummelhuis and

Bakker, 2012), the effects of each domain will spill over from one to the other, despite the temporary separation between work and family (Wood et al., 2020). Therefore, when employees are highly thriving at work, the experience and resources in their work can significantly help them better solve related problems in the family and improve their efficiency and performance (Ilies et al., 2017). In addition, studies have found that individuals who highly thrive at work tend to have higher emotional management ability at work. Through effective emotional management, individuals can avoid negative emotions and events, reduce the depletion of psychological resources, and increase their ability and motivation to fulfill family obligations and play family roles (Greenhaus and Powell, 2006; Zheng and Powell, 2012). Thus, we propose the following hypothesis:

*Hypothesis 1:* Thriving at work has a significant positive effect on family role performance.

### The mediating role of work-family enrichment

The mechanisms through which thriving at work affects employees' outcomes in the family domain are explored through the



lens of work–family enrichment. Work–family enrichment is when resources in one domain “contribute to the development of personal resources that drive increased outcomes in another domain” (Ten Brummelhuis and Bakker, 2012). Through an instrumental approach, research has found that thriving at work can affect employees’ work–family enrichment. Employees who highly thrive at work are motivated by internal factors, are enthusiastic about work, and have a stronger ability to work and learn, which are conducive to acquiring more skills and gaining more opportunities to accumulate knowledge. This helps employees to perform better at home and achieve work–family enrichment (Bakker et al., 2012; Ilies et al., 2017). In addition, thriving at work enhances work–family enrichment in emotional ways. As mentioned earlier, thriving contains an element of vitality, which is a positive psychological experience. Research has demonstrated that thriving at work is associated with work resources that reduce work stress and stimulate positive emotions (Xanthopoulou et al., 2007). Employees who highly thrive at work tend to have high positive emotions at work, and such emotional feelings (also a type of resource) spill over to the field of family life, which enables employees to have positive emotions when playing family roles, thereby enhancing work–family enrichment (Ilies et al., 2017). Therefore, we propose the following hypothesis:

*Hypothesis 2: Thriving at work has a significant positive effect on work–family enrichment.*

Work–family enrichment leads to the mutual transfer of resources in different fields and helps individuals acquire more resources. When individuals have more disposable resources, they can deal with the pressure of family life and achieve family role performance (Russo et al., 2018; Wu et al., 2021). Studies have found that work–family enrichment, which is a positive result of resources accumulated by employees in the process of work and brought into family life, can generate more resources in the family, and the motivation level stimulated by resource accumulation makes individuals perform better in the family (Lazarova et al., 2010). Other studies have confirmed that work–family enrichment positively promotes individuals’ physical and mental health, and good physical and psychological resources increase the possibility of role involvement, thus positively affecting family role performance (Williams et al., 2006; Rich et al., 2010). The study of Ma et al. (2014) also found that when employees have a high work–family enrichment, they often have a high level of family involvement, which further promotes family role performance. Thus, we propose the following hypothesis:

*Hypothesis 3: Work–family enrichment has a significant positive effect on family role performance.*

Combining *H2* and *H3*, we propose the following:

*Hypothesis 4: Work–family enrichment plays a mediating role in the relationship between thriving at work and family role performance.*

## The moderating effect of family-supportive supervisor behavior

The work–home resource model assumes that the interaction between multiple resources (e.g., psychological and situational)

can have a synergistic effect (Greenhaus et al., 2012). According to this model, contextual resources (e.g., pro-family policies and family-supportive supervisor behavior) play a moderating role in the relationship between individual psychological resources stimulated by the work domain and the work–family facilitation relationship. Hobfoll et al. (2018) suggested that by cultivating valuable work resources, managers can create a good cycle of resources for their employees. Family-supportive supervisor behavior is supportive behavior exhibited by leaders toward employees’ family life, constructing a person-centered, pro-family style of leadership to influence employees’ attitudes and behaviors, which help them to better fulfill their work and family responsibilities and improve the relationship between work and family. Specifically, with high family-supportive supervisor behavior, individuals receive more resource support from their organization and accumulate a wealth of personal resources. At this point, they are more likely to focus on resource acquisition and pursue access to resources (Halbesleben et al., 2014). Therefore, when employees receive a high level of encouragement and support from their leaders, they will expand their work resources and perceive more energy at work, which would effectively contribute to their work–family enrichment and enhance their problem-solving skills and fulfillment of family roles in the family domain. Research has also found that when leaders provide employees with instrumental support, employees usually concentrate on their work and make full use of resources to achieve the sharing and mutual promotion of resources in the field of work and family (Matthews et al., 2014; Tang et al., 2017).

However, with low family-supportive supervisor behavior, an individual faces a greater threat to resources and workload exerts progressively more pressure or hindrance on the individual, which may inhibit the individual’s current psychological resources (thriving at work), and it prevents the positive role it plays from being fully realized and utilized (Hobfoll, 2011). Therefore, when experiencing low levels of family-supportive supervisor behavior, employees are prevented from further depleting their own resources for thriving at work by experiencing a lack of total contextual resources, thereby reducing the strength of the positive relationship between thriving at work and work–family enrichment. For example, studies have revealed that employees with low levels of family-supportive supervisor behavior are more likely to have a strong sense of time encroachment and habitually define themselves as “outsiders,” which impedes the flexible transition between work and family roles (Wang et al., 2018). Thus, we propose the following hypothesis:

*Hypothesis 5: Family-supportive supervisor behavior plays a moderating role in the relationship between thriving at work and work–family enrichment. The higher the family-supportive supervisor behavior, the stronger the positive effect of thriving at work on work–family enrichment.*

The above discussion reveals that family-supportive supervisor behavior moderates the relationship between thriving at work and work–family enrichment and influences the indirect effect of thriving at work on family role performance through work–family enrichment. Specifically, work–family enrichment mediates the effect of thriving at work on family role performance, but the level of family-supportive supervisor behavior influences the strength of the mediating effect. Based on the above reasoning, we propose the following hypothesis:

**Hypothesis 6:** Family-supportive supervisor behavior moderates the indirect effect of thriving at work on family role performance through work–family enrichment. The higher the family-supportive supervisor behavior, the stronger the indirect effect of thriving at work on family role performance through work–family enrichment.

The theoretical model of this study is summarized in [Figure 2](#).

## Methods

This research conducts a questionnaire survey on married employees of four enterprises and public institutions in northwest China. The enterprises are in the following industries: medicine and health, education and training, as well as science and technology about agriculture and forestry. To deeply explore the changes and feelings of employees in a natural environment, increase the inference of the causality of the variables, and reduce common method biases, this study employs the experience sampling method to collect data. With the support and cooperation of senior managers and human resources departments, the researchers invited 478 front-line employees from four companies to participate in the survey, among which 200 employees volunteered to participate in the survey. The theoretical model of this study has variables at both within- and between-individual levels. Because many respondents do not answer online questionnaires seriously, such as by filling the questionnaire several times or not answering some questions, a paper questionnaire is adopted in this study.

The research team placed the questionnaires in small, sealable, and anonymous disposable envelopes, each with double-sided tape that was pre-laminated. Before the survey, the supervisors of each company emphasized the importance of the research in helping the surveyed employees to thrive at work, explained the research process in detail, expressed their support for the project, and encouraged everyone to cooperate. The supervisor then handed out one-time questionnaire envelopes to the subjects and left the room afterward. The research team stayed in the meeting room and collected the questionnaires after completion. Thus, data on between-individual level variables (demographic variables, intrinsic motivation, and family-supportive supervisor behavior) were collected.

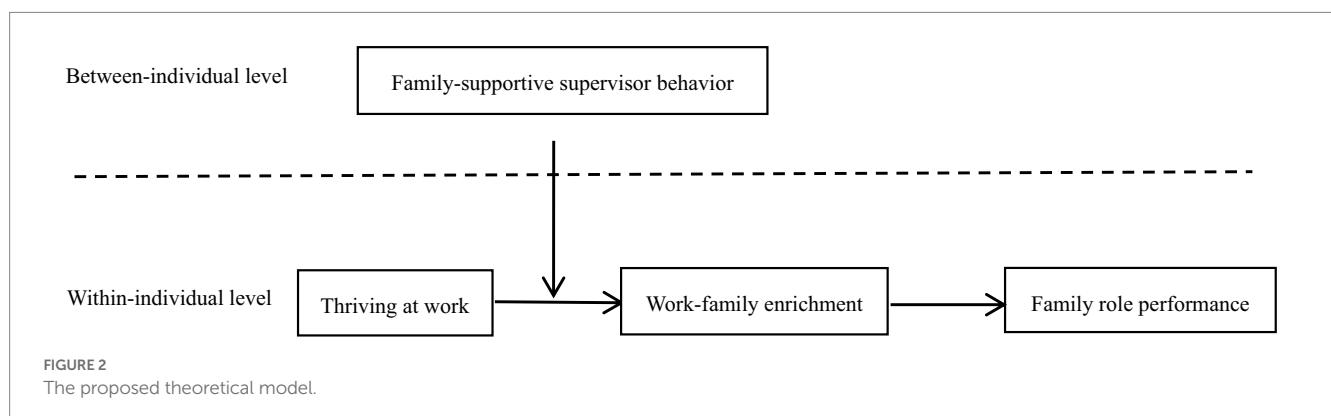
The data about the following within-individual level variables were collected over five consecutive working days: thriving at work,

work–family enrichment, family role performance, and job demands. The questionnaires were distributed during working hours and at night. (1) Distribution during working hours: the supervisor distributes the sealable questionnaire about thriving at work and job demands to the respondents to fill at regular intervals (4:30 PM on weekdays) and leaves the room afterward. To ensure the timeliness of the survey, the responses were collected on the spot by the research team. (2) Distribution in the evening: The questionnaires about family role performance and work–family enrichment were packed into file bags and distributed to the respondents before leaving work, and the respondents were instructed to answer them carefully from 20:30 to 21:00. The research team reminded the subjects who volunteered to participate in the WeChat group to fill it out in time. The next morning, the subjects returned the sealed envelopes to the research team. In addition, the one-time and daily questionnaires were paired using a coded format (i.e., the one-time questionnaires were numbered and subjects were asked to remember their number, and on five consecutive days, the subjects were asked to fill in their questionnaire number). The data collection process was completely anonymous and voluntary. The researcher gave a small gift to respondents who completed the questionnaire survey during the five working days.

In the first stage, 200 questionnaires were distributed; 191 were retrieved, and 178 were valid. In the daily survey phase, 890 questionnaires were collected from 178 married employees, with 755 valid questionnaires—an effective rate of 85.1%. According to the descriptive statistics, 31 respondents work in science and technology about agriculture and forestry 1 (20.5%) industry, 41 in medicine and health (27.2%), 43 in education and training (28.5%), and 36 in science and technology about agriculture and forestry 2 (23.8%). In terms of gender, 74 are males (49.0%), and 77 are females (51.0%). In terms of age, 86 (57.0%) are under 35 years, 42 (27.8%) are 36–45 years, and 23 (15.2%) are more than 45 years. Regarding education, 42 (27.8%) have a junior college degree or below, and 109 (72.2%) have a bachelor's degree or above. Regarding working experience, 40 (26.5%) have worked for 5 years or less; 48 (31.8%) have worked for 5–10 years, and 63 (41.7%) have worked for 10 years or more.

## Variables

This study measures job demands on a five-point Likert scale, with 1 representing “very small” and 5 representing “very large.” Other variables are measured on a seven-point Likert scale, with 1



representing “strongly disagree” and 7 representing “strongly agree.” To ensure that the meaning of the translated Chinese questionnaire is consistent or similar to that of the original English questionnaire, members of the research group and the English language professionals were engaged to translate the questionnaire. Due to the particularity of the experience sampling method, we modify the original scale used in the five consecutive days of work by adding the time description qualifier of “today.”

**Thriving at work.** The scale of thriving at work has two dimensions—vitality and learning. Studies have been conducted to evaluate the vitality and learning dimensions in an integrated manner and data were obtained through subjective evaluations, and this paper also draws on previous practices to measure thriving at work (Riaz et al., 2018; Feeney and Fitzgerald, 2019; Li et al., 2020). The vitality dimension adopts the scale developed by Atwater and Carmeli (2009). It contains eight items, such as “Today, I feel active and energetic at work.” The learning dimension adopts the scale developed by Carmeli and Spreitzer (2011), containing three items, such as “Today, to what extent do the things you learn at work help you in your life?” As the current mainstream measurement instrument, the reliability of the scale has been validated in many research measurements with samples involving members of different types of organizations, which shows that the scale has a relatively wide applicability (Niessen et al., 2012; Kleine et al., 2019; Lin et al., 2020). In the present study, Cronbach’s alpha of the vitality dimension is 0.86, and that of each of the 5 days ranges from 0.84 to 0.87. Cronbach’s alpha of the learning dimension is 0.74, and that of each of the 5 days ranges from 0.70 to 0.80. Total scale Cronbach’s alpha is 0.89, and that of each of the 5 days ranges from 0.88 to 0.91.

**Family role performance.** We use the scale developed by Chen et al. (2014) to measure family performance. It contains eight items, including “I will maintain things around the home after work today.” The reliability of the scale has been validated in previous studies and has wide applicability (Las Heras et al., 2017; Kelly et al., 2020). Its Cronbach’s alpha is 0.92, and that of each of the 5 days ranges from 0.89 to 0.93.

**Work–family enrichment.** We use the scale developed by Wayne et al. (2004) to measure work–family enrichment. It contains four items, including “The things I do at work help me deal with personal and practical issues at home.” After the development of this scale, the reliability and validity of the scale were tested using empirical data and analysis, and the results were more than satisfactory for further research and analysis of the work and family–related topics (Li et al., 2022). Its Cronbach’s alpha is 0.80, and that of each of the 5 days ranges from 0.78 to 0.85.

**Family-supportive supervisor behavior.** We use the scale developed by Hammer et al. (2009) to measure family-supportive supervisor behavior. It contains four items. Hammer et al. (2009) argued that family-supportive supervisor behavior is mainly reflected by a leader’s supportive behavior for employees’ family life and other aspects. The strength of its effectiveness mainly comes from employees’ perception, so employees should fill out the questionnaires. The items include “My supervisor and I can talk effectively to solve conflicts between work and nonwork issues.” After the development of this scale, the reliability and validity of the scale were tested using empirical data and analysis, and the results were more satisfactory for further research and analysis (Erdogan et al., 2022; Yu et al., 2022). Its Cronbach’s alpha is 0.79.

**Control Variables.** This study controls for demographic variables that can affect the results, such as sex, age, education level, and years of service. Moreover, previous studies have found that job demands can affect work–family relationships (Bakker et al., 2008), and intrinsic motivation can affect thriving at work (Menges et al., 2017). Therefore, these within-individual variables are also controlled in this study. The scale developed by Karasek (1979) is used to measure job demands; the items include “Requires working fast.” Its Cronbach’s alpha is 0.87, and that of each of the 5 days ranges from 0.85 to 0.89. Intrinsic motivation is measured by the scale developed by Ryan and Connell (1989); the items include “Because I enjoy the work itself.” Cronbach’s alpha of intrinsic motivation is 0.86.

## Data analysis

Maas and Hox (2005) suggested that a sample size of more than 50 people, collected for five consecutive days, is a relatively accurate data estimate. The final valid data for this study were data on 151 people, collected for five consecutive days, which meet the minimum sample size requirement. This suggests that the data are suitable for multilevel analysis. In terms of specific analysis methods, correlation and reliability analyses were carried out using SPSS. In addition, the data had a relatively obvious nested structure, i.e., the measurement level was nested within the individual level, so Mplus 8.4 was used to conduct multilevel validation factor analysis and multilevel modeling to test the research hypotheses. First, following the suggestions of Hofmann and Gavin (1998) and Enders and Tofghi (2007), all within-individual level variables are centralized with group-mean centering to effectively exclude the influence of between-individual variable differences. Therefore, the results of the data analysis fully reflect the relationship between within-individual differences. Second, all between-individual level variables are centralized with the grand-mean centering. Moreover, the Parametric Bootstrap program (20,000 Monte Carlo replicates) recommended by Preacher et al. (2010) is used to test the intermediate effect by estimating the bias correction confidence interval at 95%. The moderating effect is analyzed using the random slope method, and the moderating effect is tested using the Monte Carlo Simulation (MCS) method.

## Results

### Descriptive statistical analysis

This study examines the percentage of intra-individual variance and the coefficient of variation between groups (ICC1) for intra-individual level variables separately. The results reveal that all these variables have sufficient intra-individual variance percentages (see Table 1). Therefore, thriving at work [ICC(1) = 0.37,  $F(150, 604) = 3.99$ ,  $p < 0.001$ ], work–family enrichment [ICC(1) = 0.40,  $F(150, 604) = 4.38$ ,  $p < 0.001$ ], and family role performance [ICC(1) = 0.47,  $F(150, 604) = 5.547$ ,  $p < 0.001$ ] are suitable for cross-layer analysis. The mean, standard deviation, and correlation coefficient of the variables are presented in Table 2. Among the within-individual variables, thriving at work and work–family enrichment ( $r = 0.27$ ,  $p < 0.001$ ) have a significantly positive correlation with family role performance ( $r = 0.33$ ,  $p < 0.001$ ). Work–family enrichment and family role

performance ( $r = 0.40$ ,  $p < 0.001$ ) have a significantly positive correlation. This lays a preliminary foundation for testing the hypotheses. Moreover, job demand is significantly negatively correlated with thriving at work ( $r = -0.07$ ,  $p = 0.049$ ) and family role performance ( $r = -0.10$ ,  $p = 0.009$ ). Thriving at work is positively correlated with family-supportive supervisor behavior ( $r = 0.24$ ,  $p = 0.003$ ) and intrinsic motivation ( $r = 0.18$ ,  $p = 0.027$ ). Family-supportive supervisor behavior is positively correlated with work-family enrichment ( $r = 0.31$ ,  $p < 0.001$ ) and intrinsic motivation ( $r = 0.17$ ,  $p = 0.038$ ).

## Confirmatory factor analysis

We use Mplus 8.0 to conduct a multi-level confirmatory factor analysis (MCFA) of our focal variables to verify discriminant validity.

The results reveal that the four-factor model fits best ( $\chi^2/df = 1.95$ , RMSEA = 0.04, SRMR<sub>within</sub> = 0.0, SRMR<sub>between</sub> = 0.01, CFI = 0.97, TLI = 0.97), and its fitting coefficients are better than those of other models (see Table 3), indicating that there is good discriminative validity among the variables.

Podsakoff et al. (2003) also suggested that the Harman single factor and controlling for an unmeasured single latent methods factor should be used to evaluate common method biases. The results reveal that in the unrotated factor analysis, the variance explanation rate of the first common factor is 27.57%, which is lower than 40%. Common method factors ( $\chi^2/df = 1.77$ , RMSEA = 0.03, SRMR<sub>within</sub> = 0.03, SRMR<sub>between</sub> = 0.01, CFI = 0.98, TLI = 0.97) are added to compare the fitting of the four-factor model (see Table 3), and the results reveal that the fitting indices—CFI, TLI, RMSEA, SRMR<sub>within</sub>, and SRMR<sub>between</sub>—do not significantly improve. Therefore, common method biases have little impact in this study.

TABLE 1 Percentage of variance of within-individual variables.

Variable	Within-individual variance ( $e^2$ )	Between-individual variance ( $r^2$ )	Percentage of within-individual variance (%)
Thriving at work	0.48	0.28	63.16%
Work-family enrichment	0.87	0.58	60.00%
Family role performance	0.89	0.80	52.66%

Percentage of within-individual variance = within-individual/(within-individual + between-individual variance).

## Test of hypotheses

Table 4 reveals that the zero model of work-family enrichment and family role performance is a random effect one-way ANOVA without any variables; Models 1 and 5, on the basis of the zero model, add within-individual control variables and between-individual control variables; Models 2 and 6, on the basis of Models 1 and 5, add the within-individual level variable thriving at work; Model 3, on the basis of Model 2 by adding the between-individual level moderating variable family-supportive supervisor behavior; Model 4 by adding an interaction term between thriving at work and family-supportive supervisor behavior to Model 3; and Model 7 by adding the within-individual level variable work-family enrichment to Model 6.

TABLE 2 Means, standard deviations, and correlations of the study variables.

Between-individual level variables	M	SD <sub>within</sub>	SD <sub>between</sub>	1	2	3	4	5	6	7	8	9	10
1. Sex	0.51	—	0.50	1									
2. Age	1.58	—	0.74	−0.12	1								
3. Educational status	0.72	—	0.45	0.07	−0.09	1							
4. Work experience	2.15	—	0.81	−0.24**	0.58**	0.06	1						
5. Intrinsic motivation	4.47	—	1.27	0.01	0.05	0.05	0.03	1					
6. Family-supportive supervisor behavior	4.61	—	1.16	−0.09	−0.04	−0.14	−0.03	0.17*	1				
<i>Within-individual level variables</i>													
7. Thriving at work	4.82	0.87	0.62	−0.16*	−0.10	0.01	0.08	0.18*	0.24**	1	0.27***	0.33***	−0.07*
8. Work-family enrichment	4.61	1.20	0.87	−0.03	−0.08	0.06	0.02	0.16	0.31**	0.37**	1	0.40***	0.02
9. Family role performance	4.96	1.30	0.99	−0.13	−0.06	0.12	0.03	0.04	0.01	0.34**	0.37**	1	−0.10**
10. Job demands	4.08	0.93	0.77	−0.14	0.25**	0.03	0.06	0.00	0.12	−0.12	−0.03	−0.25**	1

(1) Between-individual level variables = 151; Within-individual level variables = 755. (2) The result below the between-individual level correlation coefficient is the correlation coefficient calculated by aggregating within-individual level variables to between-individual level variables. (3) Male = 0; Female = 1; under the age of 35 = 1; under the age of 36 to 45 = 2; above the age of 45 = 3; junior college and below = 0; bachelor degree or above = 1; 5 years or less working experience = 1; 5 to 10 years of working experience = 2; more than 10 years of working experience = 3. (4) \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .



TABLE 3 CFA.

Model	$\chi^2$	df	$\chi^2/df$	$\Delta\chi^2/(\Delta df)$	CFI	TLI	RMSEA	SRMR within	SRMR between
Four-factor model: A; B; C; D	447.24	229	1.95	–	0.97	0.97	0.04	0.03	0.01
Three-factor model: A + B; C; D	1304.20	231	5.65	856.96(2)	0.86	0.84	0.08	0.09	0.01
Two-factor model: A + B + C; D	3381.93	232	14.58	2934.69(3)	0.59	0.54	0.13	0.14	0.01
One-factor model + CMV: A; B; C; D; CMV	364.45	206	1.77	–	0.98	0.97	0.03	0.03	0.01

(1) Within-individual level variables = 755; (2) A = thriving at work, B = work–family enrichment, C = family role performance, D = family-supportive supervisor behavior; (3) “+” indicates the combination of two factors into one factor; (4) CMV represents common method bias; (5) all  $\Delta\chi^2$  in  $p < 0.001$  significant.

As presented in Table 4, in the family role performance model, the fit result of Model 5 significantly improves when control variables are added to the zero models ( $\Delta - 2LL = 47.14$ ,  $p < 0.001$ ). The fit results of Model 6 significantly improve after adding thriving at work into the model ( $\Delta - 2LL = 64.30$ ,  $p < 0.001$ ), and the regression coefficient between thriving at work and family role performance is 0.43 ( $p < 0.001$ ), thus supporting H1.

As presented in Table 4, in the work–family enrichment model, the fit result of Model 1 does not significantly improve ( $\Delta - 2LL = 15.43$ ,  $p = 0.080$ ) when the control variable is added to the zero models. The relevant result of Model 2 significantly improves ( $\Delta - 2LL = 17.18$ ,  $p < 0.001$ ), and the regression coefficient between thriving at work and work–family enrichment is 0.23 ( $p < 0.001$ ), supporting H2. The fit results of Model 3 significantly improve when family-supportive supervisor behavior is added to the model ( $\Delta - 2LL = 17.18$ ,  $p < 0.001$ ). The regression coefficient between family-supportive supervisor behavior and work–family enrichment is 0.22 ( $p < 0.001$ ), and the regression coefficient between thriving at work and work–family enrichment is 0.23 ( $p < 0.001$ ) but still significant.

Based on Model 6, the fit results of Model 7 significantly improve when work–family enrichment is added to the model ( $\Delta - 2LL = 108.31$ ,  $p < 0.001$ ), and the regression coefficient between work–family enrichment and family role performance is 0.39 ( $p < 0.001$ ), thus supporting H3. Moreover, because work–family enrichment partially explains family role performance, the regression coefficient between thriving at work and family role performance decreases to 0.34 ( $p < 0.001$ ) but is still significant, suggesting that work–family enrichment may mediate the relationship between thriving at work and family role performance. To verify H4, we use the Monte Carlo method in the Parametric Bootstrap procedure recommended by Preacher et al. (2010) to test the mediation effect. The results of Table 5 indicate that the mediation effect of thriving at work on family role performance through work–family enrichment is 0.09, 95% CI [0.05, 0.13] excluding 0; the mediating effect accounts for 20.93% of the total effect. Thus, H4 is supported.

Statistically, using the log-likelihood ratio test, we find that the chi-square statistic is significant ( $-2LL(1) = 79.84$ ,  $p < 0.001$ ). This implies that using random slope models provides a better fit than random intercept models. This study probes the cross-level moderating effect using a random slope analysis. Model 4 in Table 4 reveals that the interaction term between thriving at work and family-supportive supervisor behavior has a significant positive effect on work–family enrichment ( $\gamma = 0.27$ ,  $p < 0.001$ ). The results of the simple slope test (Figure 3) reveal that when the level of family-supportive supervisor behavior is high (1 SD above the mean), thriving at work has a significant positive effect on work–family enrichment ( $\gamma = 0.51$ ,  $p < 0.001$ ), and the prediction effect is relatively high. When the level

of family-supportive supervisor behavior is low (1 SD below the mean), the effect of thriving at work on work–family enrichment is not significant ( $\gamma = -0.10$ ,  $p = 0.353$ ). Moreover, the difference between them is significant ( $\gamma = 0.61$ ,  $p < 0.001$ ), 95% CI [0.31, 0.92]. Thus, H5 is supported.

To test the moderated mediation effect, we use the MCS method to analyze the mediating effect of work–family enrichment under different family-supportive supervisor behavior levels. As presented in Table 6, when the level of family-supportive supervisor behavior is high (1 SD above the mean), the indirect effect of thriving at work on family role performance through work–family enrichment is significant (indirect effect = 0.20, 95% CI [0.11, 0.29]). When the family-supportive supervisor behavior level is low (1 SD below the mean), the indirect effect of thriving at work on family role performance through work–family enrichment is not significant (indirect effect =  $-0.04$ , 95% CI [ $-0.13$ , 0.04]). Moreover, the difference between the two is significant (indirect effect = 0.24, 95% CI [0.12, 0.36]). Thus, H6 is supported.

## Discussion

This study found that thriving at work was a positive predictor of family role performance. The results of this study suggest that the two roles employees play in the work domain and family life are not always in contradictory opposition, and that the energy employees gain from participating in work activities helps to promote individual family role activities. While most previous studies have tended to emphasize the effects of thriving at work within the work domain (Porath et al., 2012; Hildenbrand et al., 2018; Chang and Busser, 2020; Christensen-Salem et al., 2021), we aim to explore how work affects employees' family behaviors, which helps enrich the research on work–family enrichment. At the same time, the findings also confirm that work–family enrichment mediates the relationship between thriving at work and family role performance. That is, in addition to the direct effect of thriving at work on family role performance, it also indirectly contributes to family role performance by affecting employees' work–family enrichment. According to the work–home resource model, employees actively use this work resource to spill over the benefits it brings to the family domain, thereby improving their role performance in family activities, i.e., generating work–family enrichment (Ilies et al., 2017; Wood et al., 2020; Wayne et al., 2022). Abid and Contreras (2022) also pointed out that the positive psychological resources of individuals are the main aspect that facilitates the occurrence of work–family enrichment. From the results of the present study, it appears that thriving at work is just such a positive psychological state that



TABLE 4 Results of the multi-level analysis.

Variables		Work–family enrichment					Family role performance			
		Zero model	M1	M2	M3	M4	Zero model	M5	M6	M7
	Intercept	4.61***	3.87***	3.87***	3.94***	3.92***	4.96***	4.29***	4.28***	4.42***
Within-individual control variables	Job demands		0.13*	0.13*	0.12*	0.09		0.22***	0.23***	0.19***
Between-individual control variables	Science and technology about agriculture and forestry 1		−0.54*	−0.54*	−0.53	−0.49		−1.20***	−1.21***	−1.16***
	Medicine and health		−0.34	−0.34	−0.33	−0.30		−0.99***	−1.00***	−0.96***
	Education training		−0.28	−0.28	−0.24	−0.24		−0.07	−0.07	−0.07
	Sex		−0.02	−0.02	0.02	0.01		−0.30*	−0.30*	−0.31*
	Education background		0.02	0.02	0.11	0.12		0.22	0.21	0.22
	Age		−0.20	−0.20	−0.16	−0.16		0.04	0.04	0.04
	Working years		0.11	0.11	0.10	0.10		−0.03	−0.03	−0.04
	Intrinsic motivation		0.12*	0.12*	0.09	0.09		0.07	0.07	0.07
Within-individual level	Thriving at work			0.23***	0.23***	0.20**			0.43***	0.34***
	Work–family enrichment									0.39***
Between-individual level	Family-supportive supervisor behavior				0.22***	0.22***				
Cross-layer interaction	Thriving at work*Family supportive supervisor behavior					0.27***				
Variance component	Within-individual variance ( <i>e</i> )	0.87***	0.86***	0.84***	0.84***	0.61***	0.89***	0.86***	0.78***	0.65***
	Between-individual variance ( <i>r<sub>0</sub></i> )	0.58***	0.53***	0.53***	0.48***	0.52***	0.80***	0.62***	0.64***	0.66***
Model fit index	Logarithmic likelihood (LL)	−1128.61	−1120.89	−1112.30	−1105.93	−1058.44	−1154.56	−1130.99	−1098.84	−1044.69
	Freedom degree ( <i>df</i> )	3	12	13	14	17	3	12	13	14
	Δ −2LL		15.43	17.18	12.75	94.97		47.14	64.30	108.31
	Δ <i>df</i>		9	1	1	3		9	1	1

(1) Between-individual level variables = 151; within-individual level variables = 755. (2) The coefficients in the table are non-standardized regression coefficients. (3) Other control variables are enterprises (agriculture and forestry about science and technology 2 is the reference group), sex, age, education training, and working years. (4) Robust maximum likelihood estimator (maximum likelihood). (5) When no control variables are included, the model still holds. (5) \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

promotes the occurrence of work–family enrichment, which in turn has a positive effect on family role performance.

In addition, in today’s world of increasing work–family conflict, a family-supportive supervisor style that focuses on building harmony between the organization and employees is considered a constructive and popular leadership style for employees. Some studies have found that family-supportive supervisor can help employees transition well between work and family by providing them with work resources and modeling work–family balance (Odle-Dusseau et al., 2012; Hammer et al., 2013). This study describes the boundary conditions of the relationship between thriving at work and work–family enrichment in terms of the environment. The results showed that family-supportive supervisor behavior positively moderated between thriving at work and work–family enrichment and also positively moderated the mediating role of work–family enrichment between thriving at

work and family role performance, which to some extent validates and extends the above findings that our inclusion of family-supportive supervisor behavior as an environmental resource to help individuals achieve emotional permeability and physical separation between work and family explains the scenarios under which individuals are able to allocate and generate resources more effectively.

### Theoretical significance

First, due to the finiteness of resources, individual work and family roles are sometimes incompatible, resulting in work–family conflict. However, work and family are not always contradictory and conflicting. Although resources are limited, they have enrichment. Thus, resources in different fields can be transferred and utilized in

TABLE 5 Mediating effect analysis.

Path	Effect size	95% CI
Total effect: Thriving at work→Family role performance	0.43	[0.32, 0.53]
Direct effect: Thriving at work→Family role performance	0.34	[0.25, 0.43]
Mediation effect: Thriving at work→Work-family enrichment→Family role performance	0.09	[0.05, 0.13]

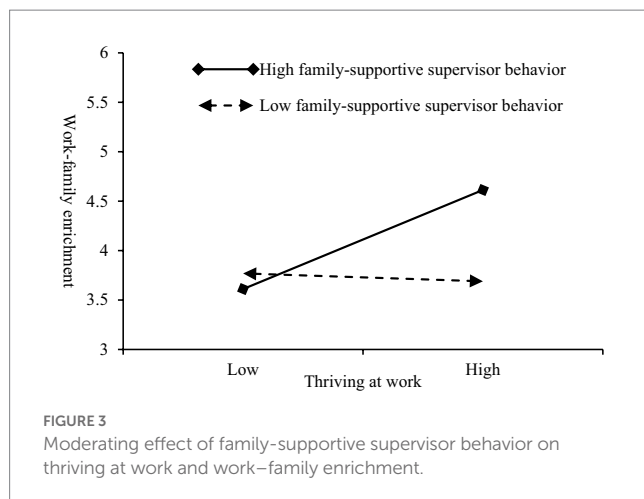


TABLE 6 Moderated mediation effects.

Path	Condition	Effect size	95% CI
Thriving at work→Work-family enrichment→Family role performance	High family-supportive supervisor behavior	0.20	[0.11, 0.29]
	Low family-supportive supervisor behavior	−0.04	[−0.13, 0.04]
	Difference	0.24	[0.12, 0.36]

other fields (Booth-LeDoux et al., 2020; Lin et al., 2021). At present, thriving at work is a relatively new construct in organizational behavior, and there is a lack of research on the positive relationship between it and family-level variables from the perspective of employees' positive psychological resources. Based on the work-home resource model and from the perspective of resource flow, this study reveals how employees accumulate resources in the work environment and apply them in the family environment, discusses the positive impact of thriving at work on family role performance, and points out the potential boundary conditions. This study enriches the theoretical research on the relationship between thriving at work and family role performance.

Second, it makes up for some deficiencies of the current research on work-family enrichment. Currently, although researchers are showing more and more interest in the field of work-family

enrichment, most of the existing studies focus on the negative spillover effects (work-family conflict) between work and family (Xin et al., 2018), and research on the antecedent and outcome variables of work-family enrichment is not very mature. Most studies focus on whether the types of resources provided by organizations are conducive to the generation of work-family enrichment. Only a few studies have focused on the important role of personal psychological resources in the workplace (thriving at work) in realizing positive work-family relationships. This study incorporates work-family enrichment into the model framework. It discusses the mechanism of the effect of thriving at work on family role performance. The results also contribute to research in the field of work-family enrichment by further enriching the work-family resources model, namely, to work in the field of psychological resources by work-family enrichment influence in the field of the family. Thus, it serves as a reference for relevant future research.

Third, previous studies on family role performance mostly reveal the influencing factors of family role performance from the perspective of between-individual static, which makes the research results largely affected by common method biases, impacting the persuasiveness of the empirical results (Podsakoff et al., 2003). Due to its unique advantages, the experience sampling method is the most important method for domestic and foreign researchers to reveal the fluctuating nature of the mechanism of psychological phenomena, such as work exuberance, organizational commitment, work performance, and work satisfaction, within a short period from the perspective of within-individual dynamics (Conway et al., 2015; Diestel et al., 2015). However, studies on the short-term fluctuations of family role performance from the perspective of within-individual dynamics are relatively limited (Chen et al., 2014). This study attempts to “capture” the dynamic experience of employees' family role performance under natural circumstances using the experience sampling method and analyzes the internal dynamic mechanism of the impact of thriving at work on individual employees' family role performance. It reveals the obvious short-term fluctuation of family role performance and starts from the work-family resource model. It confirms that the daily individual resource changes of employees' thriving at work affect their daily family role performance through work-family enrichment, thus it improves our understanding of how family role performance is enhanced. In addition, the application of the multi-level experience sampling method helps to systematically and completely explore the co-promotion effect of thriving at work (within-individual variable) and family-supportive supervisor behavior (between-individual variable) on employees' family role performance.

Fourth, previous studies have suggested that family-supportive supervisor behavior can help improve employees' work behavior (Bosch et al., 2018). Some studies have found that family-supportive supervisor behavior is beneficial to easing work-family conflict and improving marital satisfaction (Russo et al., 2018). This study examines the moderating effect of family-supportive supervisor behavior on work-family enrichment through a multi-level analysis and further examines the moderated mediating effect of the first stage. This study enriches and deepens previous research that is based on the work-home resource model by revealing that thriving at work is the generator of resources; work-family enrichment is the converter of resources; and family-supportive supervisor

behavior is the catalyst of resource generation and transformation, which regulates the generation of thriving at work (individual resources) and the transformation of resources by work–family enrichment. These results indicate that the positive effects of family-supportive supervisor behavior are not only limited to the work domain or the alleviation of work–family conflict but also can promote a positive work state and the fulfillment of employees' family life roles through work–family enrichment. Moreover, it reveals that the work–home resource model applies to some extent. A supervisor who cares about the needs of employees' families and lives can make thriving at work play a greater role, but thriving at work would be greatly reduced when the supervisors do not provide family and life support.

## Practical implications

The results of this study also have many implications for managers and employees. First, the research finds that thriving at work can effectively improve employees' family role performance, which means that enterprises can integrate thriving at work into their human resource management process, pay attention to guiding employees to form the values of active learning and staying active, and publicize the benefits of this sense of vitality to their family life. Employees should also be aware of the positive impact of continuous learning and vitality at work on their families and achieving a win-win situation between family and work.

Second, work–family enrichment links thriving at work and family role performance. Therefore, managers should attach great importance to the mutually beneficial relationship between work and family. On the one hand, they should understand the dual responsibilities of family and work shouldered by employees and advocate a win-win situation between career and family. On the other hand, companies can create opportunities for employees to demonstrate their work roles, allowing them to apply resources from their work field to their family life while remaining active at work.

Third, family-supportive supervisor behavior plays a positive role in thriving at work and family role performance. Therefore, managers need to increase supportive behaviors for employees' families, such as helping employees solve their family challenges to coordinate the demands of work and family better. Moreover, when selecting and promoting leaders, the organization can focus on leaders who demonstrate more family-supportive behaviors, or the organization can organize various training to cultivate and encourage leaders to form a family-supportive supervisor style, which would not only promote the family role performance of employees but also benefits the organization.

## Limitations and future directions

This study has certain limitations and aspects that need to be further studied. First, this study adopts the experience sampling method. This method captures the dynamic changes between variables to a certain extent and helps deduce causality more effectively (Moskowitz and Young, 2006). However, we can still

provide sufficient evidence of the causality between the variables. Moreover, all the data are self-reported, so there may be some common method biases. Therefore, future studies can collect core data at different time points or adopt a more rigorous longitudinal study design supplemented by field experiments to obtain more accurate and effective causal inference.

Second, due to the specific nature of the experience sampling method of data collection, there are greater difficulties in selecting a sample, resulting in a smaller sample size. All the samples of this study are from enterprises and public institutions in a particular area in northwest China, which reduces the influence of regional cultural and economic differences on the research results and restricts the generalizability of the research results. Future research can collect samples from different regions to improve the universality and applicability of the conclusions. In addition, this study covers married employees in various enterprises and institutions in China and does not explore the study population by industry and field. Therefore, it is not clear whether thriving at work has different effects on married employees in different industries and fields. In future research, married employees should be analyzed by industry to provide targeted measures for companies in different industries.

Third, further additions to the moderating variables are needed to build on the present model. This study argues that work–family enrichment is the key to linking thriving at work and family role performance, and thus, it is important to explore how to enhance this relationship. The present model does not consider environmental factors and only incorporates family-supportive supervisor behavior. The impact of factors such as organizational climate and a sense of family support on the relationship between thriving at work and work–family enrichment can be further explored in the future.

Fourth, through argument and hypotheses testing, this study mentions the potential role of some variables but does not measure them. For example, explaining the relationship between thriving at work and family role performance will be conducive to improving employees' self-efficacy and happiness in life. However, we do not measure self-efficacy and happiness in life. Therefore, researchers can measure these variables in future studies to significantly improve our understanding of the relationship between thriving at work and family role performance.

## Conclusion

Based on the work–home resource model, this study uses an experience sampling method to explore the impact of thriving at work on family role performance and the mechanism of work–family enrichment and family-supportive supervisor behavior. We find that thriving at work positively affects family role performance partly through the mediating effect of work–family enrichment at the individual level. Moreover, family-supportive supervisor behavior moderates the relationship between thriving at work and work–family enrichment. Through work–family enrichment, family-supportive supervisor behavior also moderates the indirect relationship between thriving at work and family role performance. Specifically, the higher the level of family-supportive supervisor behavior, the stronger the indirect effect of thriving at work on family role performance through work–family enrichment.

As demonstrated, work and family are not always in conflict and individuals need to look at things as positively as possible, taking full advantage of their work prosperity and utilizing the positive experiences that work brings at home. Companies should also strengthen their awareness and ability to provide family support behaviors to help employees better differentiate between work and family, isolate themselves from work in time and space, enjoy family life with pleasure and efficiency, and go to work the next day with great anticipation, thus achieving a win-win situation in both the work and family spheres.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author/s.

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the School of Psychology at Northwest Normal University. The patients/participants provided their written informed consent to participate in this study.

## References

- Abid, G., and Contreras, F. (2022). Mapping thriving at work as a growing concept: review and directions for future studies. *Information*. 13, 383–403. doi: 10.3390/info13080383
- Abid, G., Sajjad, I., Elahi, N. S., Farooqi, S., and Nisar, A. (2018). The influence of prosocial motivation and civility on work engagement: the mediating role of thriving at work. *Cogent Bus. Manage.* 5, 1–19. doi: 10.1080/23311975.2018.1493712
- Abid, G., Zahra, I., and Ahmed, A. (2016). Mediated mechanism of thriving at work between perceived organization support, innovative work behavior and turnover intention. *Soc. Sci. Electron. Publ.* 9, 982–998.
- Amstad, F. T., Meier, L. L., Fasel, U., Elfering, A., and Semmer, N. K. (2011). A meta-analysis of work-family conflict and various outcomes with a special emphasis on cross-domain versus matching-domain relations. *J. Occup. Health Psychol.* 16, 151–169. doi: 10.1037/a0022170
- Atwater, L., and Carmeli, A. (2009). Leader-member exchange, feelings of energy, and involvement in creative work. *Leadersh. Q.* 20, 264–275. doi: 10.1016/j.leaqua.2007.07.009
- Bakker, A. B., Demerouti, E., and Brummelhuis, L. (2012). Work engagement, performance, and active learning: the role of conscientiousness. *J. Vocat. Behav.* 80, 555–564. doi: 10.1016/j.jvb.2011.08.008
- Bakker, A. B., Demerouti, E., and Dollard, M. F. (2008). How job demands affect partners' experience of exhaustion: integrating work-family conflict and crossover theory. *J. Appl. Psychol.* 93, 901–911. doi: 10.1037/0021-9010.93.4.901
- Bensemmane, S., Ohana, M., and Stinglhamber, F. (2019). Team overall justice and strain: a daily diary study. *J. Manag. Psychol.* 33, 229–242. doi: 10.1108/JMP-07-2017-0223
- Booth-LeDoux, S. M., Matthews, R. A., and Wayne, J. H. (2020). Testing a resource-based spillover-crossover-spillover model: transmission of social support in dual-earner couples. *J. Appl. Psychol.* 105, 732–747. doi: 10.1037/apl0000460
- Bosch, M. J., Heras, L. M., Russo, M., Rofcanin, Y., and Grau, M. G. (2018). How context matters: the relationship between family supportive supervisor behaviours and motivation to work moderated by gender inequality. *J. Bus. Res.* 82, 46–55. doi: 10.1016/j.jbusres.2017.08.026
- Carmeli, A., and Russo, M. (2016). The power of micro-moves in cultivating regardful relationships: implications for work-home enrichment and thriving. *Hum. Resour. Manag. Rev.* 26, 112–124. doi: 10.1016/j.hrmr.2015.09.007
- Carmeli, A., and Spreitzer, G. M. (2011). Trust, connectivity, and thriving: implications for innovative behaviors at work. *J. Creat. Behav.* 43, 169–191. doi: 10.1002/j.2162-6057.2009.tb01313.x
- Chang, W., and Busser, J. A. (2020). Hospitality career retention: the role of contextual factors and thriving at work. *Int. J. Contemp. Hosp. Manag.* 32, 193–211. doi: 10.1108/IJCHM-10-2018-0831
- Chang, W., Busser, J., and Liu, A. (2020). Authentic leadership and career satisfaction: the mediating role of thriving and conditional effect of psychological contract fulfillment. *Int. J. Contemp. Hosp. Manag.* 32, 2117–2136. doi: 10.1108/IJCHM-06-2019-0551
- Chen, Y. P., Shaffer, M., Westman, M., Chen, S., Lazarova, M., and Reiche, S. (2014). Family role performance: scale development and validation. *Appl. Psychol.* 63, 190–218. doi: 10.1111/apps.12005
- Christensen-Salem, A., Walumbwa, F. O., Hsu, C. I. C., Misati, E., Babalola, M. T., and Kim, K. (2021). Unmasking the creative self-efficacy-creative performance relationship: the roles of thriving at work, perceived work significance, and task interdependence. *Int. J. Hum. Resour. Manag.* 32, 4820–4846. doi: 10.1080/09585192.2019.1710721
- Conway, N., Clinton, M., Sturges, J., and Budjanovcanin, A. (2015). Using self-determination theory to understand the relationship between calling enactment and daily well-being. *J. Organ. Behav.* 36, 1114–1131. doi: 10.1002/job.2014
- Derks, D., Bakker, A. B., Peters, P., and van Wingerden, P. (2016). Work-related smartphone use, work-family conflict and family role performance: the role of segmentation preference. *Hum. Relat.* 69, 1045–1068. doi: 10.1177/0018726715601890
- Diestel, S., Rivkin, W., and Schmidt, K. H. (2015). Sleep quality and self-control capacity as protective resources in the daily emotional labor process: results from two diary studies. *J. Appl. Psychol.* 100, 809–827. doi: 10.1177/0018726715601890
- Elahi, N. S., Abid, G., Arya, B., and Farooqi, S. (2020). Workplace behavioral antecedents of job performance: mediating role of thriving. *Serv. Ind. J.* 40, 755–776. doi: 10.1080/02642069.2019.1638369
- Enders, C. K., and Tofighi, D. (2007). Centering predictor variables in cross-sectional multi-level models: a new look at an old issue. *Psychol. Methods* 12, 121–138. doi: 10.1037/1082-989X.12.2.121
- Erdogan, D. T., Heras, M. L., Rofcanin, Y., Bosch, M. J., and Stollberger, J. (2022). Family motivation of supervisors: exploring the impact on subordinates' work performance via family supportive supervisor behaviors and work-family balance satisfaction. *J. Appl. Soc. Psychol.* 52, 1179–1195. doi: 10.1111/jasp.12919
- Feeney, J., and Fitzgerald, J. (2019). Attachment, conflict and relationship quality: laboratory-based and clinical insights. *Curr. Opin. Psychol.* 25, 127–131. doi: 10.1016/j.copsyc.2018.04.002
- Frazier, M. L., and Tupper, C. (2018). Supervisor prosocial motivation, employee thriving, and helping behavior: a trickle-down model of psychological safety. *Group Org. Manag.* 43, 561–593. doi: 10.1177/1059601116653911
- Greenhaus, J. H., and Powell, G. N. (2006). When work and family are allies: a theory of work-family enrichment. *Acad. Manag. Rev.* 31, 72–92. doi: 10.5465/amr.2006.19379625

## Author contributions

BY was responsible for the research conception, design, and article revision. SS was responsible for article writing, data analysis and translation. ZZ was responsible for researching the feasibility of the article and proposing revisions. QD and JW were responsible for the translation correction and revision of the article. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Greenhaus, J. H., Ziegert, J. C., and Allen, T. D. (2012). When family-supportive supervision matters: relations between multiple sources of support and work-family balance. *J. Vocat. Behav.* 80, 266–275. doi: 10.1016/j.jvb.2011.10.008
- Halbesleben, J. R. B., Neveu, J. P., and Paustianunderdahl, S. C. (2014). Getting to the “COR”: understanding the role of resources in conservation of resources theory. *J. Manag.* 40, 1334–1364. doi: 10.1177/0149206314527130
- Hammer, L. B., Kossek, E. E., Bodner, T., and Crain, T. (2013). Measurement development and validation of the family supportive supervisor behavior short-form (FSSB-SF). *J. Occup. Health Psychol.* 18, 285–296. doi: 10.1037/a0032612
- Hammer, L. B., Kossek, E. E., Yragui, N. L., Bodner, T. E., and Hanson, G. C. (2009). Development and validation of a multidimensional measure of family supportive supervisor behaviors (FSSB). *J. Manag.* 35, 837–856. doi: 10.1177/0149206308328510
- Hildenbrand, K., Sacramento, C. A., and Binnewies, C. (2018). Transformational leadership and burnout: the role of thriving and followers' openness to experience. *J. Occup. Health Psychol.* 23, 31–43. doi: 10.1037/ocp0000051
- Hobfoll, S. E. (2011). Conservation of resource caravans and engaged settings. *J. Occup. Organ. Psychol.* 84, 116–122. doi: 10.1111/j.2044-8325.2010.02016.x
- Hobfoll, S. E., Halbesleben, J., Neveu, J. P., and Westman, M. (2018). Conservation of resources in the organizational context: the reality of resources and their consequences. *Annu. Rev. Organ. Psych. Organ. Behav.* 5, 103–128. doi: 10.1177/0149206314527130
- Hofmann, D. A., and Gavin, M. B. (1998). Centering decisions in hierarchical liner models: implications for research in organization. *J. Manag.* 24, 623–641. doi: 10.1177/014920639802400504
- Ilies, R., Liu, X. Y., Liu, Y., and Zheng, X. (2017). Why do employees have better family lives when they are highly engaged at work? *J. Appl. Psychol.* 102, 956–970. doi: 10.1037/apl0000211
- Jachimowicz, J. M., Cunningham, J. L., Staats, B. R., Gino, F., and Menges, J. I. (2021). Between home and work: commuting as an opportunity for role transitions. *Organ. Sci.* 32, 64–85. doi: 10.1287/orsc.2020.1370
- Jia, L., Shaw, J. D., Tsui, A. S., and Park, T. Y. (2014). A social-structural perspective on employee-organization relationships and team creativity. *Acad. Manag. J.* 57, 869–891. doi: 10.5465/amj.2011.0147
- Jiang, Z. (2017). Proactive personality and career adaptability: the role of thriving at work. *J. Vocat. Behav.* 98, 85–97. doi: 10.1016/j.jvb.2016.10.003
- Jiang, Z., Jiang, Y., and Nielsen, I. (2021). Thriving and career outcomes: the roles of achievement orientation and resilience. *Hum. Resour. Manag. J.* 31, 143–164. doi: 10.1111/1748-8583.12287
- Jiang, Z., Milia, L. D., Jiang, Y., and Jiang, X. (2020). Thriving at work: a mentoring-moderated process linking task identity and autonomy to job satisfaction. *J. Vocat. Behav.* 118:103373. doi: 10.1016/j.jvb.2019.103373
- Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Acad. Manag. J.* 33, 692–724. doi: 10.5465/256287
- Karasek, R. (1979). Job decision latitude, job demands and mental strain: implications for job redesign. *Adm. Sci. Q.* 24, 285–308. doi: 10.2307/2392498
- Kelly, C. M., Rofcanin, Y., Las Heras, M., Ogbonnaya, C., Marescaux, E., and Bosch, M. J. (2020). Seeking an “i-deal” balance: schedule-flexibility i-deals as mediating mechanisms between supervisor emotional support and employee work and home performance. *J. Vocat. Behav.* 118:103369. doi: 10.1016/j.jvb.2019.103369
- Kleine, A. K., Rudolph, C. W., and Zacher, H. (2019). Thriving at work: a meta-analysis. *J. Organ. Behav.* 40, 973–999. doi: 10.1002/job.2375
- Las Heras, M., Rofcanin, Y., Matthijs Bal, P., and Stollberger, J. (2017). How do flexibility i-deals relate to work performance? Exploring the roles of family performance and organizational context. *J. Organ. Behav.* 38, 1280–1294. doi: 10.1002/job.2203
- Lazarova, M., Westman, M., and Shaffer, M. A. (2010). Elucidating the positive side of the work-family interface on international assignments: a model of expatriate work and family performance. *Acad. Manag. Rev.* 35, 93–117. doi: 10.5465/amr.35.1.zok93
- Li, C., Jiang, S., Fan, X., and Zhang, Q. (2020). Exploring the impact of marital relationship on the mental health of children: does parent-child relationship matter? *J. Health Psychol.* 25, 1669–1680. doi: 10.1177/1359105318769348
- Li, D., Li, Y., Hu, Y., and Tu, Y. (2022). How do servant leadership and self-esteem at work shape family performance in China? A resource gain development perspective. *Manag. Decis.* 60, 550–566. doi: 10.1108/MD-08-2020-1104
- Lin, S. H. J., Chang, C. H. D., Lee, H. W., and Johnson, R. E. (2021). Positive family events facilitate effective leader behaviors at work: a within-individual investigation of family-work enrichment. *J. Appl. Psychol.* 106, 1412–1434. doi: 10.1037/apl0000827
- Lin, C. P., Xian, J., Li, B., and Huang, H. (2020). Transformational leadership and employees' thriving at work: the mediating roles of challenge-hindrance stressors. *Front. Psychol.* 11:1400. doi: 10.3389/fpsyg.2020.01400
- Ma, H. Y., Shen, C. G., Yang, J., Tang, H. Y., and Xie, J. L. (2014). Boundary flexibility and work-family conflict and enrichment: from person-environment fit perspective. *Acta Psychol. Sin.* 46, 540–551. doi: 10.3724/SPJ.1041.2014.00540
- Maas, C. J., and Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodol. Eur. J. Res. Methods Behav. Soc. Sci.* 1, 86–92. doi: 10.1027/1614-2241.1.3.86
- Marchiondo, L. A., Cortina, L. M., and Kabat-Farr, D. (2018). Attributions and appraisals of workplace incivility: finding light on the dark side? *Appl. Psychol.* 67, 369–400. doi: 10.1111/apps.12127
- Matthews, R. A., Mills, M. J., Trout, R. C., and English, L. (2014). Family-supportive supervisor behaviors, work engagement, and subjective well-being: a contextually dependent mediated process. *J. Occup. Health Psychol.* 19, 168–181. doi: 10.1037/a0036012
- Menges, J. I., Tussing, D. V., Wihler, A., and Grant, A. M. (2017). When job performance is all relative: how family motivation energizes effort and compensates for intrinsic motivation. *Acad. Manag. J.* 60, 695–719. doi: 10.5465/amj.2014.0898
- Mortier, A. V., Vlerick, P., and Clays, E. (2015). Authentic leadership and thriving among nurses: the mediating role of empathy. *J. Nurs. Manag.* 24, 357–365. doi: 10.1111/jonm.12329
- Moskowitz, D. S., and Young, S. N. (2006). Ecological momentary assessment: what it is and why it is a method of the future in clinical psychopharmacology. *J. Psychiatry Neurosci.* 31, 13–20. doi: 10.1111/j.1600-079x.2005.001278.x
- Niessen, C., Maeder, I., Stride, C., and Jimmieson, N. L. (2017). Thriving when exhausted: the role of perceived transformational leadership. *J. Vocat. Behav.* 103, 41–51. doi: 10.1016/j.jvb.2017.07.012
- Niessen, C., Sonnentag, S., and Sach, F. (2012). Thriving at work—a diary study. *J. Organ. Behav.* 33, 468–487. doi: 10.1002/job.763
- Odle-Dusseau, H. N., Britt, T. W., and Greene-Shortridge, T. M. (2012). Organizational work-family resources as predictors of job performance and attitudes: the process of work-family conflict and enrichment. *J. Occup. Health Psychol.* 17, 28–40. doi: 10.1037/a0026428
- Podsakoff, P. M., Mackenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Porath, C., Spreitzer, G., Gibson, C., and Garnett, F. G. (2012). Thriving at work: toward its measurement, construct validation, and theoretical refinement. *J. Organ. Behav.* 33, 250–275. doi: 10.1002/job.756
- Preacher, K. J., Zyphur, M. J., and Zhang, Z. (2010). A general multi-level SEM framework for assessing multi-level mediation. *Psychol. Methods* 15, 209–233. doi: 10.1037/a0020141
- Qaiser, S., Abid, G., Arya, B., and Farooqi, S. (2020). Nourishing the bliss: antecedents and mechanism of happiness at work. *Total Qual. Manag. Bus. Excell.* 31, 1669–1683. doi: 10.1080/14783363.2018.1493919
- Rehmat, M., Abid, G., Ahmed, A., Naqvi, F. N., and Anum, L. (2021). Past and present of thriving at workplace: a nomological network. *Acad. J. Soc. Sci.* 5, 73–108. doi: 10.54692/ajss.2021.05011428
- Ren, S., Babalola, M. T., Ogbonnaya, C., Hochwarter, W. A., Akemu, O., and Agyemang-Mintah, P. (2022). Employee thriving at work: the long reach of family incivility and family support. *J. Organ. Behav.* 43, 17–35. doi: 10.1002/job.2559
- Riaz, S., Xu, Y., and Hussain, S. (2018). Understanding employee innovative behavior and thriving at work: a Chinese perspective. *Adm. Sci.* 8:46. doi: 10.3390/admsci8030046
- Rich, B. L., Lepine, J. A., and Crawford, E. R. (2010). Job engagement: antecedents and effects on job performance. *Acad. Manag. J.* 53, 617–635. doi: 10.5465/amj.2010.51468988
- Russo, M., Buonocore, F., Carmeli, A., and Guo, L. (2018). When family supportive supervisors meet employees' need for caring: implications for work-family enrichment and thriving. *J. Manag.* 44, 1678–1702. doi: 10.1177/0149206315618013
- Ryan, R. M., and Connell, J. P. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. *J. Pers. Soc. Psychol.* 57, 749–761. doi: 10.1037/0022-3514.57.5.749
- Spreitzer, G., Sutcliffe, K., Dutton, J., Sonenshein, S., and Grant, A. M. (2005). A socially embedded model of thriving at work. *Organ. Sci.* 16, 537–549. doi: 10.1287/orsc.1050.0153
- Straub, C., Beham, B., and Islam, G. (2019). Crossing boundaries: integrative effects of supervision, gender and boundary control on work engagement and work-to-family positive spillover. *Int. J. Hum. Resour. Manag.* 30, 2831–2854. doi: 10.1080/09585192.2017.1340324
- Tang, Y., Huang, X., and Wang, Y. (2017). Good marriage at home, creativity at work: family-work enrichment effect on workplace creativity. *J. Organ. Behav.* 38, 749–766. doi: 10.1002/job.2175
- Tariq, H., and Ding, D. (2018). Why am I still doing this job? The examination of family motivation on employees' work behaviors under abusive supervision. *Pers. Rev.* 47, 378–402. doi: 10.1108/PR-07-2016-0162
- Ten Brummelhuis, L. L., and Bakker, A. B. (2012). A resource perspective on the work-home interface: the work-home resources model. *Am. Psychol.* 67, 545–556. doi: 10.1037/a0027974
- Ten Brummelhuis, L. L., and Greenhaus, J. H. (2018). How role jugglers maintain relationships at home and at work: a gender comparison. *J. Appl. Psychol.* 103, 1265–1282. doi: 10.1037/apl0000340
- Walumbwa, F. O., Muchiri, M. K., Misati, E., Wu, C., and Meiliani, M. (2018). Inspired to perform: a multilevel investigation of antecedents and consequences of thriving at work. *J. Organ. Behav.* 39, 249–261. doi: 10.1002/job.2216



- Wang, S. Y., Liu, H., and Liu, R. G. (2018). The influence of family supportive supervisor behavior on employee helping behavior: from the perspective of family-like exchange relationships. *Chin. J. Manage.* 15, 980–987. doi: 10.16538/j.cnki.fem.20200212.302
- Wayne, J. H., Grzywacz, J. G., Carlson, D. S., and Kacmar, K. M. (2007). Work-family facilitation: a theoretical explanation and model of primary antecedents and consequences. *Hum. Resour. Manag. Rev.* 17, 63–76. doi: 10.1016/j.hrmr.2007.01.002
- Wayne, J. H., Michel, J. S., and Matthews, R. A. (2022). Balancing work and family: a theoretical explanation and longitudinal examination of its relation to spillover and role functioning. *J. Appl. Psychol.* 107, 1094–1114. doi: 10.1037/apl0001007
- Wayne, J., Musisca, N., and Fleeson, W. (2004). Considering the role of personality in the work-family experience: relationships of the big five to work-family conflict and facilitation. *J. Vocat. Behav.* 64, 108–130. doi: 10.1016/S0001-8791(03)00035-6
- Williams, A., Franche, R. L., Ibrahim, S., Mustard, C. A., and Layton, F. R. (2006). Examining the relationship between work-family spillover and sleep quality. *J. Occup. Health Psychol.* 11, 27–37. doi: 10.1037/1076-8998.11.1.27
- Wood, J., Oh, J., Park, J., and Kim, W. (2020). The relationship between work engagement and work-life balance in organizations: a review of the empirical research. *Hum. Resour. Dev. Rev.* 19, 240–262. doi: 10.1177/1534484320917560
- Wu, C., Hunter, E. M., and Sublett, L. W. (2021). Gaining affective resources for work-family enrichment: a multisource experience sampling study of micro-role transitions. *J. Vocat. Behav.* 125:103541. doi: 10.1016/j.jvb.2021.103541
- Xanthopoulou, D., Bakker, A. B., Demerouti, E., and Schaufeli, W. B. (2007). The role of personal resources in the job demands-resources model. *Int. J. Stress. Manag.* 14, 121–141. doi: 10.1037/1072-5245.14.2.121
- Xin, J., Chen, S., Kwan, H. K., Chiu, R. K., and Yim, F. H. K. (2018). Work-family spillover and crossover effects of sexual harassment: the moderating role of work-home segmentation preference. *J. Bus. Ethics* 147, 619–629. doi: 10.1007/s10551-015-2966-9
- Yu, A., Pichler, S., Russo, M., and Hammer, L. (2022). Family-supportive supervisor behaviors (FSSB) and work-family conflict: the role of stereotype content, supervisor gender, and gender role beliefs. *J. Occup. Organ. Psychol.* 95, 275–304. doi: 10.1111/joop.12379
- Zhai, Q., Wang, S., and Weadon, H. (2020). Thriving at work as a mediator of the relationship between workplace support and life satisfaction. *J. Manage. Organ.* 26, 168–184. doi: 10.1017/jmo.2017.62
- Zhang, J., Bal, P. M., Akhtar, M. N., Long, L., Zhang, Y., and Ma, Z. (2019). High-performance work system and employee performance: the mediating roles of social exchange and thriving and the moderating effect of employee proactive personality. *Asia Pac. J. Hum. Resour.* 57, 369–395. doi: 10.1111/1744-7941.12199
- Zhang, S., and Tu, Y. (2018). Cross-domain effects of ethical leadership on employee family and life satisfaction: the moderating role of family-supportive supervisor behaviors. *J. Bus. Ethics* 152, 1085–1097. doi: 10.1007/s10551-016-3306-4
- Zheng, C., and Powell, G. N. (2012). No pain, no gain? A resource-based model of work-to-family enrichment and conflict. *J. Vocat. Behav.* 81, 89–98. doi: 10.1016/j.jvb.2012.05.003



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# Influence mechanism and impacting boundary of workplace isolation on the employee's negative behaviors

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**Introduction:** Based on social identity theory, by introducing organizational identification as mediating variable and identification orientation as moderating variable, this paper studies the influence mechanism and impacting boundary of workplace isolation on employee fatigue and turnover intention.

**Methods:** Based on logic relationship, seven basic hypotheses are put forward to construct the theoretical model of the problem. Based on the 300 effective questionnaires being obtained from employees in Mainland China, the empirical investigation adopts the three-phase lag time design. By regression analysis and bootstrap test.

**Results:** (1) Workplace isolation has a significant positive effect on employee's work fatigue; (2) Workplace isolation has a significant positive effect on employee's turnover intention; (3) Organizational identification plays a partial mediating role between workplace isolation and work fatigue; (4) Organizational identification plays a partial mediating role between workplace isolation and employee's turnover intention; (5) Employee identification orientation negatively moderates the relationship between workplace isolation and organizational identification, that is to say, the higher the degree of identification orientation, the more inhibited the negative impact of workplace isolation on organizational identification; (6) Employee identification orientation has a negative moderating effect, namely, compared with the low degree of employee identification orientation, the higher the employee identification orientation, the positive effect of workplace isolation on work fatigue and turnover intention through organizational identification become weaker.

**Discussion:** Understanding these influencing mechanisms will have a great influence on guiding managers to mitigate the negative effects of "workplace isolation" in practice and improve the work efficiency of employees.

## KEYWORDS

workplace isolation, organizational identification, identification orientation, work fatigue, turnover intention (TI)

## 1. Introduction

The global spread and normalization of COVID-19 have had a huge impact on people's work and life (1, 2), and "isolation" has also frequently appeared in different parts of society (3). In recent years, the management domain closely concerns another "isolation" belonging to the professional category of workplace form, which is quite different from the former "isolation." With the rapid economic growth, the overall quality of workers in the whole society has improved while the competition

in the workplace has increased and the interpersonal conflicts frequently occur. Especially, the “workplace isolation” became common and leads to increasingly serious management and social problems (4). In the United States, a survey of 262 employees in the workplace showed that 69% of employees believed that they were excluded and isolated by their leaders or colleagues during work (5); In China, a survey lasting 1 month conducted by a recruitment company on more than 10,000 current employees showed that nearly half of the employees believed that they had been isolated and excluded at work (6).

Under the Chinese organizational culture, workplace isolation is more reflected in cold violence due to the deep influence of traditional cultural concepts such as authority worship and the implicit and introverted life belief (6). Besides, workplace destructive behaviors are more in the form of implicit and indirect mental abuse (7), such as workplace gossip (8), and workplace isolation (7). In foreign workplaces, workplace isolation is more reflected in fierce violence based on the universal value of facing directly (9). Most destructive behaviors in the workplace involve direct physical conflicts (7), such as workplace aggression (10), workplace victimization (11).

The study of workplace destructive behavior in China should start from the cold violence in the workplace, such as exclusion and isolation. In the past, studies on workplace cold violence mostly focused on workplace exclusion (12–16). As a more hidden conflict than workplace exclusion, there are less researches on workplace isolation (4). Only a few papers involve the impact of workplace isolation on employees’ active production behavior, such as lowering job performance (7, 12), reducing job satisfaction (7), suppressing employees’ innovative behavior and narrowing teamwork (4).

Workplace isolation refers to the psychological construct including organizational isolation and colleague isolation perceived by employees, which lack of support from colleagues and superiors, and lack of social and emotional interaction opportunities with team members (7). In short, workplace isolation refers to employees’ psychological perception of their organization, which is formed due to the lack of support from colleagues and leaders for work, as well as the lack of social and emotional interaction with team members. In addition, the overall impact of workplace isolation on employees’ negative behavior has not been studied so far. As we all know, employees’ negative behavior will bring further destructive effects to the organization, such as reducing the morale of organization members and affecting the development of the organization. The direct impact of employees’ negative behavior comes from two aspects, namely work fatigue and turnover intention. Firstly, if employees feel extreme fatigue, their functional ability will be diminished. The negative effects are reflected in both the reduction of individual work efficiency and job satisfaction (14), and lead to negative or deferred response to work (17). Secondly, when employees are dissatisfied or feel frustrated in expectations, they will have the idea of leaving the organization (18), which will lead to the brain drain of the organization, lower the positivity of the organization, and damage the performance of the organization (19).

To sum up, this paper uses work fatigue and turnover intention as indicators to measure employees’ negative behavior, and uses social identity theory as a guide to explore

the mechanism of the negative effects exerted by workplace isolation. As mentioned above, this paper is intended to supplement the theory that is relatively neglected in this research field.

## 2. Theoretical framework

According to social identity theory, individuals derive their self-image from the social category they belong to Tajfel and Turner (20, 21). Therefore, employees will feel that they are not accepted by the organization because of workplace isolation, so they cannot integrate themselves into the organization, and it is difficult for them to become a member of the organization, which will reduce the identification of the organization. Naturally, if employees have to work when they have a low sense of organizational identification and can’t be accepted by the organization, it will result in work fatigue (22), which will trigger employees’ turnover intention for a long time. In addition, individual behavior is determined by the organizational environment where they are located and their own internal characteristics (23). So, employees’ negative behaviors, such as work fatigue and even resignation, are affected by the organizational environment and their own characteristics. On the one hand, employees are affected by work isolation. This unaccepted and excluded organizational environment affects employees’ positivity to integrate emotionally, which leads to negative work behaviors. On the other hand, employees’ own characteristics will also affect their work behavior. According to the self-identity orientation theory (24), employees’ identification orientation is an individual preferred personality trait defined by themselves, which will affect the perception and interpretation of external information (25). Employees’ identification orientation is characterized by meeting personal needs and achieving self-improvement (26). Although workplace isolation makes it difficult for employees to integrate into the organization at the level of organizational environment, employees’ self-defined preferred identification orientation can help employees generate recognition of the organization with their own characteristics and inhibit the occurrence of work fatigue and turnover intention.

In view of this, we explore the impact mechanism of workplace isolation on employees’ negative behavior from the dual perspective of organizational environment and individual characteristics, and focus on three following issues. (1) the impact of workplace isolation on employees’ work fatigue and turnover intention from the aspect of organizational environment. (2) the mediating effect of organizational identification when workplace isolation affects work fatigue and turnover intention based on social identity theory. (3) the moderating role and impact boundary of employee identification orientation from the perspective of individual characteristics.

## 3. Theoretical hypotheses

### 3.1. Workplace isolation and work fatigue

The characteristics of workplace isolation are as follows. Firstly, when employees are working, they need to invest more resources

to complete task. But they feel tired because they are isolated by the organization and colleagues. Secondly, the essence of workplace isolation stems from the lack of emotion and opportunity between colleagues (7). Without communication objects, employees lack emotional communication and catharsis leads to employees' depression. At the same time, employees feel helpless and exhausted in the face of work tasks (27); Thirdly, employees isolated by the organization cannot access core tasks, core personnel and core technologies (4). Due to the inability to find core personnel and learn core technologies, their ability to solve problems are limited, and they often feel helpless and hopeless, which then leads to work fatigue. Fourthly, workplace isolation usually leads to unfair treatment, such as unequal development opportunities, remuneration and promotion opportunities. Even if work harder and study more actively, isolated employees may still receive unequal treatment, which will make employees feel disappointed, generate negative thoughts, and increase their sense of work fatigue; Fifthly, for individuals, intimacy can predict individual health and wellbeing, while loneliness and isolation are more likely to make individuals experience health problems such as stress, anxiety and fatigue (28). Isolated employees are more likely to experience frustration, powerlessness, lack of opportunities for career development in the future, so they will lose work initiative, which result in work fatigue (29); Finally, isolation will infect and influence each other among employees, resulting in negative behavior of the organization team. Based on the above analyses, this paper proposes the first hypothesis:

**Hypothesis 1: workplace isolation has a significantly positive impact on employees' work fatigue.**

### 3.2. Workplace isolation and turnover intention

Turnover intention refers to the intention to leave the organization of employees for various reasons after working in the organization for a period of time (30). Firstly, due to the lack of cooperation with supervisors and colleagues, employees have to complete tasks without help and guidance, which leads to employees' turnover intention. Secondly, when encountering difficulties at work, employees suffering workplace isolation have no colleagues to communicate and can't get rid of their bad mood, which will inevitably lead to negative work attitude and turnover intention (31). Thirdly, workplace isolation will make employees fail to integrate into colleagues and teams, resulting in interpersonal alienation. The isolated employees will subconsciously keep distance from their colleagues or teams and lack the sense of belonging, resulting in the idea of resignation (32). Finally, workplace isolation accompanies unfair treatment. When employees feel treated unfairly, they will have the idea of leaving the organization (33). At the same time, isolated employees are unwilling or don't dare to express their ideas, and ignored during group decisions, which will also give rise to the leaving tendency of employees.

The isolation employees facing in the workplace are not only the subjective intentional isolation of their colleagues and leaders at work, but also the unintentional exclusion in the organization

(4). On the one hand, this intentional and unintentional exclusion makes employees feel abandoned by the mainstream group psychologically. In order to vent their bad mood, employees may leave the organization. On the other hand, employees who affected by isolation are facing the risk of losing resources (positive emotions, self-efficiency). In order to avoid the loss of resources, employees will also have turnover intention. In view of this, this paper proposes the second hypothesis:

**Hypothesis 2: workplace isolation has a significantly positive impact on employee turnover intention.**

### 3.3. The mediating role of organizational identification

Organizational identification is a kind of perception belonging to the organization, which means that individuals define themselves as a member of the organization (34). According to the social identity theory, organizational identification is a special form of social identification. Individuals often need to obtain self-concept from the positioning of the relationship with the organization and others (6, 21). The most critical way to obtain self-concept for employees is the external identification (21). If employees are isolated by other members of the organization, they will feel that they are not accepted by the organization, which will reduce the organizational identification and distort their self-awareness.

Workplace isolation will inhibit employees' organizational identification, mainly because workplace isolation will pose a threat to people's basic needs. First, workplace isolation affects people's need to belongings. Human beings are certain kind of social animals who want to belong to certain groups or organizations and maintain certain social connections (35). Due to the lack of communication and emotional exchange, workplace isolation blocks the social contact between isolated employees and others, thus undermining people's need for belonging. Second, workplace isolation affects people's need to self-esteem. Self-esteem is an important factor for individuals to generate and maintain positive emotions (36). Workplace isolation makes isolated employees unwelcome due to the lack of support from colleagues and leaders. Because of being despised and neglected by others and organizations, isolated employees' positive emotions, like self-confidence, wellbeing and self-esteem, will be damaged. Third, workplace isolation affects people's need to control. People want to maintain a certain control over the surrounding to reduce the impact of environmental uncertainty on them (37). Workplace isolation affects the isolated employees' sense of control over interpersonal interaction. Isolated employees are difficult to get support and response from others and cannot meet their own control needs. Fourth, workplace isolation affects people's need to meaningful existence (6, 38). Workplace isolation deprives isolated employees of the meaningful existence within the organization. Because isolated employees normally have no access to core tasks and key leaders, they feel themselves unnecessary and insignificant in the organization. Obviously, workplace isolation cannot meet employees' needs for belonging, self-esteem, control and existence, which will weaken employees' sense of identification with the organization. In addition, the decline of employees' organizational

identification will lead to their negative emotions toward work and turnover intention (39).

If employees' organizational identification is threatened, employees' emotional connection to the organization will be destroyed, and employees' overall awareness of organizational relevance will be reduced (40, 41). In this working state, employees try to leave the organization and are unwilling to continue to work hard to achieve organizational goals. Even if they decide to stay in the organization, it is difficult for employees to devote themselves to work and easy to feel tired. On the contrary, if an employee has a high degree of identification with the organization, it means that he or she has the group consciousness and believes that he or she is an indispensable part of the organization (40). In this way, the employee will associate organizational achievements with personal achievements, so he or she is willing to put more efforts into it. To achieve organization's mission and long-term goals, he or she will spare no effort to work.

In short, due to workplace isolation, employees cannot get the support and guidance of colleagues or leaders at work, nor can they get emotional communication and interpersonal interaction. They feel it difficult to integrate into the organization and be accepted by the organization. Isolated employees are difficult to meet the needs of belonging, self-esteem, control and existence at work. Without the organizational identification, they feel tired at work and even try to leave the organization. According to these, another two hypotheses are proposed:

**Hypothesis 3: organizational identification plays a mediating role in the relationship between workplace isolation and work fatigue; Workplace isolation will inhibit employees' identification with the organization, resulting in employees' work fatigue.**

**Hypothesis 4: organizational identification plays a mediating role in the relationship between workplace isolation and turnover intention; Workplace isolation will inhibit employees' identification with the organization, resulting in employees' turnover intention.**

### 3.4. The moderating role of identification orientation

Self-identity orientation theory (24) believes that individuals have their own ways to obtain a sense of belonging in their environment, and personal identification orientation is a stable personality trait (25). Employees' identification orientation shows strong motivation for self-improvement (26). Although workplace isolation reduces employees' sense of identification with the organization, employees can alleviate the negative impact of workplace isolation on organizational identification through self-improvement and self-support personality traits.

For employees with high identification orientation, they can achieve self-improvement through proactive behavior, and then identify with the organization during work. As intrinsic motivation, self-improvement is an important driving factor to motivate employees to implement positive work behavior (25). This intrinsic motivation of self-improvement can inhibit or even offset the low organizational identification caused by workplace isolation. In addition, individual identification orientation can alleviate the

negative results caused by organizational inequity (42). Workplace isolation actually originates from the unfair treatment of colleagues and leaders. This unfair treatment makes employees unable to integrate into the organization, which reduces employees' sense of identification with the organization. However, employees with high personal identification orientation, with the intrinsic motivation of self-improvement, are willing to seize the opportunity and prove their ability to curb the negative impact. Therefore, we propose the following hypothesis 5:

**Hypothesis 5: identification orientation negatively moderates the relationship between workplace isolation and organizational identification. Namely, the stronger the identification orientation of employees, the weaker the negative impact of workplace isolation on organizational identification and vice versa.**

### 3.5. The moderated mediating model

Combining the mediating effect of hypothesis 3 and 4 with the moderating effect of Hypothesis 5, a moderated mediating model is established. Organizational identification plays a mediating role not only between workplace isolation and work fatigue, but also between workplace isolation and turnover intention. However, these mediating effects are affected by identification orientation. Specifically, for employees with high identification orientation, the positive effect of workplace isolation on work fatigue and turnover intention through organizational identification will be weakened, which leads to hypothesis 6 and hypothesis 7.

**Hypothesis 6: identification orientation negatively moderates the positive and indirect relationship between workplace isolation and work fatigue through organizational identification. Namely, the stronger the identification orientation of employees, the weaker the positive indirect relationship and vice versa.**

**Hypothesis 7: identification orientation negatively moderates the positive and indirect relationship between workplace isolation and turnover intention through organizational identification. Namely, the stronger the identification orientation of employees, the weaker the positive indirect relationship and vice versa.**

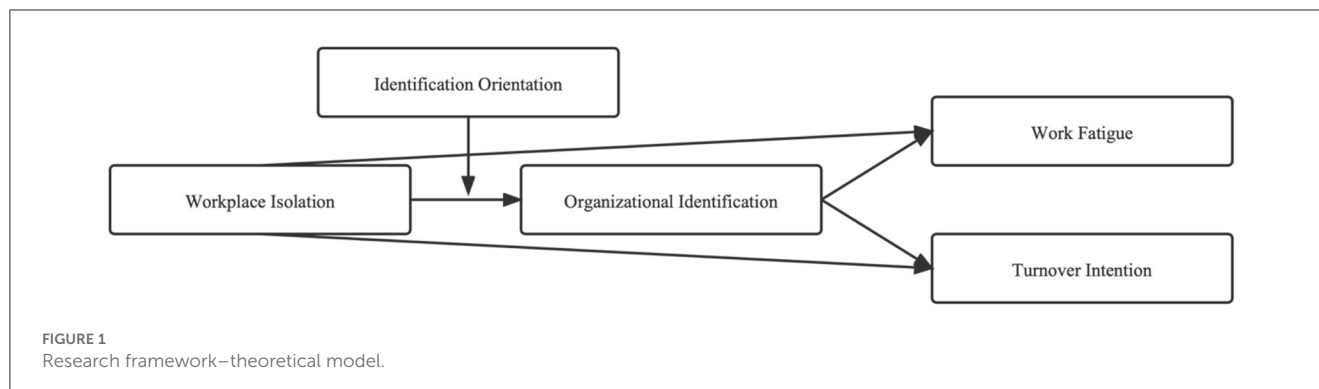
So far, organizational identification is introduced as the mediating variable and identification orientation as the moderating variable. According to the logical relationship, seven hypotheses are put forward to build a theoretical model to study the impact of workplace isolation on employees' negative behaviors. The research framework of this paper is as follows (Figure 1).

## 4. Method design and variable measurement

### 4.1. Sample extraction and investigation process

An electronic questionnaire was sent to the employees of enterprises in Beijing, Shanghai, Guangzhou, Shenzhen, Dongguan, Zhuhai and other regions. Before the survey, we fully communicated with the employees, informed that there was no right or wrong answer to all the respondents, and promised the anonymity and confidentiality of the questionnaire. At the same





time, in order to avoid the deviation of the common method, the same group of people were required to fill in three parts of questionnaire at separated three time points. Each interval was 1 month, so the survey lasted for 3 months (from June to August 2021).

The first part of questionnaire (time point 1: early June 2021) involved the issue of workplace isolation. Five hundred questionnaires were distributed and 499 among those were recovered. The second part of questionnaire (time point 2: early July 2021) investigated employees' identification orientation and organizational identification. Four hundred ninety-nine questionnaires were issued and 415 among those were recovered. The third part of questionnaire (time point 3: early August 2021) investigated employees' work fatigue and turnover intention. Four hundred fifteen questionnaires were issued and 388 were recovered. In addition, common control variables are added, including gender, age, education level, wages, weekly working hours, etc.

After the completion of the survey, the three parts of questionnaires were matched according to the last four digits of the employee's mobile phone number, and the invalid questionnaires without answer were eliminated. Finally, 300 valid questionnaires were obtained from employees of enterprises in mainland China, and the effective recovery rate was 60.12%. In this questionnaire survey, there were 160 male employees, accounting for 53.3% of the total, and 140 female employees, accounting for the remaining 46.7%. Seventy-three unmarried employees, accounting for 24.3% of the questionnaire survey; and 227 married employees, accounting for remaining 75.7%. The average education level of the surveyed employees is junior college, the average age is 39.17 years, the average working period is 4.7 years, and the average weekly working hours is 50.45 h. Further details on the demographics of the group are shown in Table 1.

## 4.2. Measuring tools

In order to ensure the reliability and validity of the questionnaire, the existing mature measurement was used for reference. Before the survey, according to the standard translation and back-translation procedure (43), the questionnaire was repeatedly proofread before issuance, and the measurement

TABLE 1 Demographic characteristics of the sample.

Variables	Number	Percentage
<b>Gender</b>		
Male	160	53.3
Female	140	46.7
<b>Marital status</b>		
Married	227	75.7
Single	74	24.3
<b>Education</b>		
Secondary school	5	1.7
High school	65	21.7
University	200	66.7
Post-university	30	10
<b>Age</b>		
20–29	59	19.7
30–39	99	33
40–49	92	30.7
50–59	50	16.7
<b>Length of service (years)</b>		
1–5	198	66
6–10	101	33.7
> 11	1	0.3
	Mean	SD
Working hours	50.5	6.9

was finally accurately translated into Chinese. In addition, the Likert 5-point scale was used in the questionnaire (1–5 in the questionnaire respectively mean “Strongly disagree” to “Strongly agree”).

Workplace isolation: the questionnaire compiled by Marshall et al. (7) was used for the survey, with a total of 10 reverse questions. For example, “when I encounter problems, I have colleagues I can rely on”. The Cronbach's  $\alpha$  coefficient is 0.908.

Organizational identification: the organizational identification scale compiled by Smidts et al. (34) was used, with five questions

in total. For example, “I have a strong sense of belonging to the company I work for.” The Cronbach’s  $\alpha$  coefficient is 0.766.

Identification orientation: the individual identification orientation scale compiled by Johnson et al. (42) was used, with five questions in total. For example, “I am good at seizing the opportunity to prove my ability or talent is superior to others.” The Cronbach’s  $\alpha$  coefficient is 0.888.

Work fatigue: the work fatigue scale compiled by Frone and Tidwell (17) was used. The questionnaire can be divided into three dimensions, namely physical work fatigue, mental work fatigue and emotional work fatigue, with a total of 18 questions. For example, “Do you feel physically tired after work,” “Do you feel mentally tired after work,” “I feel very depressed after work.” The Cronbach’s  $\alpha$  coefficient is 0.956.

Turnover intention: the scale developed by Wayne et al. (44) was used with 5 questions. For example, “I am actively looking for another work,” “I am seriously considering leaving this firm.” The Cronbach’s  $\alpha$  coefficient is 0.874.

Control variables: because demographic variables also have an impact on work fatigue and turnover intention (17, 44), gender, age, education level, marital status, length of service, etc. are the main factors. At the same time, weekly working hours also have a differential impact on turnover intention (45). In order to verify the model more accurately, these factors were measured as control variables, including gender, age, education level, marital status, length of service and weekly working hours.

### 4.3. Data analysis methods

This study used SPSS 21.0 for Harman’s one-way test, descriptive statistics, correlation analysis, and multiple regression analysis, and Mplus7.4 was used for confirmatory factor analysis. When testing the mediating effect, the confidence interval of the mediating effect was estimated by using the Bootstrap technique and the PROCESS program (46). When testing the moderated mediating effect, according to Edwards and Lambert (47) method and Bootstrap technology (Bootstrap), the significance of value and difference the indirect effect under the high and low moderators should be tested.

## 5. Results and analysis

### 5.1. Common method deviation test

The questionnaire was collected in a multi-stage manner suggested by Podsakoff et al. (48) to prevent possible common method deviations from the data. At the same time, Harman single-factor test was used to test whether this study was affected by the common method deviation. First, exploratory factor analysis without rotation was carried out on the questions. There were six common factors with eigenvalues  $>1$ . The variance interpretation rate of the first factor is 29.05%, which is less than the standard 40% (48). Through the comparison of a series of competition models, the analysis results are shown in the table below (Table 2).

It can be seen from above table that the fitting results of confirmatory factor analysis of single factor model ( $\chi^2 = 4,529.46$ ,

$df = 860$ ,  $RMSEA = 0.119$ ,  $SRMR = 0.154$ ,  $CFI = 0.506$ ,  $TLI = 0.481$ ) is not ideal, indicating that there is no serious common method deviation between variables.

### 5.2. Confirmatory factor analysis

Since the variable data came from employee self-evaluation, it is necessary to use confirmatory factor analysis to test the discriminant validity of each variable (48). Therefore, the fitting indexes are selected to judge the fitting degree of the model. The Chi-square difference must reach a significant level, Root Mean Square Error of Approximation (RMSEA) must be  $<0.08$ , and the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) must be  $>0.9$ .

Table 2 shows the model adaptation of the five-factor model ( $\chi^2 = 1,563.36$ ,  $df = 850$ ,  $RMSEA = 0.053$ ,  $SRMR = 0.055$ ,  $CFI = 0.904$ ,  $TLI = 0.901$ ) is better than other competition models. All the adaptation indexes of the five-factor model have passed the test, which can determine the existence of discrimination of all variables. The five variables represent five different constructs.

### 5.3. Correlation analysis

In order to explore the relationship between workplace isolation, organizational identification, identification orientation, work fatigue and turnover intention, correlation analysis was conducted. The mean, standard deviation and correlation coefficient of key variables are shown in Table 3.

Table 3 shows that the correlation coefficients between variables are significant, “workplace isolation” and work fatigue ( $r = 0.218$ ,  $p < 0.001$ ), “workplace isolation” and turnover intention ( $r = 0.326$ ,  $p < 0.001$ ) show a significant positive correlation, which provides preliminary evidence for subsequent hypotheses testing.

### 5.4. Hypothesis testing results

#### 5.4.1. Control variable inspection results

In order to clarify the impact of demographic variables, the gender, age, years of education, marital status, length of service and weekly working hours of employees are taken as control variables for regression analysis, and the results are shown in Table 4.

According to model 1 in Table 4, employees’ length of service and weekly working hours has an impact on Organizational Identification: the longer employees’ length of service, the lower organizational identification ( $\beta = -0.174$ ,  $p < 0.01$ ); the longer the weekly working hours, the higher the employees’ organization identification ( $\beta = 0.161$ ,  $p < 0.01$ ).

According to model 4 in Table 4, employees’ age, education level and marital status have an impact on work fatigue: older employees are more likely to feel fatigue at work ( $\beta = 0.339$ ,  $p < 0.05$ ); higher-educated employees are more likely to feel fatigue at work ( $\beta = 0.284$ ,  $p < 0.01$ ). Employees with high education are more likely to engage in complex work and the company have higher requirements for their ability, which leads to employees’

TABLE 2 Results of confirmatory factor analysis ( $n = 300$ ).

Model	$\chi^2$	df	$\Delta\chi^2$	RMSEA	SRMR	CFI	TLI
Five-factor model (hypothesis)	1,563.36	850		0.053	0.055	0.904	0.901
Four-factor model (A+B)	1,815.87	854	252.51***	0.061	0.072	0.871	0.863
Four-factor model (B+C)	1,915.26	854	351.90***	0.064	0.086	0.857	0.849
Three-factor model (A+B+C)	2,422.03	857	858.67***	0.078	0.084	0.789	0.778
Two-factor model (A+B+C+D)	3,932.68	859	2,369.32***	0.109	0.147	0.586	0.565
Two-factor model (A+B+C+E)	2,998.23	859	1,434.87***	0.091	0.099	0.712	0.697
Single factor model (A+B+C+D+E)	4,529.46	860	2,966.10***	0.119	0.154	0.506	0.481

A-workplace isolation; B-organizational identification; C-identification orientation; D-work fatigue; E-turnover intention; “+” indicates integration.

TABLE 3 Mean values, standard deviations and correlation coefficients of variables ( $N = 300$ ).

Variables	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10
1 Gender	0.470	0.500										
2 Age	39.170	8.855	0.147*									
3 Years of education	14.930	1.964	−0.123*	−0.845***								
4 Marital status	0.760	0.430	0.110	0.724***	−0.527***							
5 Length of service	4.700	2.736	0.110	0.485***	−0.427***	0.424***						
6 Working hours	50.455	6.954	0.072	0.208***	−0.122*	0.298***	0.236***					
7 Workplace isolation	2.591	0.911	0.100	0.200***	−0.213***	0.134*	0.142*	0.035				
8 Organizational identification	3.601	0.805	−0.104	−0.045	0.053	0.002	−0.133*	0.124*	−0.395***			
9 Identification orientation	3.646	1.052	−0.075	−0.152**	0.220***	−0.006	−0.041	−0.024	−0.394***	0.239***		
10 Work fatigue	2.917	0.978	−0.030	−0.174**	0.185**	−0.310**	−0.046	−0.156**	0.218***	−0.317***	−0.206***	
11 Turnover intention	2.602	1.055	−0.011	−0.082	−0.004	−0.151**	−0.061	−0.110*	0.326***	−0.315***	−0.237***	0.311***

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

higher likelihood to feel fatigue. Married employees are more likely to feel fatigue at work ( $\beta = -0.426$ ,  $p < 0.001$ ). Married employees put part of their limited energy in their families, they may suffer from work fatigue due to lack of energy when facing the work.

Therefore, it is necessary to fix the control variables when verifying the model. When processing the subsequent models, we analyzed the results in the case of controlling the employees' gender, age, education level, marital status, length of service, weekly working hours and other attributes.

## 5.4.2. Main effect test results

In order to verify the impact of “workplace isolation” on work fatigue and turnover intention, regression analysis was conducted on work fatigue and turnover intention, respectively. According to model 5 in Table 4, “workplace isolation” has a significantly positive impact on work fatigue ( $\beta = 0.270$ ,  $p < 0.001$ ), **Hypothesis 1 is confirmed**. According to model 8 in

Table 4, “workplace isolation” has a significantly positive impact on turnover intention ( $\beta = 0.350$ ,  $p < 0.001$ ), **Hypothesis 2 is confirmed**.

## 5.4.3. Mediating effect test results

In order to verify whether organizational identification plays a mediating role in the relationship between “workplace isolation” and work fatigue/turnover intention, according to model 6 in Table 4, organizational identification plays a partial mediating role in the relationship between “workplace isolation” and work fatigue ( $\beta = -0.237$ ,  $p < 0.001$ ). In order to further clarify this mediating effect, Process software was used to test based on Bootstrap method. The results are shown in Table 5.

It can be seen from Table 5 that the indirect and direct effects of organizational identification are significant, and 0 is not included in the 95% confidence interval, indicating that organizational identification plays a partial mediating role

TABLE 4 Regression analysis model.

Variables	Organizational identification			Work fatigue			Turnover intention		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
<b>Control variable</b>									
Gender	−0.100	−0.072	−0.073	−0.003	−0.023	−0.040	0.005	−0.020	−0.035
Age	−0.021	−0.005	0.017	0.339*	0.328**	0.327**	−0.142	−0.156	−0.157
Years of education	−0.004	−0.062	−0.062	0.284**	0.324**	0.309**	−0.206	−0.154	−0.168
Marital status	0.052	0.051	0.039	−0.426***	−0.425***	−0.413***	−0.135	−0.134	−0.123
Length of service	−0.174**	−0.153*	−0.162**	0.113	0.098	0.062	−0.009	−0.027	−0.061
Weekly working hours	0.161**	0.158**	0.164**	−0.091	−0.089	−0.052	−0.064	−0.061	−0.027
<b>Independent variable</b>									
Workplace isolation		−0.391***	−0.333**		0.270***	0.178**		0.350***	0.266***
<b>Mediating variable</b>									
Organizational identification						−0.237***			−0.216***
<b>Moderating variable</b>									
Identification orientation			0.067						
<b>Interaction terms</b>									
Workplace isolation * identification orientation			0.141*						
R <sup>2</sup>	0.054	0.199	0.226	0.134	0.204	0.249	0.040	0.156	0.194
ΔR <sup>2</sup>	0.054*	0.145***	0.172***	0.134***	0.069***	0.114***	0.040*	0.116***	0.153***

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

TABLE 5 Bootstrap test for mediating effect 1.

Mediating effect	Effect size	Standard error	95% Confidence interval	
			Lower confidence limit	Upper confidence limit
Indirect effect	0.099	0.028	0.047	0.157
Direct effect	0.191	0.061	0.071	0.311

Bootstrap sample size  $N = 5,000$ .

between “workplace isolation” and work fatigue. **Hypothesis 3 is confirmed.**

According to model 9 in Table 4, organizational identification plays a partial mediating role between “workplace isolation” and turnover intention ( $\beta = -0.216$ ,  $p < 0.001$ ). In order to further clarify this mediating effect, Process software was used to test based on Bootstrap method. The results are shown in Table 6.

It can be seen from Table 6 that the indirect and direct effects of organizational identification are significant, and 0 is not included in the 95% confidence interval, indicating that organizational identification plays a partial mediating role between “workplace isolation” and work fatigue. **Hypothesis 4 is confirmed.**

#### 5.4.4. Moderating effect test results

According to model 3 in Table 4, interaction term between employees’ workplace isolation and individual identification

orientation is significant ( $\beta = 0.141$ ,  $p < 0.05$ ). In addition,  $\Delta R^2$  (the interaction term based on the control variables and the moderating variable) = 0.172 ( $p < 0.001$ ), indicating that individual identification orientation plays a moderating role in the relationship between “workplace isolation” and organizational identification. In order to further clarify the moderating effect, Process software was used to test based on Bootstrap method. The results are shown in Table 7.

It can be seen from Table 7 that the moderating effect of individual identification orientation is significant at both low and high levels, and 0 is not included in the 95% confidence interval. Then, by using method of Aiken et al. (49), the high and low levels of the moderating variables were adjusted (plus or minus) by one standard deviation ( $\pm 1SD$ ) around the average, and the results are shown in Figure 2.

According to Figure 2, the higher the individual identification orientation, the weaker the positive impact of “workplace isolation” on organizational identification. **Hypothesis 5 is confirmed.**

TABLE 6 Bootstrap test for mediating effect 2.

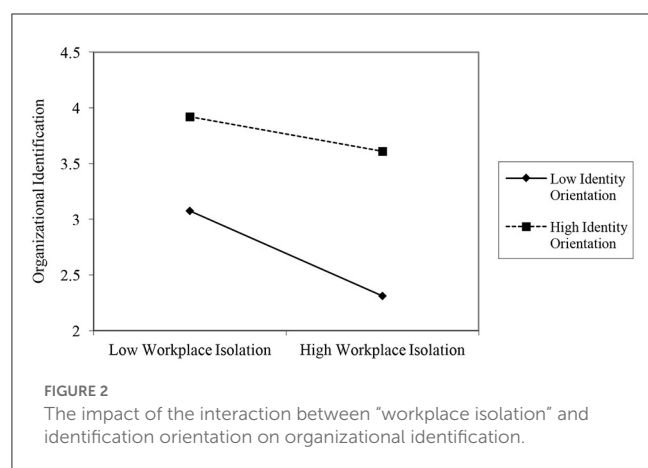
Mediating effect	Effect size	Standard error	95% Confidence interval	
			Lower confidence limit	Upper confidence limit
Indirect effect	0.098	0.032	0.039	0.161
Direct effect	0.308	0.068	0.174	0.441

Bootstrap sample size  $N = 5,000$ .

TABLE 7 Bootstrap test of moderating effect.

Moderating effect	Effect size	Standard error	95% Confidence interval	
			Lower confidence limit	Lower confidence limit
Low (+1SD)	−0.419	0.067	−0.550	−0.287
Middle	−0.194	0.051	−0.392	−0.194
High (+1SD)	−0.169	0.075	−0.317	−0.023

Bootstrap sample size  $N = 5,000$ .



#### 5.4.5. Moderated mediating effect test results

In order to test whether individual identification orientation moderates the indirect impact of “workplace isolation” on work fatigue through organizational identification, Bootstrap method is used to test the moderated mediating model. The analysis results are shown in Table 8.

According to Table 8, under high degree of identification orientation, the indirect effect value is 0.049, and its 95% confidence interval is [0.006, 0.096]. Under low degree of identification orientation, the indirect effect value is 0.121, and its 95% confidence interval is [0.063, 0.181]. It can be seen that individual identification orientation also further negatively moderates the indirect impact of “workplace isolation” on work fatigue through organizational identification. **Hypothesis 6 is confirmed.**

Similarly, in order to test whether individual identification orientation moderates the indirect impact of “workplace isolation” on turnover intention through organizational identification, Bootstrap method is used to test the moderated mediating model. The analysis results are shown in Table 9.

According to Table 9, under high degree of identification orientation, the indirect effect value is 0.048, and its 95% confidence interval is [0.006, 0.097]. Under low degree of identification orientation, the indirect effect value is 0.119, and its 95% confidence interval is [0.055, 0.191]. It can be seen that individual identification orientation further negatively moderates the indirect impact of “workplace isolation” on turnover intention through organizational identification. **Hypothesis 7 is confirmed.**

## 6. Conclusion and discussion

### 6.1. Conclusion

From the dual perspective of internal motivation of organizational environment and personal characteristics, this paper examines the mediating role of organizational identification between workplace isolation and work fatigue/turnover intention, and examines the moderating role of individual identification orientation, aiming to reveal the impact mechanism of workplace isolation on employees’ negative work behaviors. The conclusions are as follows: Firstly, “workplace isolation” has a significantly positive impact on employees’ work fatigue and turnover intention; Secondly, organizational identification plays a partial mediating role between “workplace isolation” and work fatigue/turnover intention; Thirdly, individual identification organizational identification, that is, the higher the individual identification orientation, it will inhibit more the negative impact of “workplace isolation” on organizational identification; Finally, individual identification orientation also further negatively moderates the indirect effect of “workplace isolation” on work fatigue and turnover intention through organizational identification, that is, compared with a lower degree of individual identification orientation, the positive effect of “workplace isolation” on work fatigue and turnover intention through organizational identification will be weakened for employees with higher identification orientation.



TABLE 8 Moderated mediating effect Bootstrap test 1.

Independent variable	Mediating variable	Moderating variable	Indirect effect	Standard error	95% Confidence interval	
					Lower confidence limit	Lower confidence limit
Workplace isolation		Low (-SD)	0.121	0.036	0.063	0.181
	Organizational identification	Identification orientation				
		High (+SD)	0.049	0.028	0.006	0.096

Bootstrap sample size  $N = 5,000$ .

TABLE 9 Moderated mediating effect Bootstrap test 2.

Independent variable	Mediating variable	Moderating variable	Indirect effect	Standard error	95% Confidence interval	
					Lower confidence limit	Lower confidence limit
Workplace isolation		Low (-SD)	0.119	0.042	0.055	0.191
	Organizational identification	Identification orientation				
		High (+SD)	0.048	0.028	0.006	0.097

Bootstrap sample size  $N = 5,000$ .

## 6.2. Theoretical contributions

First of all, this study verifies the impact of workplace isolation on employees' negative behaviors, which is conducive to a comprehensive and in-depth understanding of the negative consequences of workplace isolation, and provides new empirical evidence for enriching and expanding research on workplace isolation (4). The antecedent variables of work fatigue and turnover intention were expanded. This study fills the theoretical gap between workplace isolation and work fatigue and turnover intention, and enriches the cognition of workplace isolation and work negative behavior to a certain extent.

Second, organizational identification plays a mediating role in the process of workplace isolation's impact on employees' negative work behaviors. Based on the social exchange theory, the research starts from the organizational environment of workplace isolation. It is difficult to meet the needs of belonging, self-esteem, control and existence of employees, reduce the identification with the organization, and show work fatigue and turnover tendency. At the same time, this study combines workplace isolation, organizational Identification, work fatigue, and turnover intention are integrated in a framework, revealing the pathway through which workplace isolation affects employees' negative work behaviors (7). Since previous studies on organizational identity paid less attention to interpersonal factors, the research results of this study on the relationship between workplace isolation and organizational identity also have certain enlightening significance for expanding the research on the antecedents of organizational identity.

Finally, this study verified that personal identity orientation negatively moderates the relationship between workplace isolation and organizational identity, and negatively moderates the mediating effect of organizational identification in the process of workplace isolation affecting employees' negative work behaviors. This conclusion supports the intrinsic motivation of self-identity orientation theory (50). Employees with

high personal identity orientation can alleviate the negative impact of workplace isolation and reduce organizational identity with their inner motivation of independence and self-improvement. This paper expands the research on the boundary conditions of the relationship between workplace isolation and organizational identity, and reveals whether the internal motivation of employee identity orientation affects the path of workplace isolation on its negative work behavior through organizational identification.

## 6.3. Practical contributions

Accompanied by the attention of workplace isolation, alleviate its negative impact. This study provides practical guidance on how to deal with work-related negative behaviors brought about by workplace isolation. The study clarifies the impact mechanism of workplace isolation from the perspective of organizational isolation environment and internal self-improvement motivation, which can help organizations and employees clarify workplace isolation more accurately and objectively. Therefore, managers try to mitigate the negative impact of workplace isolation on individuals as much as possible. Organizations can try to create a mutual understanding, tolerance, and proactive organizational culture and communication mechanism, form a united, inclusive, and open working atmosphere, and prevent workplace isolation from happening.

**Strengthen employee identification with the organization.** Since organizational identification plays a mediating role between workplace isolation and employees' negative work behaviors, companies can inhibit the positive impact of workplace isolation on employees' work fatigue and turnover intention by increasing employees' identification with the organization. Employees who identify with the organization, consider themselves a member of the

organization, take the organization's goals as their work goals, and are more willing to make efforts and contributions (51). Therefore, managers actively communicate with employees to solve their work difficulties and enhance employees' sense of belonging to the organization (52). The human resources department can also appropriately increase team cohesion building activities to enhance employees' sense of identity.

**Improve employee identity orientation.** Due to employees' different identification orientation, their feelings and behaviors toward "workplace isolation" are different. Therefore, managers should cultivate employees' identification orientation for the organization and improve employees' adaptability to negative events and emotions through targeted and planned training (53). In addition, when recruiting employees, the human resources department can test the employee's identification orientation and consider using the employee's identification orientation as a reference factor for hiring employees.

Finally, when facing decentralized office or home working, organizations can use information technology to strengthen interaction with employees (54), provide more remote communication platforms, establish channels for employee interaction, and provide personalized care for employees (55).

## 7. Limitation and future research directions

Admittedly, although this paper has made very valuable research conclusions, there are some research limitations need to be noted: due to the single source of data, the interpretation of causality in this paper is limited to a certain extent. It is suggested that longitudinal data should be adopted in subsequent studies in order to establish the causality more clearly; Secondly, due to the constraints of time, space and other factors, the sample size

and data sources of this paper are not very extensive; Finally, this paper based the survey on employees themselves, the impact of family atmosphere on "workplace isolation" and the impact of organizational atmosphere and leadership were not considered. It is suggested that subsequent studies pay attention to these factors.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

Both authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Vaziri H, Casper WJ, Wayne JH, Matthews RA. Changes to the work-family interface during the COVID-19 pandemic: examining predictors and implications using latent transition analysis. *J Appl Psychol.* (2020) 105:1073–87. doi: 10.1037/apl0000819
- Pietromonaco PR, Overall NC. Applying relationship science to evaluate how the COVID-19 pandemic may impact couples' relationships. *Am Psychologist.* (2021) 76:438–50. doi: 10.1037/amp0000714
- Pietromonaco PR, Overall NC. Implications of social Isolation, separation and loss during the COVID-19 pandemic for couples' relationships. *Curr Opin Psychol.* (2021) 43:189–94. doi: 10.1016/j.copsyc.2021.07.014
- Sahai S, Ciby MA, Kahwaji AT. Workplace isolation: a systematic review and synthesis. *Int. J. Manag.* (2020) 11:2745–58. doi: 10.34218/IJM.11.12.2020.257
- Fox S, Stallworth LE. Racial/ethnic bullying: exploring links between bullying and racism in the US workplace. *J Vocat Behav.* (2005) 66:438–56. doi: 10.1016/j.jvb.2004.01.002
- Wu Z, Liu J, Hui C. Workplace ostracism and organizational citizenship behavior: the roles of organizational identification and collectivism. *Nankai Business Rev.* (2010) 13:36–44. doi: 10.3969/j.issn.1008-3448.2010.03.006
- Marshall GW, Michaels CE, Mulki JP. Workplace isolation: exploring the construct and its measurement. *Psychol Mark.* (2007) 24:195–223. doi: 10.1002/mar.20158
- Chandra G, Robinson SL. They're talking about me again: the impact of being the target of gossip on emotional distress and withdrawal. In: *Academy of Management Conference.* Chicago. Paper presented at the annual meeting of the Academy of Management, Boston (2009).
- Yan Y, Zhou E, Long L, Ji Y. The influence of workplace ostracism on counterproductive work behavior: the mediating effect of state self-control. *Soc Behav Person Int J.* (2014) 42:881–90. doi: 10.2224/sbp.2014.42.6.881
- Neuman JH, Baron RA. Workplace violence and workplace aggression: evidence concerning specific forms, potential causes, and preferred targets. *J Manage.* (1998) 24:391–419. doi: 10.1177/014920639802400305
- Aquino K. Structural and individual determinants of workplace victimization: the effects of hierarchical status and conflict management style. *J Manage.* (2000) 26:171–93. doi: 10.1177/014920630002600201
- Mulki JP, Locander WB, Marshall GW, Harris EG, Hensel J. Workplace isolation, salesperson commitment, and job performance. *J Personal Sell Sales Manag.* (2008) 28:67–78. doi: 10.2753/PSS0885-3134280105
- Kwan HK, Zhang X, Liu J, Lee C. Workplace ostracism and employee creativity: an integrative approach incorporating pragmatic and engagement roles. *J Appl Psychol.* (2018) 103:1358–66. doi: 10.1037/apl0000320
- Jiang P, Zhang L. Does conformity lead to gains? the effect of workplace ostracism on performance evaluation from a self-presentational view. *Acta Psychologica Sinica.* (2021) 53:400–12. doi: 10.3724/SP.J.1041.2021.00400
- Deng X, He S, Lyu P, Zhou X, Ye Y, Meng H, et al. Spillover effects of workplace ostracism on employee family life: the role of need for affiliation

and work-home segmentation preference. *Acta Psychologica Sinica*. (2021) 53:1146–60. doi: 10.3724/SP.J.1041.2021.01146

16. Wang D, Qin Y, Zhou W. The effects of leaders' prosocial orientation on employees' organizational citizenship behavior—the roles of affective commitment and workplace ostracism. *Psychol Res Behav Manag*. (2021) 14:1171–85. doi: 10.2147/PRBM.S324081

17. Frone MR, Tidwell MCO. The meaning and measurement of work fatigue: development and evaluation of the three-dimensional work fatigue inventory (3D-WFI). *J Occup Health Psychol*. (2015) 20:273. doi: 10.1037/a0038700

18. Li L, Müller R, Liu B, Wang Q, Wu G, Zhou S. Horizontal-leader identification in construction project teams in China: how Guanxi impacts coworkers' perceived justice and turnover intentions. *Project Manag J*. (2021) 52:577–91. doi: 10.1177/87569728211042509

19. Michele Kacmar K, Andrews MC, Van Rooy DL, Chris Steilberg R, Cerrone S. Sure everyone can be replaced... but at what cost? Turnover as a predictor of unit-level performance. *Acad Manag J*. (2006) 49:133–44. doi: 10.5465/amj.2006.20785670

20. Tajfel H, Turner JC. Social psychology of intergroup relations. *Annu Rev Psychol*. (1982) 33:1–39. doi: 10.1146/annurev.ps.33.020182.000245

21. Tajfel H, Turner JC. The social identity theory of intergroup behavior. In: Worchel S, Austin WG, editors. *The Psychology of Intergroup Behavior*. Chicago: Nelson Hall (1986).

22. Ghanbary A, Haghshanas B, Habibi E, Abedi M. The investigation relationship between mental workload and occupational fatigue in the administrative staffs of a communications service company. *Iranian J Health Safe Environ*. (2019) 6:1221–5.

23. Schneider B. The people make the place. *Pers Psychol*. (1987) 40:437–53. doi: 10.1111/j.1744-6570.1987.tb00609.x

24. Brewer MB, Gardner W. Who is this “We”? levels of collective identity and self-representations. *J Personal Soc Psychol*. (1996) 71:83–93. doi: 10.1037/0022-3514.71.1.83

25. Johnson RE, Chang CH, Yang LQ. Commitment and motivation at work: the relevance of employee identity and regulatory focus. *Acad Manag Rev*. (2010) 35:226–45. doi: 10.5465/AMR.2010.48463332

26. Brickson S. The impact of identity orientation on individual and organizational outcomes in demographically diverse settings. *Acad Manag Rev*. (2000) 25:82–101. doi: 10.5465/amr.2000.2791604

27. Mann S, Varey R, Button W. An exploration of the emotional impact of teleworking via computer-mediated communication. *J Manag Psychol*. (2000) 15:668–90. doi: 10.1108/02683940010378054

28. Myers D. The social psychology of sustainability. *World Fut J Gen Evol*. (2003) 59:201–11. doi: 10.1080/02604020310133

29. Winwood PC, Winefield AH, Dawson D, Lushington K. Development and validation of a scale to measure work-related fatigue and recovery: the occupational fatigue exhaustion/recovery scale (OFER). *J Occup Environ Med*. (2005) 47:594–606. doi: 10.1097/01.jom.0000161740.71049.c4

30. Mobley WH. Intermediate linkages in the relationship between job satisfaction and employee turnover. *J Appl Psychol*. (1977) 62:237–40. doi: 10.1037/0021-9010.62.2.237

31. Cavanaugh MA, Boswell WR, Roehling MV, Boudreau JW. An empirical examination of self-reported work stress among US managers. *J Appl Psychol*. (2000) 85:65–74. doi: 10.1037/0021-9010.85.1.65

32. Ying W, Shasha L. Impacts of organizational silence on employee's negative behavior and its action mechanism. *Sci Res Manag*. (2017) 38:144–52.

33. Poon JM. Distributive justice, procedural justice, affective commitment, and turnover intention: a mediation–moderation framework 1. *J Appl Soc Psychol*. (2012) 42:1505–32. doi: 10.1111/j.1559-1816.2012.00910.x

34. Smidts A, Pruyn ATH, Van Riel CB. The impact of employee communication and perceived external prestige on organizational identification. *Acad Manag J*. (2001) 44:1051–62. doi: 10.2307/3069448

35. Baumeister RF, Leary MR. The need to belong: desire for interpersonal attachments as a fundamental human motivation.

*Psychol Bull*. (1995) 117:497–529. doi: 10.1037/0033-2909.117.3.497

36. Leary MR, Baumeister RF. The nature and function of self-esteem: sociometer theory. In: *Advances in Experimental Social Psychology*. Academic Press (2000). p. 1–62.

37. Friedland N, Keinan G, Regev Y. Controlling the uncontrollable: effects of stress on illusory perceptions of controllability. *J Pers Soc Psychol*. (1992) 63:923–31. doi: 10.1037/0022-3514.63.6.923

38. Solomon S, Greenberg J, Pyszczynski T. A terror management theory of social behavior: the psychological functions of self-esteem and cultural worldviews. *Adv Exp Soc Psychol*. (1991) 24:93–159. doi: 10.1016/S0065-2601(08)60328-7

39. Dutton JE, Dukerich JM, Harquail CV. Organizational images and member identification. *Admin Sci*. (1994) Q39:239–63. doi: 10.2307/2393235

40. Ashforth BE, Mael F. Social identity theory and the organization. *Acad Manag Rev*. (1989) 14:20–39. doi: 10.5465/amr.1989.4278999

41. Patchen, M. (1970). *Participation, Achievement and Involvement on the Job*. Englewood Cliffs, NJ: Prentice Hall.

42. Johnson RE, Selenta C, Lord RG. When organizational justice and the self-concept meet: consequences for the organization and its members. *Organ Behav Hum Decis Process*. (2006) 99:175–201. doi: 10.1016/j.obhdp.2005.07.005

43. Brislin RW. The wording and translation of research instruments. In: Lonner WJ and Berry JW, editors. *Field Methods in Cross-Cultural Research*. Sage Publications, Inc (1986). p. 137–64.

44. Wayne SJ, Shore LM, Liden RC. Perceived organizational support and leader-member exchange: a social exchange perspective. *Acad Manag J*. (1997) 40:82–111. doi: 10.5465/257021

45. Scott CR, Connaughton SL, Diaz-Saenz HR, Maguire K, Ramirez R, Richardson B, et al. The impacts of communication and multiple identifications on intent to leave: a multimethodological exploration. *Manag Commun Quarterly*. (1999) 12:400–35. doi: 10.1177/0893318999123002

46. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Publications, New York, NY: The Guilford Press (2017).

47. Edwards JR, Lambert LS. Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychol Method*. (2007) 12:1–22. doi: 10.1037/1082-989X.12.1.1

48. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol*. (2003) 88:879–903. doi: 10.1037/0021-9010.88.5.879

49. Aiken LS, West SG, Reno RR. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, NP: Sage (1991).

50. Hornsey MJ. Social identity theory and self-categorization theory: a historical review. *Soc Personal Psychol Compass*. (2008) 2:204–22. doi: 10.1111/j.1751-9004.2007.00066.x

51. Yue CA, Men LR, Ferguson MA. Examining the effects of internal communication and emotional culture on employees' organizational identification. *Int J Bus Commun*. (2021) 58:169–95. doi: 10.1177/2329488420914066

52. Salas-Vallina A, Alegre J, López-Cabralés Á. The challenge of increasing employees' well-being and performance: how human resource management practices and engaging leadership work together toward reaching this goal. *Hum Resour Manage*. (2021) 60:333–47. doi: 10.1002/hrm.22021

53. Brunetto Y, Dick T, Kerri M, Cully A. Building capacity in the healthcare sector: a strengths-based approach for increasing employees' well-being and organisational resilience. *J Manag Organ*. (2020) 26:309–23. doi: 10.1017/jmo.2019.53

54. Saura JR, Ribeiro-Soriano D, Saldaña PZ. Exploring the challenges of remote work on Twitter users' sentiments: from digital technology development to a post-pandemic era. *J Bus Res*. (2022) 142:242–54. doi: 10.1016/j.jbusres.2021.12.052

55. Ewing M, Men LR, O'Neil J. Using social media to engage employees: Insights from internal communication managers. *Int J Strat Commun*. (2019) 13:110–32. doi: 10.1080/1553118X.2019.1575830



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# The effect of job insecurity on knowledge hiding behavior: The mediation of psychological safety and the moderation of servant leadership

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As the global economy deteriorates because of the great shocks such as COVID-19 pandemic and wars among nations, the business environment is suffered from uncertainty and risk. To deal with it, several firms have attempted to maximize its efficiency via downsizing and restructuring to diminish costs. Thus, the degree of anxiety is increased among employees who worry about the loss of their job. The current research hypothesizes that job insecurity increases employees' knowledge hiding behavior by diminishing the degree of their psychological safety. In other words, psychological safety functions as the underlying process (i.e., mediator) in the job insecurity-knowledge hiding behavior link. Furthermore, this paper tries to examine the boundary condition of how to decrease the detrimental influence of job insecurity, focusing on the moderating effect of servant leadership. Utilizing a 3-wave time-lagged data from 365 Korean employees, we empirically demonstrated that employees who perceive job insecurity are less likely to perceive psychological safety, eventually increasing their knowledge hiding behavior. We also found that servant leadership functions as a positive moderator which buffers the negative impact of job insecurity on psychological safety. Theoretical and practical contributions are described.

## KEYWORDS

job insecurity, knowledge hiding behavior, psychological safety, servant leadership, moderated mediation model

## Introduction

Since the outbreak of the COVID-19 pandemic, the global economy has stagnated, resulting in many employees around the world losing their jobs (1, 2). In addition, as the robot automation system and artificial intelligence (AI) have advanced, employees have become more threatened with job loss and their job insecurity has worsened (3). Since job insecurity has a substantial adverse effect on both companies and their work force, organizational managers need to understand these effects and take timely action to prevent them (4–6). Existing studies on the topic show that job insecurity has a negative impact not only on organization members' attitudes and perceptions such as job satisfaction, organizational identification, and organizational commitment (7, 8), but also on their behaviors such as organizational deviance, safety behavior, innovative behavior, voice behavior, and organizational citizenship behavior (9–11). However, knowledge plays a pivotal role in an organization. Not only does it promote innovation in products,



technologies, and services and help firms create value, but it also allows firms to secure competitive advantages in a rapidly changing competitive environment (12–14).

As described above, although existing studies have shed light on job insecurity's adverse effects, those have relatively overlooked certain important topics as follows. First, even though knowledge-management is very important to organizations/companies, to the best of our knowledge, few studies have examined the impact of job insecurity on “knowledge-related” behaviors, such as knowledge sharing or knowledge hiding behavior (3, 15). Of course, we acknowledge that existing contributions have explained the influence of job insecurity on several important employee behaviors such as in-role/extra-role behavior, safety behavior, voice behavior, innovative behavior, and organizational citizenship behavior (9–11, 15–20). However, the previous works have relatively underexplored the influence of job insecurity in the context of “knowledge”. Considering that knowledge creates value-added services and products, substantially affecting firms' competitive advantage (12–14), delving into the impact of job insecurity on employees' knowledge-related behaviors is highly recommended.

Second, “few” studies have examined the mediating mechanisms in the association between job insecurity and knowledge-related behaviors (3, 15, 21). These mechanisms merit scholarly attention because they would allow us to understand “why” job insecurity affects knowledge hiding and “what factors” strengthen or attenuate the effects of job insecurity in an organization (3, 15, 21).

Third, and most crucial, existing studies on the topic have overlooked the importance of leadership in attenuating the detrimental effects of job insecurity (3, 15). Most contributions have focused on the moderating role of individual characteristics (e.g., emotional intelligence, proactive personality, internal locus of control, and self-esteem) and organizational context (e.g., macro-economic conditions, social safety networks, and labor market insecurity)—i.e., how they reduce the adverse effects of job insecurity (6, 17, 22–25). Leaders have been known to substantially affect their followers' perceptions, attitudes, and behaviors by assigning tasks, assessing employees' performance, and making explicit and implicit rules (26, 27). Followers also perceive their leaders as main actors who symbolize the organizations they lead (28). Hence, it is useful to examine leadership's moderating effect on the consequences of job insecurity.

To open this “black box” as described above, our study explores the underlying mechanism (i.e., mediator) and its contingent variable (i.e., moderator) in the relationship between job insecurity and knowledge hiding behavior. Specifically, we suggest that an employee's psychological safety may mediate the relationship between job insecurity and knowledge hiding behavior. Moreover, servant leadership would positively moderate the association between job insecurity and psychological safety by buffering the negative effects of job insecurity. With this focus, our study extends existing knowledge about “why” job insecurity influences knowledge hiding behavior and “when” the impact of job insecurity changes.

## Theory and hypotheses

### Job insecurity and knowledge hiding behavior

First, this study suggests that job insecurity would increase the extent to which an employee hides knowledge (12, 15, 29). Knowledge hiding is defined as the deliberate concealment of knowledge when another employee requests information. Knowledge hiding makes it difficult to maintain an organization's competitive advantage and achieve success in a dynamic and rapidly changing organizational environment, because it prevents employees from sharing and transferring crucial work-related information, knowledge, and expertise (12–14). Although existing works have paid little attention to the association between job insecurity and knowledge hiding (15, 30), we rely on the conservation of resources theory (29) to suggest that job insecurity may increase the extent to which an employee hides knowledge. According to the conservation of resources theory (29), when an individual member faces the threat of losing resources, he or she is likely to attempt to reduce his or her energies and resources in the context or environment around him or her. Therefore, when an employee gets a sense of job insecurity, he or she is likely to redirect his or her energies and resources away from his or her tasks at work (15, 29). As a result, the employee would not make sufficient effort to share his or her knowledge with his or her colleagues.

**Hypothesis 1:** An employee's job insecurity may increase their knowledge hiding behavior.

### Job insecurity and psychological safety

In this paper, we expect job insecurity to reduce employees' psychological safety (3, 31–33). Psychological safety refers to “an individual's perception of being able to show himself or herself without fear of adversely affecting his or her status, career, or self-image” ((33), p. 708). Although research on the relationship between job insecurity and employees' psychological safety is scarce (3, 32), it is obvious that job insecurity has a detrimental effect on employees' psychological safety (31, 33). When employees find an organization psychologically safe, they engage in risk-taking behaviors and have less fear that their opinions or ideas will be rejected, which makes them voice these ideas and opinions (31). Consequently, employees do not hesitate to seek their coworkers or supervisors for support and feedback, because they believe that the latter will not treat them unfavorably. On the contrary, when employees consider an organization psychologically unsafe, they will feel pressured and afraid and will find it difficult to freely express their opinions and thoughts (31, 33, 34). This can further decrease their psychological safety. Thus, organizations with high job insecurity will have employees feel that they are not being respected and protected by their employer, which is likely to prevent them from raising issues and opinions beneficial to the organization's success and development (21, 35–37).



**Hypothesis 2:** An employee's job insecurity may reduce their psychological safety.

## Psychological safety and knowledge hiding behavior

In this study, we suggest that lower levels of psychological safety would increase the extent of an employee's knowledge hiding (31, 33, 38). An employee who feels a low level of psychological safety is not likely to cooperate with his or her colleagues, nor actively share his or her opinions and create knowledge (39–41). Thus, when his or her degree of psychological safety is low, the employee will be reluctant to share ideas, thoughts, and feelings with his or her colleagues and he or she will likely find it difficult to ask for help due to the fear or anxiety of being criticized (42). Additionally, a low degree of psychological safety may lead the employee to form negative perceptions and be skeptical of interpersonal relationships within the organization. As a result, the employee is likely to perceive his or her colleagues as rivals for survival in this environment (38, 43). Therefore, employees with low levels of psychological safety would abstain from sharing their knowledge in their organizations.

**Hypothesis 3:** Decreased employees' psychological safety may increase their knowledge hiding behavior.

## Mediating role of psychological safety in the job insecurity-knowledge hiding behavior link

Integrating the dynamics discussed above (i.e., job insecurity, psychological safety, and knowledge hiding), we suggest that employees' psychological safety will mediate the relationship between job insecurity and knowledge hiding. Our mediation model can be supported by a context-attitude-behavior framework (44, 45). According to this perspective, an organization is characterized by a number of environmental or contextual factors, such as systems, practices, rules, and climates, which mold employees' attitudes and behaviors. In employees' minds, job insecurity is a critical context that influences their attitudes, such as psychological safety, and eventually affects their behaviors, such as knowledge hiding. Thus, we suggest that psychological safety mediates the relationship between job insecurity and knowledge hiding.

**Hypothesis 4:** Employees' psychological safety may mediate the relationship between job insecurity and knowledge hiding behavior.

## Moderating effect of servant leadership in the job insecurity-psychological safety link

Moreover, and more important, we suggest that servant leadership would positively moderate the relationship between

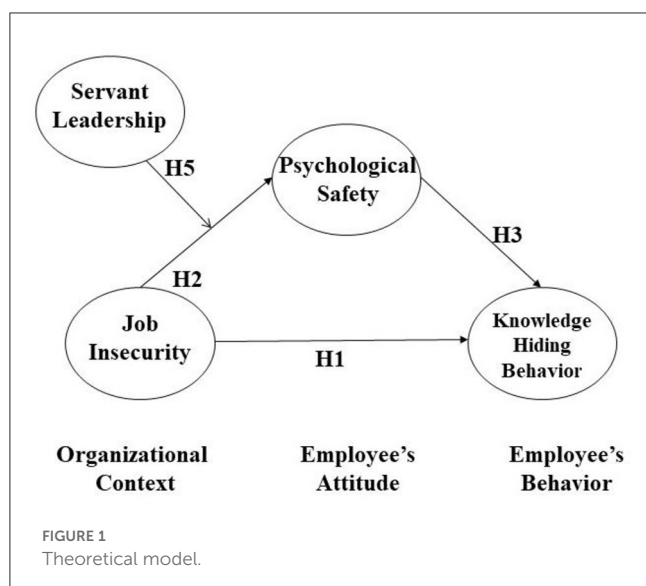
Job insecurity and psychological safety (23, 46, 47). In other words, our research sets boundary conditions by focusing on servant leadership and its role in the relationship between job insecurity and psychological safety. Our argument that job insecurity may lower employees' psychological safety is reasonable and acceptable. However, job insecurity may not always affect psychological safety in the same way because in real organizations, several contextual/contingent factors (e.g., personality, gender, age, leadership style, organizational climate, rule, and systems) moderate the relationship between the two variables (23, 46, 47).

This paper focuses on servant leadership, which is one of many leadership styles. This concept can be defined as “an (1) other-oriented approach to leadership (2) manifested through one-on-one prioritizing of follower individual needs and interests, (3) and outward reorienting of their concern for self toward concern for others within the organization and the larger community” [(48), p. 114]. In particular, we suggest that servant leadership mitigates job insecurity's detrimental effect on psychological safety. Servant leadership would provide followers with effective guidance about how to properly cope with any negative emotions, personal problems, and crises that stem from job insecurity (49–53). This leadership style encourages employees to feel a sense of respect, mutual trust, support, and self-worth in the organization, eventually reducing job insecurity's negative impact on psychological safety (49, 50, 53). For instance, when a leader's servant leadership is high, his or her behavior helps followers effectively resolve their anxiety and fear of unstable employment, even if they feel very insecure in their jobs. As a result, the employee is less likely to feel less safe psychologically (48, 50, 53).

In contrast, when a leader's servant leadership is low, employees find it difficult to cope with the negative emotions, personal issues, and crises concomitant to their unstable jobs. They are also likely to feel less respected and supported by their leader (49, 50, 53). Thus, leaders' low servant leadership may induce the followers who suffer in their unstable jobs to feel that they cannot effectively cope with said jobs and to become isolated from the organization. The negative influence of job insecurity on psychological safety would thus fail to become adequately resolved and may even be amplified (48, 50, 53).

**Hypothesis 5:** Servant leadership may positively moderate the relationship between job insecurity and psychological safety.

In sum, this study aims to understand how job insecurity influences knowledge hiding through the mechanism of employees' psychological safety. It predicts that servant leadership plays a moderating role in the link between job insecurity and psychological safety. Specifically, when servant leadership is high, job insecurity's negative impact is more modest than when it is low. We use structural equation modeling (SEM) to empirically test our proposed moderated mediation model. Our study contributes to and extends our knowledge on job insecurity in the following way. First, we focus on a knowledge-related variable (i.e., employees' knowledge hiding) that is affected by job insecurity. Second, we establish the underlying mechanism that links employees' job insecurity and knowledge hiding. Third, we propose a way in which organizations can attenuate the negative impact of job insecurity on employees' psychological safety by suggesting that servant



leadership moderates the relationship between the two. Finally, we utilized three-wave time-lagged data, which minimizes the possibility of common method bias compared to a cross-sectional study. Figure 1 visualizes our hypothesized model.

## Methods

### Participants and procedure

We collected time-lagged data from three waves of surveys, with each new wave taking place 4 or 5 weeks after its predecessor. We used an online survey administration firm, which maintains approximately 3,450,000 panel data representatives of the Korean population, to recruit adults who work full time. We aim to minimize the common method variance problems inherent to cross-sectional studies by using 3-wave time-lagged data. The survey participants registered through an authentication system and had to identify their occupation status by providing an e-mail address or a mobile phone number. Existing research has established that using such an online survey system is a reliable way of obtaining diverse samples (54).

The operation function of the online system allowed us to ensure that the surveys were distributed to the same participants, with each new wave taking place 4 or 5 weeks after its predecessor. The survey system gave the participants sufficient time to respond to each survey (e.g., 2 or 3 days) and the respondents were allowed to answer the survey whenever they wanted.

In an effort to ensure an efficient response, the survey firm used traps and timestamps for geographic IP violators to monitor the integrity of the data. These tools prevented participants from repeatedly accessing the survey and completing the questionnaire. In order to guarantee the spontaneity and confidentiality of our participants' responses, the experts at the survey firm contacted them directly to request their consent to take part in our survey. We promised compliance with common ethical standards (such as ensuring anonymity) to those who agreed to participate, and

received their informed consent. Our respondents received a cash reward equivalent to US\$8. Our study received institutional review board (IRB) approval from our respective universities in South Korea.

A total of 1,512 participants completed our first (Time 1) survey, designed to measure job insecurity and servant leadership. Four weeks later, 421 participants completed our second (Time 2) questionnaire, which measured employees' psychological safety. Five weeks later, the same participants received our third (Time 3) survey, which measured knowledge hiding. Thus, after excluding the missing data, out of 512 participants, our final analysis sample consisted of 365 participants who answered all three questionnaires (a response rate of 71.29%). We used several recommendations proposed by earlier studies to calculate our sample size. First, we used G\*Power version 3.1.9.7 to determine the minimum sample size in order to assess whether our sample size was appropriate. According to our power analysis, which is based on previous research (55), 365 different samples had the adequate power (0.80) to identify a medium effect at an alpha level of  $p = 0.05$ . Furthermore, our research model followed the rule of ten (56), which states that one observable variable should include at least 10 cases. Considering that our research model contained 24 observable variables, thus our 365 cases would be sufficient. Table 1 provides a description of the characteristics of our respondents.

### Measures

We measured different variables at each of the three survey points. At time 1, we measured the degree of job insecurity and servant leadership. At time 2, employees were asked to report their psychological safety. Finally, at time 3, we measured the employees' knowledge hiding behavior from their direct supervisors. All variables were measured on five-point Likert scales (1 = strongly disagree, 5 = strongly agree). We also calculated the variables' internal consistency *via* their Cronbach alpha values.

#### Job insecurity (Time 1, collected from employees)

We measured employees' job insecurity using five items developed by Kraimer et al. (57). A sample item read: "My job is not a secure one." The value of the Cronbach's alpha is 0.91.

#### Servant leadership (Time 1, collected by employees)

Servant leadership was measured by Liden et al. (58) seven items. A sample item is: "My supervisor puts my best interests ahead of his/her own". The value of Cronbach's alpha is 0.79.

TABLE 1 Descriptive characteristics of the sample.

Characteristic	Percent (%)
<b>Gender</b>	
Male	52.1
Female	47.9
<b>Age (years)</b>	
20–29	14.0
30–39	36.1
40–49	33.5
50–59	16.4
<b>Education</b>	
Below high school	8.2
Community college	18.9
Bachelor's degree	61.1
Master's degree or higher	11.8
<b>Occupation</b>	
Office worker	71.2
Profession (Practitioner)	7.9
Manufacturing/Engineering	6.0
Public official	5.5
Sales and marketing	4.1
Administrative positions	3.8
Education	0.3
Freelancer	0.3
Others	0.9
<b>Position</b>	
Staff	22.7
Assistant manager	21.6
Manager or deputy general manager	33.4
Department/general manager or director and above	22.2
<b>Tenure (years)</b>	
Below 5	46.8
5–10	26.9
11–15	13.1
16–20	8.0
21–25	1.4
Above 26	3.8
<b>Industry type</b>	
Manufacturing	24.7
Wholesale/Retail business	11.8
Construction	11.5
Health and welfare	10.7
Information services and telecommunications	8.8

(Continued)

TABLE 1 (Continued)

Characteristic	Percent (%)
Education	7.9
Services	6.6
Financial/insurance	3.3
Consulting and advertising	1.1
Others	12.6

## Psychological safety (Time 2, collected from employees)

We measured employees' psychological safety using seven items (31). A sample item read: "I am able to bring up problems and tough issues in this organization." The value of the Cronbach alpha is 0.80.

## Knowledge hiding behavior (Time 3, collected from employees' direct supervisors)

We utilized five items of knowledge hiding behavior scale which consists of eleven items (59). Each employee's immediate supervisor evaluated the level of his or her knowledge hiding behavior. The reason why we shortened the full items is that the five items were validated by existing empirical research which were conducted in the context of South Korea (60). A sample item is "This employee pretended that he or she couldn't find the information that his or her colleagues wanted", and "This employee gives colleagues a little bit of assistance, but didn't help them to the extent they wanted". The value of the Cronbach's alpha is 0.95.

## Control variables

We measured several control variables in addition to our primary variables of interest. In line with existing research on knowledge hiding (59), we used participants' gender, tenure, and education level, all measured in our Time 2 survey.

## Statistical analysis

We first conducted a frequency analysis to confirm the demographic characteristics of our participants. The relationships among the variables in our study were calculated through correlation analysis using SPSS 26 and Pearson. We followed Anderson and Gerbing (61) by adopting a two-step procedure (i.e., a measurement model and a structural model). We then conducted a series of confirmatory factor analyses (CFA) to evaluate the empirical distinctiveness of our main variables (i.e., job insecurity, servant leadership, psychological safety, and knowledge hiding).

Afterwards, we used AMOS 23 to run our structural model and performed an analysis of moderated mediation using the maximum likelihood (ML) estimator.

We calculated the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA) to ensure the empirical distinctiveness of each of our main variables. Browne and Cudeck (62) suggest that it is ideal to have CFI and TLI values above 0.90 and an RMSEA value below 0.06. Next, we ran a bootstrapping analysis to confirm the significance of the indirect effect of psychological safety (63). Finally, we performed a bootstrapping analysis by estimating a 95% confidence interval (CI) to see if our hypothesis of mediation and indirect mediation was supported. When the confidence interval (CI) excludes zero (0), the indirect effect is significant at level 0.05 (63).

## Results

### Descriptive statistics

We find that some of the variables in our study are significantly correlated with one another (e.g., job insecurity, servant leadership, psychological safety, and knowledge hiding). Table 2 presents the descriptive statistics of and the correlations between our variables.

### Measurement model

We first conduct a series of CFAs to ensure that each of our main variables is empirically distinctive (job insecurity, servant leadership, psychological safety, and knowledge hiding). Specifically, the chi-square difference test allows us to establish whether our proposed four-factor model (job insecurity, psychological safety, servant leadership, and knowledge hiding) is better than alternative models (e.g., a three-factor model, a two-factor model, and a one-factor model).

First, the hypothesized 4-factor model had a good and acceptable fit ( $\chi^2$  (df = 109) = 212.224; CFI = 0.974; TLI = 0.967; RMSEA = 0.051). Then, we conducted a series of chi-square difference tests by comparing the 4-factor model with a 3-factor

model ( $\chi^2$  (df = 112) = 1239.387; CFI = 0.715; TLI = 0.655; RMSEA = 0.165), a 2-factor model ( $\chi^2$  (df = 114) = 1699.100; CFI = 0.600; TLI = 0.523; RMSEA = 0.194), and a 1-factor model ( $\chi^2$  (df = 115) = 1763.298; CFI = 0.584; TLI = 0.508; RMSEA = 0.197). The results of the chi-square difference tests showed that the 4-factor model was better than others. Thus, this result means that our four research variables have an appropriate degree of discriminant validity.

### Structural model

Our study uses a moderated mediation model that adds mediators and moderators to the relationship between job insecurity and knowledge hiding. First, the mediator (psychological safety) mediates the relationship between job insecurity and knowledge hiding. Second, the moderator (servant leadership) ameliorates the negative relationship between job insecurity and psychological safety.

Next, we multiply job insecurity and servant leadership in the moderation structure to create an interaction term. The variables are mean-centered to avoid multicollinearity. This technique reduces the multicollinearity and the correlation between our two variables (64).

We calculate tolerance values and variance inflation factors (VIF) to assess the effects of multicollinearity (64). We find that the tolerance values of job insecurity and servant leadership are 1.000 and 1.000, respectively. Their VIF values are 1.001 and 1.001, respectively. The results demonstrate/suggest that the two variables (job insecurity and servant leadership) are free of multicollinearity, as their tolerance values are >0.2 and their VIF values are <10.

### Results of the mediation analysis

We conduct a chi-square difference test that compares our full mediation model to a partial mediation model to identify the best mediation model. Except for the direct path from job insecurity to knowledge hiding behavior, the full and the partial mediation models are identical. The results of the fit indices are

TABLE 2 Correlation between research variables.

	Mean	S.D.	1	2	3	4	5	6	7
1. Gender_T2	1.48	0.50	–						
2. Education_T2	2.76	0.76	–0.14**	–					
3. Tenure_T2	7.49	7.26	–0.24**	0.01	–				
4. Position_T2	2.96	1.60	–0.39**	0.24**	0.28**	–			
5. Job insecurity_T1	2.79	0.87	–0.06	–0.07	0.01	0.11*	–		
6. SL_T1	3.07	0.67	–0.11*	0.05	0.03	0.15*	–0.00	–	
7. PS_T2	3.20	0.60	–0.17**	0.10	0.12*	0.19**	–0.26**	0.39**	–
8. KHB_T3	2.23	0.84	0.09	–0.10	0.09	0.03	0.23**	0.03	–0.22**

\* $p < 0.05$ , \*\* $p < 0.01$ . S.D. means standard deviation, SL means servant leadership, PS means psychological safety, and KHB indicates knowledge hiding behavior. As for gender, males are coded as 1 and females as 2. As for position, general manager or higher are coded as 5, deputy general manager and department manager 4, assistant manager 3, clerk 2, and others below clerk as 1. As for education, “below high school diploma” level is coded as 1, “community college” level as 2, “bachelor’s” level as 3, and “master’s degree or more” level is coded as 5.

reasonable both for the full mediation model [ $\chi^2 = 295.377$  (df = 137), CFI = 0.957, TLI = 0.947, and RMSEA = 0.056] and for the partial mediation model [ $\chi^2 = 287.111$  (df = 136), CFI = 0.959, TLI = 0.949, and RMSEA = 0.055]. Yet, the chi-square difference test between the two ( $\Delta\chi^2 [1] = 8.266$ ,  $p < 0.01$ ) indicates that the partial mediation model is significantly better than the full mediation model. The findings suggest that job insecurity affects knowledge hiding behavior both “indirectly” (through psychological safety) and “directly”.

We add our control variables into our research model since the variables can affect the dependent variable (i.e., knowledge hiding behavior). And we found that all control variables are statistically insignificant.

Then, the results showed that job insecurity and knowledge hiding are positively and significantly correlated ( $\beta = 0.17$ ,  $p < 0.01$ ). Thus, Hypothesis 1 is supported. Hypothesis 1 expected the “partial” mediation model (which was superior to full mediation) to contain the coefficient value of the relationship between job insecurity and knowledge hiding behavior. These results are consistent with the fact that the partial mediation model’s fit indices are superior to those of the full mediation model. When we take the two together, we accept the Hypothesis 1. That is, rather than only indirectly, job insecurity is more likely to both “directly” and “indirectly” affect knowledge hiding behavior *via* psychological safety.

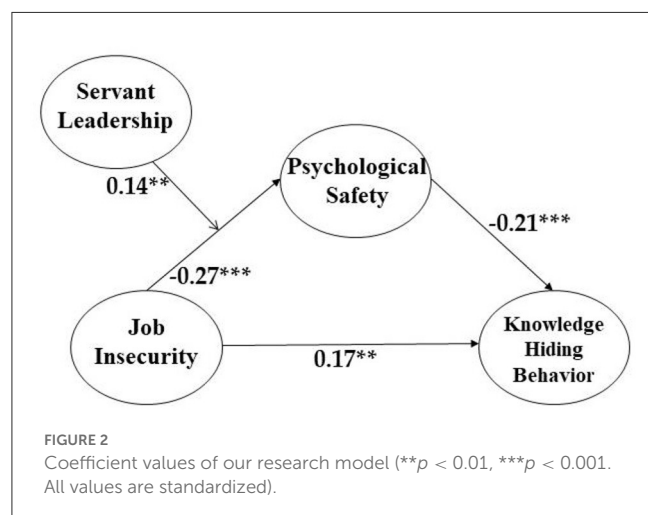


TABLE 3 Results of structural model.

Hypothesis	Path (Relationship)	Unstandardized estimate	S.E.	Standardized estimate	Supported
1	Job insecurity → Knowledge Hiding Behavior	0.155	0.053	0.165**	Yes
2	Job insecurity → Psychological Safety	−0.145	0.030	−0.267***	Yes
3	Psychological Safety → Knowledge Hiding Behavior	−0.358	0.102	−0.208***	Yes
5	Job insecurity × Servant Leadership	0.099	0.037	0.137**	Yes

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ . Estimate indicates standardized coefficients. S.E. means standard error. The coefficient value of the path from job insecurity to knowledge hiding behavior (H1) was in the partial mediation model which was not accepted as a final model.

We also discovered a significant negative association between job insecurity and psychological safety ( $\beta = -0.27$ ,  $p < 0.001$ ), supporting Hypothesis 2. In addition, Figure 2 indicates that psychological safety is negatively and significantly correlated with knowledge hiding behavior ( $\beta = -0.21$ ,  $p < 0.001$ ), supporting Hypothesis 3 (Please see Table 3).

## Bootstrapping

Hypothesis 4 predicted that psychological safety mediates the impact of job insecurity on knowledge hiding. To test Hypothesis 4, we perform a bootstrapping analysis (sample size = 10,000) (63). We use the resulting bias-corrected confidence interval (CI) to determine whether the mediation is significant. The 95% confidence interval (CI) should exclude the zero for us to be able to declare the mediation significant (63). We use these guidelines and a sample of 10,000 to confirm that psychological safety’s indirect effect is significant, as the confidence interval does not contain zero (95% confidence interval [0.020, 0.105]). Thus, the mediating effect of psychological safety is statistically significant, and Hypothesis 4 receives some support. Table 4 illustrates the direct, the indirect, and the total effect of job insecurity on knowledge hiding.

## Result of the moderation analysis

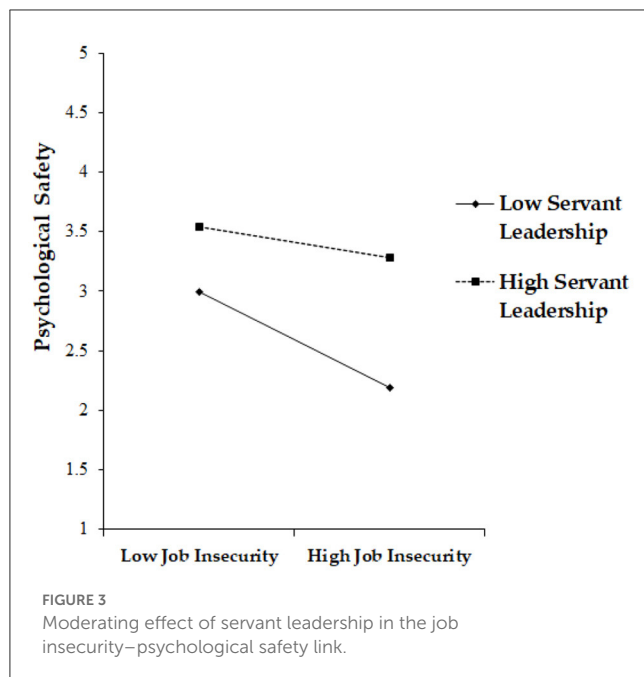
Hypothesis 5 proposed that servant leadership positively moderates the negative relationship between job insecurity and psychological safety. To test Hypothesis 5, we mean-centered the two variables and generated an interaction term (i.e., job insecurity × servant leadership). The results demonstrated that the interaction term is significantly related to psychological safety ( $\beta = 0.14$ ,  $p < 0.01$ ). As expected, servant leadership plays a buffering role in the negative relationship between job insecurity and psychological safety. Specifically, the negative

TABLE 4 Direct, indirect, and total effects of the final research model.

Model (Hypothesis 4)	Direct effect	Indirect effect	Total effect
Job insecurity → Psychological Safety → Knowledge Hiding Behavior	0.165	0.056	0.221

All values are standardized.





effect of job insecurity on psychological safety is buffered when servant leadership is high compared to when it is low. Taken together, these findings support Hypothesis 5 (Please see Figure 3).

## Discussion

We have examined and tested the mediating effect of psychological safety in the relationship between job insecurity and knowledge hiding, as well as the buffering role of servant leadership in the association between job insecurity and psychological safety. We use a three-wave time-lagged study and find that employees who feel job insecurity are less likely to feel psychological safety, which leads to increased knowledge hiding. We also establish that servant leadership functions as a buffering factor, which positively moderates the relationship between job insecurity and psychological safety. We can draw several theoretical and practical implications from our results.

## Theoretical implications

From a theoretical perspective, this study makes the following contributions. First, we have examined the relationship between job insecurity and knowledge-related behaviors. The relationships between job insecurity and behavioral outcomes (e.g., innovative behavior, voice behavior, organizational citizenship behavior, safety behavior, and counterproductive work behavior) are well-documented (15, 16, 18–20). However, surprisingly, the research on knowledge-related outcomes is considerably limited (3, 15). Given that knowledge is the driving force behind organizational innovation and ultimately

determines firms' competitive advantage and success (12–14), it is necessary to examine the relationship between job insecurity and knowledge-related behaviors. Therefore, this study enriches the literature on job insecurity by engaging in this line of research.

Second, even though existing research has highlighted the need to explore additional underlying mechanisms and boundary conditions in the relationship between job insecurity and knowledge-related behaviors (3, 15), few studies have done so. To better understand why and when this relationship occurs, it is important to examine its mediators and moderators. By integrating a context-attitude-behavior framework with social identity theory, this study has emphasized the roles of employees' psychological safety as a mediating mechanism and servant leadership as a boundary condition. In doing so, we extend existing research on the relationship between job insecurity and knowledge hiding by adding a substantive intermediating mechanism and boundary condition to interpret how job insecurity affects knowledge hiding and when the impact of job insecurity is minimized or strengthened.

Third, existing research on job insecurity has established/discovered that leadership plays a critical role in buffering the negative impact of job insecurity (46). However, most studies have focused on individual-level variables, such as self-esteem, internal locus of control, proactive personality, psychological capital, resilience, and emotional intelligence (6, 17, 22–25), and/or macro-level contextual moderators, such as labor market insecurity, social safety networks, and macro-economic conditions (3, 15). Previous studies (27, 28, 46) indicate that leadership is a critical factor in encouraging subordinates' perceptions of and attitudes and behaviors toward the organization. Thus, servant leadership functions as a pivotal contingent factor in the relationship between job insecurity and knowledge hiding *via* employees' psychological safety. Our moderated-mediation model highlights the essential role of servant leadership when examining the influence of job insecurity on knowledge hiding.

## Practical implications

The results of our study also have some practical implications. First, they show that job insecurity has important implications for knowledge hiding. Our SEM reveals that job insecurity leads to increased knowledge hiding. Organizational managers should remember that job insecurity hinders the flow of knowledge across organization members because knowledge is crucial to the achievement of firms' organizational success and competitive advantage. Thus, reducing employees' job insecurity might prove more effective in preventing knowledge hiding than material or financial incentives. Organizations could implement human resource management practices like mentoring programs, long-term contracting with employees, and fair performance evaluations (46) to encourage such reductions.

Second, we suggest that psychological safety mediates the relationship between job insecurity and knowledge hiding. Reduced psychological safety can increase job insecurity's influence on knowledge hiding behaviors. Thus, implementing specific measures

to fortify employees' organizational identification should be a concern for managers. They could increase firm reputation through firm activities, systems, or lectures that inspire employees to identify themselves as members of their organizations and form positive organizational images in their minds. Therefore, managers should strive not only to decrease job insecurity but also to increase employees' psychological safety.

Third, we propose that servant leadership buffers the negative impact of job insecurity on psychological safety. In particular, in today's rapidly changing business environment, it is necessary to guide, facilitate, and inspire employees to help solve, and cope with, difficulties within their organizations, such as job insecurity. By encouraging leaders to engage in servant behaviors *via* training systems and courses (e.g., emphasizing the importance of subordinate guidance, discovering subordinates' potential and growth, providing subordinates with opportunities to maximize their abilities), leaders can develop a servant leadership style.

## Limitations and suggestions for future research

We believe that the current study may meaningfully contribute to the literature on job insecurity and knowledge hiding behavior, but it still has some limitations that need to be addressed. First, this research could not measure employees' job insecurity in an objective manner because it only uses self-reported survey data, which is subjective. However, objective indicators, such as the downsizing rate, may not directly influence employees' perceptions and attitudes because these objective characteristic (e.g., downsizing rate) tend to be interpreted through each individual's sense-making processes, which means that the objective measure would be unconsciously reflected in each employee's responses. Thus, this paper suggests that future research needs to not only use both subjective and objective measures, but also needs to compare the differential effects of these different measures. Second, this research could not properly consider a number of external factors that can substantially affect employees' job insecurity. Numerous objective factors affect an employee's perception on his or her subjective job insecurity, such as companies' downsizing rates, the quality or characteristics of the human resource management system in place, and the features of the social insecurity system at the national level (60). Therefore, we suggest that future research should more fully consider the issue by controlling for such objective variables.

Third, the fundamental values and spirit that servant leadership pursues may be universal in the West and in the East (65, 66). However, a number of cultural differences do affect individuals' understandings of the role leadership plays, and these differences eventually affect employees' responses to different leadership styles. South Korea has been affected by the Confucian hierarchical systems for the past several centuries, so Korean employees may be more familiar with a culture of command and discipline than their Western counterparts (65). As a result, Korean employees are likely to feel that their leaders' servant behaviors are not natural and effective in a real organization. Therefore, the results of this study should be interpreted with care.

## Conclusion

Our study delved into the influence of job insecurity on employees' knowledge hiding behavior. The results demonstrated that job insecurity promotes employees' knowledge hiding behavior through the mediating role of psychological safety. In turn, servant leadership functions as a positive moderator in the relationship between job insecurity and the psychological safety. The results indicate that the level of employees' psychological safety is an underlying mechanism in translating job insecurity into individual knowledge hiding behavior. In addition, servant leadership plays a buffering role, which decreases the negative influence of job insecurity. Although this research has some limitations, we expect that it can positively contribute to not only expanding the literature on job insecurity from the theoretical perspective but also providing practical implications for leaders and practitioners in organizations.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human/animal participants were reviewed and approved by Macromill Embrain Group of Ethics Committee. Macromill Embrain Group is the company providing market research service and their approval is sufficient according to the local requirements. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

JJ contributed by generating a research idea, data analysis, and writing the original draft of the manuscript. B-JK contributed in data collection, methodology, review, and editing the manuscript. JL contributed in thoroughly revising, editing, and re-writing the manuscript. All authors have read and agreed to the published version of the manuscript.

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## Conflict of interest

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## References

- Fouad NA. Editor in chief's introduction to essays on the impact of COVID-19 on work and workers. *J Vocat Behav.* (2020) 119:103441. doi: 10.1016/j.jvb.2020.103441
- Sergent K, Stajkovic AD. Women's leadership is associated with fewer deaths during the COVID-19 crisis: quantitative and qualitative analyses of United States governors. *J Appl Psychol.* (2020) 105:771. doi: 10.1037/apl0000577
- Shoss MK. Job insecurity: An integrative review and agenda for future research. *J Manage.* (2017) 43:1911–39. doi: 10.1177/0149206317691574
- Grote G, Pfrombeck J. Uncertainty in aging and lifespan research: Covid-19 as catalyst for addressing the elephant in the room. *Work Aging Retirement.* (2020) 6:246–50. doi: 10.1093/workar/waaa020
- Spurk D, Straub C. Flexible employment relationships and careers in times of the COVID-19 pandemic. *J Vocat Behav.* (2020) 119:103435. doi: 10.1016/j.jvb.2020.103435
- Lin W, Shao Y, Li G, Guo Y, Zhan X. The psychological implications of COVID-19 on employee job insecurity and its consequences: the mitigating role of organization adaptive practices. *J Appl Psychol.* (2021) 106:317. doi: 10.1037/apl0000896
- Sverke M, Hellgren J, Näswall K. No security: a meta-analysis and review of job insecurity and its consequences. *J Occup Health Psychol.* (2002) 7:242. doi: 10.1037/1076-8998.7.3.242
- Reisel WD, Probst TM, Chia SL, Maloles CM, König CJ. The effects of job insecurity on job satisfaction, organizational citizenship behavior, deviant behavior, and negative emotions of employees. *Int Stud Manage Organiz.* (2010) 40:74–91. doi: 10.2753/IMO0020-8825400105
- Jiang L. Job insecurity and creativity: The buffering effect of self-affirmation and work-affirmation. *J Appl Soc Psychol.* (2018) 48:388–97. doi: 10.1111/jasp.12519
- Breevaart K, Bohle SL, Pletzer JL, Medina FM. Voice and silence as immediate consequences of job insecurity. *Career Develop Int.* (2020) 25:204–20. doi: 10.1108/CDI-09-2018-0226
- Huang GH, Wellman N, Ashford SJ, Lee C, Wang L. Deviance and exit: The organizational costs of job insecurity and moral disengagement. *J Appl Psychol.* (2017) 102:26. doi: 10.1037/apl0000158
- Kumar V, Lai KK, Chang YH, Bhatt PC, Su FP. A structural analysis approach to identify technology innovation and evolution path: a case of m-payment technology ecosystem. *J Knowl Manage.* (2020) 25:477–99. doi: 10.1108/JKM-01-2020-0080
- Chen J, Wang L, Qu G. Explicating the business model from a knowledge-based view: nature, structure, imitability and competitive advantage erosion. *J Knowl Manage.* (2020) 25:23–47. doi: 10.1108/JKM-02-2020-0159
- Peng, H. Why and when do people hide knowledge?. *J Knowl Manage.* (2013) 17:398–415. doi: 10.1108/JKM-12-2012-0380
- Jiang L, Lavaysse LM. Cognitive and affective job insecurity: a meta-analysis and a primary study. *J Manage.* (2018) 44:2307–42. doi: 10.1177/0149206318773853
- Berntson E, Näswall K, Sverke M. The moderating role of employability in the association between job insecurity and exit, voice, loyalty and neglect. *Econ Ind Democr.* (2010) 31:215–30. doi: 10.1177/0143831X09358374
- Callea A, Urbini F, Chirumbolo A. The mediating role of organizational identification in the relationship between qualitative job insecurity, OCB and job performance. *J Manage Develop.* (2016) 35:735–46. doi: 10.1108/JMD-10-2015-0143
- Jiang L, Probst TM. A multilevel examination of affective job insecurity climate on safety outcomes. *J Occup Health Psychol.* (2016) 21:366. doi: 10.1037/ocp0000014
- Niesen W, Witte HD, Battistelli A. An explanatory model of job insecurity and innovative work behavior: Insights from social exchange and threat rigidity theory. *Contemp Occup Health Psychol Global Perspect Res Practice.* (2014) 3:18–34. doi: 10.1002/9781118713860.ch2
- Van den Broeck A, Sulea C, Vander Elst T, Fischmann G, Iliescu D, De Witte H et al. (2014). The mediating role of psychological needs in the relation between qualitative job insecurity and counterproductive work behavior. *Career Develop Int.* 19, 526–47. doi: 10.1108/CDI-05-2013-0063
- Nguyen TM, Malik A, Budhwar P. Knowledge hiding in organizational crisis: The moderating role of leadership. *J Bus Res.* (2022) 139:161–72. doi: 10.1016/j.jbusres.2021.09.026
- Xiao Z, Wu D, Liao Z. Job insecurity and workplace deviance: the moderating role of locus of control. *Social Behavior Personal Int J.* (2018) 46:1673–86. doi: 10.2224/sbp.7160
- Cheng T, Huang GH, Lee C, Ren X. Longitudinal effects of job insecurity on employee outcomes: the moderating role of emotional intelligence and the leader-member exchange. *Asia Pacific J Manage.* (2012) 29:709–28. doi: 10.1007/s10490-010-9227-3
- Darvishmotevali M, Ali F. Job insecurity, subjective well-being and job performance: The moderating role of psychological capital. *Int J Hospital Manage.* (2020) 87:102462. doi: 10.1016/j.ijhm.2020.102462
- Aguiar-Quintana T, Nguyen THH, Araujo-Cabrera Y, Sanabria-Díaz JM. Do job insecurity, anxiety and depression caused by the COVID-19 pandemic influence hotel employees' self-rated task performance? The moderating role of employee resilience. *Int J Hospital Manage.* (2021) 94:102868. doi: 10.1016/j.ijhm.2021.102868
- Kim MJ, Kim BJ. The performance implications of job insecurity: The sequential mediating effect of job stress and organizational commitment, and the buffering role of ethical leadership. *Int J Environ Res Public Health.* (2020) 17:7837. doi: 10.3390/ijerph17217837
- Lowe KB, Kroeck KG, Sivasubramaniam N. Effectiveness correlates of transformational and transactional leadership: A meta-analytic review of the MLQ literature. *Leadership Quarterly.* (1996) 7:385–425. doi: 10.1016/S1048-9843(96)90027-2
- Schein, E. H. (2010). *Organizational culture and Leadership* (Vol. 2). New York: John Wiley and Sons.
- Hobfoll SE. Conservation of resources: a new attempt at conceptualizing stress. *Am Psychol.* (1989) 44:513. doi: 10.1037/0003-066X.44.3.513
- Sverke M, Låstad L, Hellgren J, Richter A, Näswall K. A meta-analysis of job insecurity and employee performance: testing temporal aspects, rating source, welfare regime, and union density as moderators. *Int J Environ Res Public Health.* (2019) 16:2536. doi: 10.3390/ijerph16142536
- Edmondson A. Psychological safety and learning behavior in work teams. *Administrat Sci Quarterly.* (1999) 44:350–83. doi: 10.2307/2666999
- Frazier ML, Fainshmidt S, Klinger RL, Pezeshtkan A, Vrancea V. Psychological safety: a meta-analytic review and extension. *Pers Psychol.* (2017) 70:113–65. doi: 10.1111/peps.12183
- Kahn WA. Psychological conditions of personal engagement and disengagement at work. *Acad Manage J.* (1990) 33:692–724. doi: 10.5465/256287
- Lee WR, Choi SB, Kang SW. How leaders' positive feedback influences employees' innovative behavior: the mediating role of voice behavior and job autonomy. *Sustainability.* (2021) 13:1901. doi: 10.3390/su13041901
- Choi SB, Ullah SE, Kang SW. Proactive personality and creative performance: mediating roles of creative self-efficacy and moderated mediation role of psychological safety. *Sustainability.* (2021) 13:12517. doi: 10.3390/su132212517
- Opoku MA, Choi SB, Kang SW. Psychological safety in Ghana: empirical analyses of antecedents and consequences. *Int J Environ Res Public Health.* (2020) 17:214. doi: 10.3390/ijerph17010214
- Son S, Yang TS, Park J. How organizational politics and subjective social status moderate job insecurity–silence relationships. *J Manage Organiz.* (2022) 1:1–21. doi: 10.1017/jmo.2022.54
- De Cuyper N, Baillien E, De Witte H. Job insecurity, perceived employability and targets' and perpetrators' experiences of workplace bullying. *Work Stress.* (2009) 23:206–24. doi: 10.1080/02678370903257578
- Bartol KM, Liu W, Zeng X, Wu K. Social exchange and knowledge sharing among knowledge workers: the moderating role of perceived job security. *Manage Organiz Rev.* (2009) 5:223–40. doi: 10.1111/j.1740-8784.2009.00146.x
- Kang SW. Knowledge withholding: psychological hindrance to the innovation diffusion within an organisation. *Knowl Manage Res Practice.* (2016) 14:144–9. doi: 10.1057/kmrp.2014.24
- Wang W, Kang SW, Choi SB. Effects of employee well-being and self-efficacy on the relationship between coaching leadership and knowledge sharing

- intention: a study of UK and US employees. *Int J Environ Res Public Health*. (2021) 18:10638. doi: 10.3390/ijerph182010638
42. Shoss MK, Su S, Schlotzhauer AE, Carusone N. Working hard or hardly working? An examination of job preservation responses to job insecurity. *J Manage*. (2022) 01492063221107877. doi: 10.1177/01492063221107877. [Epub ahead of print].
  43. Kipkosgei F, Son SY, Kang SW. Coworker trust and knowledge sharing among public sector employees in Kenya. *Int J Environ Res Public Health*. (2020) 17:2009. doi: 10.3390/ijerph17062009
  44. Mulki JP, Jaramillo JB, Locander WB. Critical role of leadership on ethical climate and salesperson behaviors. *J Bus Ethics*. (2009) 86:125–41. doi: 10.1007/s10551-008-9839-4
  45. Ozelik H, Langton N, Aldrich H. Doing well and doing good: The relationship between leadership practices that facilitate a positive emotional climate and organizational performance. *J Manag Psychol*. (2008). doi: 10.1108/02683940810850817
  46. Kim BJ. Unstable jobs harm performance: the importance of psychological safety and organizational commitment in employees. *SAGE Open*. (2020) 10:2158244020920617. doi: 10.1177/2158244020920617
  47. Wang HJ, Lu CQ, Siu OL. Job insecurity and job performance: the moderating role of organizational justice and the mediating role of work engagement. *J Appl Psychol*. (2015) 100:1249–58. doi: 10.1037/a0038330
  48. Eva N, Robin M, Sendjaya S, Van Dierendonck D, Liden RC. Servant leadership: A systematic review and call for future research. *Leadership Quarterly*. (2019) 30:111–32. doi: 10.1016/j.leaqua.2018.07.004
  49. Bauer TN, Perrot S, Liden RC, Erdogan B. Understanding the consequences of newcomer proactive behaviors: The moderating contextual role of servant leadership. *J Vocat Behav*. (2019) 112:356–68. doi: 10.1016/j.jvb.2019.05.001
  50. Lee A, Lyubovnikova J, Tian AW, Knight C. Servant leadership: a meta-analytic examination of incremental contribution, moderation, and mediation. *J Occup Organ Psychol*. (2020) 93:1–44. doi: 10.1111/joop.12265
  51. Thao NPH, Kang SW. When servant leaders inspire followers to become organizational citizens? Empirical evidence from Vietnam. *Sage Open*. (2020) 10:2158244019900184. doi: 10.1177/2158244019900184
  52. Wang W, Kang SW, Choi SB. Servant leadership and creativity: a study of the sequential mediating roles of psychological safety and employee well-being. *Front Psychol*. (2022) 12:6670. doi: 10.3389/fpsyg.2021.807070
  53. Wu J, Liden RC, Liao C, Wayne SJ. Does manager servant leadership lead to follower serving behaviors? It depends on follower self-interest. *J Appl Psychol*. (2021) 106:152–67. doi: 10.1037/apl0000500
  54. Landers RN, Behrend TS. An inconvenient truth: Arbitrary distinctions between organizational, Mechanical Turk, and other convenience samples. *Ind Organ Psychol*. (2015) 8:142–64. doi: 10.1017/iop.2015.13
  55. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G\* Power 3.1: tests for correlation and regression analyses. *Behavior Res Methods*. (2009) 41:1149–60. doi: 10.3758/BRM.41.4.1149
  56. Barclay D, Higgins C, Thompson R. The partial least squares (PLS) approach to causal modeling: personal computer adoption and use as an illustration. *Technol Stud*. (1995) 2:285–309.
  57. Kraimer ML, Wayne SJ, Liden RC, Sparrowe RT. The role of job security in understanding the relationship between employees' perceptions of temporary workers and employees' performance. *J Appl Psychol*. (2005) 90:389. doi: 10.1037/0021-9010.90.2.389
  58. Liden RC, Wayne SJ, Liao C, Meuser JD. Servant leadership and serving culture: influence on individual and unit performance. *Acad Manage J*. (2014) 57:1434–52. doi: 10.5465/amj.2013.0034
  59. Connelly CE, Zweig D, Webster J, Trougakos JP. Knowledge hiding in organizations. *J Organ Behav*. (2012) 33:64–88. doi: 10.1002/job.737
  60. Kim HW, Kim BJ. The influence of job involvement on knowledge hiding behavior: the mediating effect of knowledge territoriality and the moderating influence of servant leadership. *Global Bus Administrat Rev*. (2021) 18:180–203. doi: 10.38115/asgba.2021.18.2.180
  61. Anderson JC, Gerbing DW. Structural equation modeling in practice: a review and recommended two-step approach. *Psychol Bull*. (1988) 103:411. doi: 10.1037/0033-2909.103.3.411
  62. Browne MW, Cudeck R. Alternative ways of assessing model fit. *Sociol Methods Res*. (1992) 21:230–58. doi: 10.1177/0049124192021002005
  63. Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychol Methods*. (2002) 7:422. doi: 10.1037/1082-989X.7.4.422
  64. Brace N, Kemp R, Snelgar R. *SPSS for Psychologists: A Guide to Data Analysis using SPSS for Windows*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers. (2006).
  65. Chun JS, Shin Y, Choi JN, Kim MS. How does corporate ethics contribute to firm financial performance? The mediating role of collective organizational commitment and organizational citizenship behavior. *J Manage*. (2013) 39:853–77. doi: 10.1177/0149206311419662
  66. Eisenbeiss SA. Re-thinking ethical leadership: an interdisciplinary integrative approach. *Leadership Quarterly*. (2012) 23:791–808. doi: 10.1016/j.leaqua.2012.03.001



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# Workplace loneliness mediates the relationship between perceived organizational support and job performance: Differing by extraversion

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This study investigated the mediating role of workplace loneliness relating perceived organizational support to job performance, as well as the moderating role of extraversion in such relationship. 332 full-time Chinese employees from various enterprises voluntarily participated in the two-wave surveys via either paper-and-pencil or online survey conducted at Credamo and Tencent Questionnaire website. Hierarchical regression and bootstrapping analyses were employed to examine the hypotheses. Results indicated that workplace loneliness partially mediates the linkage between perceived organizational support and job performance; extraversion serves as a moderator in the relationship between workplace loneliness and job performance, as well as the mediating role of workplace loneliness linking perceived organizational support to job performance, such that the relationship is stronger when extraversion is high. Supplementary analyses revealed that social companionship, but not emotional deprivation, serves as a mediator in the relationship between perceived organizational support and job performance; extraversion enhanced the direct influence of social companionship on job performance, as well as the indirect influence of perceived organizational support on job performance via social companionship. Theoretical and practical implications are discussed.

## KEYWORDS

perceived organizational support, workplace loneliness, extraversion, job performance, conservation of resources theory, social cognitive theory

## Introduction

Workplace loneliness, defined as one's perceptions of relational deficiencies in the workplace (Wright et al., 2006), has been found to be increasingly prevalent in recent years (Ozcelik and Barsade, 2018; Anand and Mishra, 2021). According to *Loneliness Economy White Paper 2017*, more than 60% of respondents indicated some degree of workplace loneliness (Wang and Liu, 2021). Much work has been conducted concerning its detrimental effects on individuals and enterprises. Specifically, workplace loneliness negatively relates to employees' well-being (Mohapatra et al., 2020), creativity (Peng et al., 2017), job performance (Lam and Lau, 2012;



Ozcelik and Barsade, 2018), and organizational citizenship behaviors (Lam and Lau, 2012; Firoz and Chaudhary, 2021), and positively associates with work–family conflict (Firoz and Chaudhary, 2021).

Given the negative effects of workplace loneliness, much attention has been paid to its antecedents. Prior studies indicated that job characteristics, such as job autonomy (Wang and Liu, 2021) and job insecurity (Andel et al., 2021), leadership factors, including paternalistic leadership (Öge et al., 2018) and transformational leadership (Kloutsiniotis et al., 2022), and social interaction variables, such as leader-member exchange, trust, and communication frequency (Arslan et al., 2020) are closely correlated to workplace loneliness. This study focuses on the effect of perceived organizational support (one remarkable organizational factor) on workplace loneliness, and more importantly, the mediating role of workplace loneliness linking perceived organizational support to job performance.

According to the conservation of resources (COR) theory, people strive to obtain and maintain resources, including both personal resources and organizational resources that are beneficial for them to achieve goals (Hobfoll, 1989; Hobfoll and Shirom, 2001; Hobfoll et al., 2003). Hobfoll (2011) further claimed that people's resources do not exist independently but travel in caravans for both individuals and enterprises. As shown in prior research, in the organizational context, individuals who have been well supported are more likely to construct or receive high leader-member exchange (Wayne et al., 1997, 2002). In the present article, we aim to examine the influence of perceived organizational support on workplace loneliness.

The COR theory also posits that potential resource losses or gains would influence one's emotions, thus leading to poorer or better performance. Drawing on this theory, much work has been conducted regarding the mediating role of emotions linking personal or organizational resources to job performance. For example, Guan et al. (2014) found that job satisfaction serves as a mediator linking perceived organizational support to job performance. Moreover, workplace loneliness serves as a mediator in the relationship between transformational leadership and burnout (Kloutsiniotis et al., 2022). Based on this premise, we propose that workplace loneliness would function as a mediator in the bonds between perceived organizational support and job performance.

Moreover, according to the social cognitive theory (SCT), human activity is jointly influenced by employees' behavior, their cognition and personalities, and external circumstances (Bandura, 1991; Bandura, 2001). In this regard, even though individuals have the same emotional experience, their perceptions or reactions may differ. SCT was widely employed to explore the moderating effect of personal traits in one's response to emotions. For example, Wanberg et al. (2020) discovered that extraversion serves as a moderator in the relationship between participating in the networking intervention and postintervention in a field experimental study. Similarly, core self-evaluations and conscientiousness are indicated to moderate the indirect influence of supervisor bottom-line mentality on social undermining *via* employee bottom-line mentality (Greenbaum et al., 2012). In the present research, we examine the moderating role of extraversion in the relationship between workplace loneliness and job performance. As extraverts tend to attach more importance to close interpersonal relationships and have higher intention to display warmth, affection, and friendliness (Hogan, 1982; Depue and Collins, 1999), they may be more frustrated when suffering from poor social ties in the workplace.

In summary, integrating the COR and SCT theories, we proposed a moderated-mediation model explaining how and for whom perceived organizational support may promote job performance, as shown in Figure 1. The contributions of the present research are threefold. Firstly, we contribute to the limited literature on the antecedents of workplace loneliness. Given that existing research on the antecedents of workplace loneliness mainly focuses on job characters and interactions with leaders (e.g., Öge et al., 2018; Andel et al., 2021). As we know, few studies have examined the influence of organizational factors such as perceived organizational support, which is the focus of the present research. Our study contributes to a new view on the antecedents of workplace loneliness.

In addition, we contribute to the nascent knowledge on the association between perceived organizational support and job performance by exploring the mediating effect of workplace loneliness. Although previous studies have identified some underlying mechanisms on how perceived organizational support influences job performance (e.g., Rubaca and Majid Khan, 2020; Zhang et al., 2021), they mainly focus on the mediating role of positive emotions or psychological states. Whether negative emotions (one of which is workplace loneliness) would serve as a mediator in such relationship has not been examined yet.

Finally, we tested the moderating role of extraversion in the workplace loneliness-job performance association, which extends our understanding of the boundary conditions for the effect of workplace loneliness. Although prior research has indicated that consciousness and need to belong moderate the influence of workplace loneliness on its outcomes (Hu et al., 2021; Basit and Nauman, 2023), it remains to be examined whether extraversion would function as a moderator in such relationship. We address this issue by examining the moderating role of extraversion in the relationship between workplace loneliness and job performance, and the indirect influence of perceived organizational support on job performance *via* workplace loneliness. This study extends SCT to the workplace loneliness literature, indicating that perceived organizational support inhibits workplace loneliness, thus leading to better job performance, and the strength of such relationships depends on the level of one's extraversion.

## Literature review and hypotheses

### Perceived organizational support, workplace loneliness, and job performance

COR theory posits that both personal resources and organizational resources are beneficial for employees to achieve their goals in the work context (Hobfoll, 1989; Hobfoll and Shirom, 2001). As one form of organizational resources, perceived organizational support, referring to an employee's overall perceptions of the extent to which their contributions are valued and their interests or well-being are acknowledged by the organization they work in, provides aids to workers in terms of equipment, funding, ideas, and physical assistance in the workplace (Eisenberger et al., 1986, 1997; Rhoades and Eisenberger, 2002). Individuals with high perceived organizational support tend to believe that their need for work or life will be satisfied and they are well respected or recognized by the organization (Eisenberger et al., 1986, 1997), and, in turn, display increased work engagement (Karatepe and Aga, 2016; Tan et al., 2020; Xu et al., 2022),

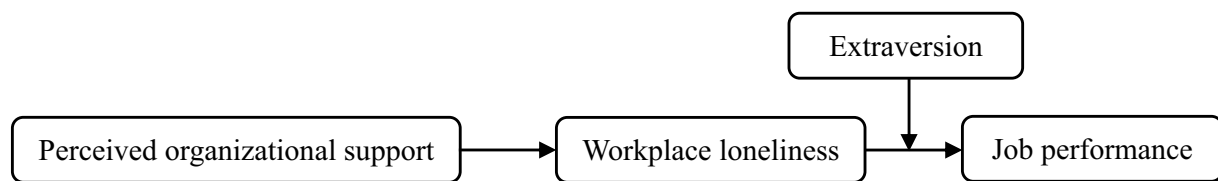


FIGURE 1  
The moderated mediation model in this study.

affective commitment (Guan et al., 2014; Nazir et al., 2019), and better job performance (Chiang and Hsieh, 2012; Guan et al., 2014). There is extensive evidence indicating the positive association between perceived organizational support and job performance employing different sources of job performance data. For example, Gillet et al. (2013) found that perceived organizational support positively relates to one's self-reported job performance; this relationship was also certificated in a survey on employees in Taiwan hotels (Chiang and Hsieh, 2012). In a study on frontline bank employees, Karatepe and Aga (2016) found that perceived organizational support positively correlates with supervisor-rated job performance. The relationship was also confirmed in a study employing job performance data from HR archival records (Tian et al., 2021).

Moreover, as one kind of external coping resource, perceived organizational support responds to the socio-emotional needs of employees (Kraimer et al., 2001), it is supposed to influence one's emotions or psychological condition. Much work has been conducted on the positive emotions or psychological conditions provoked by perceived organizational support including resilience (Zhang et al., 2021), psychological safety (Xu et al., 2022), meaningfulness (Guan and Frenkel, 2021), and job satisfaction (Guan et al., 2014; Rubaca and Majid Khan, 2020). In addition, drawing on the COR theory, people's resources including personal and organizational resources co-exist in ecological conditions that either foster or limit resource creation and sustenance (Hobfoll, 2011). As employees with high perceptions of organizational support tend to perform well, it is more likely that they will be better expected by their leaders, thus contributing to better leader-member exchange (Wayne et al., 1997, 2002). For example, Wayne et al. (1997) found that perceived organizational support is positively related to leader-member exchange in a study on two metal fabricating plants. Similarly, the relationship was confirmed in the work of Wayne et al. (2002). Considering that workplace loneliness concerns employees' perceptions of insufficient interpersonal interactions with their colleagues those they work with or enterprises they work for either quantitatively or qualitatively (Wright et al., 2006), perceived organizational support contributes to high-quality leader-member exchange. It is reasonable to predict that perceived organizational support would be negatively related to workplace loneliness.

From a COR perspective, employees suffering from workplace loneliness usually get into a stressful situation, and they tend to decrease their affective commitment (Ozcelik and Barsade, 2018) or work engagement (Basit and Nauman, 2023) so as to preserve their personal resources, which ultimately result in more social cyberloafing behaviors (Hu et al., 2021) and poor job performance (Ozcelik and Barsade, 2018; Abelsen et al., 2021). Prior research has extensively confirmed the negative relationship between workplace loneliness and

job performance. For example, Ozcelik and Barsade (2018) found that employees' self-reported workplace loneliness negatively links to supervisor-rated job performance. Workplace loneliness also negatively relates to task performance and contextual performance (Abelsen et al., 2021). More importantly, the work of Wax et al. (2022) indicated that workplace loneliness has a detrimental influence on self-reported job performance.

Besides the direct relationship of perceived organizational support-workplace loneliness and workplace loneliness-job performance, we also examine the mediating role of workplace loneliness. According to the COR theory, job resource can accumulate and therefore contribute to positive outcomes (Hobfoll, 1989; Hobfoll and Shirom, 2001). In this vein, as one kind of organizational resources in the workplace, perceived organizational support is supposed to contribute to accumulation of personal resources, which, in turn, lead to positive outcomes. For example, the mediating role of job satisfaction in associating perceived organizational support with contextual performance has been confirmed (Rubaca and Majid Khan, 2020). Similarly, Guan and Frenkel (2021) found that meaningfulness functions as a mediator in the association between perceived organizational support for strength use and thriving at work. Considering that perceived organizational support contributes to one's satisfaction of their need for affiliation and workplace loneliness is negatively related to job performance, we argue that workplace loneliness would serve as a mediator in the relationship between perceived organizational support and job performance.

Consequently, perceived organizational support would be negatively related to workplace loneliness, and workplace loneliness would serve as a mediator in the association between perceived organizational support and job performance. Therefore, we predict that:

H1: Perceived organizational support is negatively linked to workplace loneliness.

H2: Workplace loneliness functions as a mediator in the relationship between perceived organizational support and job performance.

## The moderating role of extraversion

We further propose that the negative effect workplace loneliness exerts on job performance varies for people according to whether they have high or low levels of extraversion. SCT posits that human behavior is extensively motivated and regulated by both self-generated and external sources of influence (Bandura, 1991). One of the major

self-regulative mechanisms operates in the judgment of one's behavior according to personal standards. Owing to the variances in personal standards among people of different personalities, their responses to the same events or emotional experiences may vary. As indicated in the work of Beck et al. (1983), the influence of interpersonal rejection or loss on depression varies for employees who are high or low in sociotropy or social dependence. Similarly, the work of Mohapatra et al. (2020) revealed that self-esteem serves as a moderator in the bonds between workplace loneliness and work-alienation. In the present, we aim to focus on the moderating role of extraversion.

Extraversion is a dispositional tendency to seek out and enjoy frequent and intimate interpersonal interactions, and to be self-confident, active, and dominant (Barrick and Mount, 1991). The moderating role of extraversion in employees' response to their perceptions or experiences at work has been confirmed in previous research. For instance, extraversion serves as a moderator in the relationship between span of control and the quality of leader-member exchange, such that the relationship is stronger when extraversion is high (Schyns et al., 2012). Similarly, prior research indicated the moderating role of extraversion in the relationship between agentic threats and support-seeking behaviors (Pow et al., 2017). Moreover, Lajoie et al. (2022) found that a leader's extraversion functions as an enhancer in the linkage between transformational leadership and follower vitality.

Considering that extraverts have higher need for frequent and intense social interactions (Hogan, 1982; Depue and Collins, 1999), communications with others may help to reduce their anxiety. As shown in an experimental study, extraverts experienced a lower level of anxiety than introverts after communication with a confederate *via* either computer-mediated or face-to-face communication (Rice and Markey, 2009). It is reasonable to predict that, when experiencing poor or deficient social contacts, extraverts may be more anxious or frustrated. In other words, people high in extraversion would be more oppressed by deficient interpersonal relationships. There is some evidence supporting the reverse buffering role of extraversion. In a study on students, Mishra et al. (2018) found that extraverts experienced higher levels of depression than introverts when suffering from loneliness. Thus, we propose that:

*H3: Extraversion will moderate the negative relationship between workplace loneliness and job performance, such that the relationship is stronger when extraversion is high.*

## The moderated-mediation model

When H2 and H3 are integrated, a moderated-mediation pattern is implied: due to the moderating role of extraversion on the association between workplace loneliness and job performance, extraversion is likely to accentuate the indirect influence of perceived organizational support on job performance *via* the mediating role of workplace loneliness. Accordingly, we predict:

*H4: Extraversion would moderate the mediating effect of workplace loneliness in the association between perceived organizational support and job performance, such that the relationship is stronger for extraverts than introverts.*

## Methods

### Participants and procedures

All employees voluntarily participated in the two-wave surveys *via* either a paper-and-pencil or online survey conducted at Credamo or Tencent Questionnaire website. In the first wave, 495 full-time employees from different enterprises reported their demographic information and degree of extraversion. One month later, when the scales of perceived organizational support, workplace loneliness, and job performance were distributed to them, 421 questionnaires were returned. After deleting invalid or impaired responses, the final sample consisted of 332 participants, representing a response rate of 67.07%. It included 206 females (62.05%) and 126 males (37.95%). Fifteen yuan (about \$2.35) was given to participants as a compensation for their involvement. The average age and organizational tenure were 30.76 (SD = 5.30) and 5.02 (SD = 3.84), respectively; 82.23% had a bachelor or graduate degree and 56.63% were ordinary employees. More than one-half of participants (54.22%) worked in private-owned enterprises, followed by employees worked in state-owned enterprises (21.08%) and public institutions (10.84%). Approximately one-quarter of participants (25.90%) worked in high-tech and other industries (28.31%). Participants working in the traditional industries, financial industry, and service industry were 21.08, 8.73, and 7.83%, respectively.

### Measures

Participants were asked to report the extent to which these items are accurate in describing their perceptions at work, using a 5-point Likert scale, ranging from "1 = it does not describe me at all" to "5 = it accurately describes me." We conducted translation and back-translation procedures (Brislin, 1980) to translate English items into Chinese.

#### Perceived organizational support

We employed the 8-item scale developed by Eisenberger et al. (1997) to measure perceived organizational support. A sample was "My organization cares about my opinions." Item 6 was reverse scored. The reliability value of this scale was 0.84.

#### Workplace loneliness

The 16-item scale developed by Wright et al. (2006) was employed to measure workplace loneliness. It includes two dimensions: emotional deprivation, which refers to the perception of the amount or quantity of one's relationships at work, and social companionship, defined as the perception of the quality of one's interpersonal relationships in the workplace. Emotional deprivation includes 9 items (e. g., "I often feel alienated from my co-workers") and social companionship contains 7 items (e. g., "I often feel disconnected from others at work"). Eight items were reverse scored, two items in the dimension of emotional deprivation, and 6 items from another dimension. The Cronbach's  $\alpha$  was 0.91.

#### Job performance

We employed the scale developed by Janssen (2001) to measure job performance, which contains 5 items. The original version of the



scale was used for managers or supervisors to evaluate the performance of his or her subordinates, we adapted this scale for employees to evaluate their job performance. A sample was “I always complete the duties specified in my job description.” Item 3, “I often fail to perform essential duties,” was deleted since its factor loading was less than 0.50. The reliability value of this scale was 0.76.

## Extraversion

The 8-item scale developed by Benet-Martínez and John (1998) was employed to measure extraversion. Samples are “I like to talk” and “I am outgoing and sociable.” Three items were reverse scored. The Cronbach’s  $\alpha$  was 0.81.

## Control variables

Demographic variables including gender and age were controlled, as they have been indicated to be linked to loneliness (Schmidt and Sermat, 1983). In addition, based on prior research (Ozcelik and Barsade, 2018; Zhang et al., 2021), we also controlled organizational tenure, educational level, and position in the organization. Gender was dummy coded: 0 stands for male and 1 stands for female. Age and organizational tenure were self-reported in years. Educational level was measured in the range of 1–5, representing middle school or below, high school, college, university, and postgraduate, respectively; position in the organization was measured in four categories from 1 to 4, indicating employees, junior manager, middle manager, and senior manager, separately.

## Results

The Harman’s one-factor test was employed to examine the common method bias. The single factor explained 28.21% of the variance, which is lower than 40%, implying that the common method bias is not significant in this study. Both dimensions of workplace loneliness and extraversion were modeled using parcel scores. Each includes two of the original items, except for one item of emotional deprivation and one item of social companionship, which were treated as an independent score so as to restrict the number of indicators owing to limited responses (Little et al., 2002; Matsunaga, 2008).

## Confirmatory factor analysis (CFA)

To evaluate the discriminant validity among variables included in the study, a series of CFAs was conducted before examining the hypotheses, as shown in Table 1. Our hypothesized five-factor model, including perceived organizational support, two dimensions of workplace loneliness (emotional deprivation and social companionship), extraversion, and job performance, was found to adequately fit the data: ( $\chi^2/df=2.39$ , RMSEA = 0.065, IFI = 0.916, TLI = 0.903, CFI = 0.915). Moreover, the five-factor model was also found to fit the data significantly better than other alternative models.

## Hypotheses testing

The means, standard deviations, and correlations among all variables are shown in Table 2.

Hypothesis 1 predicted that perceived organizational support would be negatively related to workplace loneliness. Results in Table 2 confirmed the negative linkage between perceived organizational support and workplace loneliness ( $r=-0.551$ ,  $p<0.01$ ); thus, hypothesis 1 was supported. The hierarchical regressions and bootstrapping analyses were then conducted to test other hypotheses (Baron and Kenny, 1986). The result of the hierarchical regressions is shown in Table 3.

Hypothesis 2 predicted workplace loneliness would mediate the relationship between perceived organizational support and job performance. As indicated in Table 3, perceived organizational support was positively associated with job performance ( $r=0.39$ ,  $p<0.01$ ), and the linkage between them was still significant ( $r=0.25$ ,  $p<0.01$ ) when workplace loneliness entered the model, indicating that workplace loneliness partly mediated the positive bonds between perceived organizational support and job performance. Bootstrapping analyses in PROCESS (Hayes, 2013), generating 5,000 samples, were then conducted to further test the hypothesis concerning the mediating role of workplace loneliness. Once again, Hypothesis 2 was confirmed, as the indirect effect of perceived organizational support on job performance *via* workplace loneliness was 0.123 (SD = 0.046),  $p<0.01$ , and BC 95% CI = [0.029, 0.214] did not include zero.

In hypothesis 3, we predicted extraversion would moderate the linkage between workplace loneliness and job performance. As shown in Table 3, there was a significantly negative influence of the interaction between workplace loneliness and extraversion on job performance ( $r=-0.18$ ,  $p<0.01$ ). Following Aiken et al. (1991), we explicated the interaction, as shown in Figure 2. This revealed that for participants high in extraversion, workplace loneliness was negatively related to job performance ( $r=-0.443$ ,  $p<0.01$ ), while for participants low on extraversion, workplace loneliness was also negatively related to job performance ( $r=-0.173$ ,  $p<0.01$ ), confirming the moderating role of extraversion. Hypothesis 3 was thus supported.

The bootstrapping analyses using Model 14 in PROCESS (Hayes, 2013), generating 5,000 samples, were conducted to examine hypothesis 4 concerning the moderated-mediation model. The results in Table 4 indicate a significant moderated mediation effect (the contrast = 0.118, SE = 0.043, BC 95% CI = [0.028, 0.201], did not include zero). In particular, for individuals low on extraversion, the mediation effect of workplace loneliness in linking perceived organizational support and job performance was not significant (indirect effect = 0.076, SE = 0.043, BC 95% CI = [-0.009, 0.160], included zero); while, for individuals high in extraversion, the indirect effect of perceived organizational support on job performance *via* workplace loneliness was significant (indirect effect = 0.195, SE = 0.058, BC 95% CI = [0.082, 0.307], did not include zero). Thus, Hypothesis 4 was supported, as the mediating effect of workplace loneliness linking perceived organizational support to job performance varies for participants high or low on extraversion.

## Supplementary analyses

To further examine the mediating role of two dimensions of workplace loneliness in the relationship between perceived organizational support and job performance, the bootstrapping analyses employing M4 in PROCESS (Hayes, 2013) were conducted, generating 5,000 samples, and both emotional deprivation and social

TABLE 1 Comparison of alternative models.

Models	Factors	$\chi^2/df$	$\Delta\chi^2$	RMSEA	IFI	TLI	CFI
1	Five factors: POS, ED, SC, EX, JP	2.39		0.065	0.916	0.903	0.915
2	Four factors: POS, ED+ SC, EX, JP	2.86	134.66**	0.075	0.885	0.870	0.884
3	Three factors: POS, ED+ SC, EX+ JP	3.96	440.18**	0.095	0.815	0.793	0.814
4	Two factors: POS+ ED+ SC, EX+JP	5.48	861.85**	0.116	0.718	0.687	0.717
5	One factor: POS+ ED+ SC+ EX+JP	6.37	1109.47**	0.127	0.661	0.626	0.659

\*\* $p < 0.01$ . POS, perceived organizational support; ED, emotional deprivation; SC, social companionship; EX, extraversion; JP, job performance.

TABLE 2 Means, standard deviations, and correlations among all variables.

Variables	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	0.62	0.49								
2. Age	30.76	5.30	−0.075							
3. Tenure	5.02	3.84	−0.120*	0.636**						
4. Education	4.05	0.75	−0.112*	0.024	0.048					
5. Position	1.65	0.86	−0.178**	0.308**	0.374**	0.148**				
6. POS	3.76	0.62	−0.030	0.026	0.145**	−0.072	0.199**			
7. WL	2.01	0.51	0.050	−0.053	−0.162**	−0.055	−0.119*	−0.551**		
8. EX	3.44	0.57	−0.175**	0.052	0.170**	0.035	0.234**	0.376**	−0.345**	
9. JP	4.23	0.54	−0.035	0.090	0.256**	0.048	0.135*	0.446**	−0.459**	0.299**

$N = 332$ , \*\* $p < 0.01$ , \* $p < 0.05$ . POS, perceived organizational support; WL, workplace loneliness; EX, extraversion; JP, job performance.

companionship were included as mediators. Results indicate that the indirect influence of perceived organizational support and job performance *via* emotional deprivation was not significant (indirect influence = 0.030, SE = 0.030, BC 95% CI = [−0.029, 0.093], included zero), while the indirect influence of perceived organizational support on job performance *via* social companionship was significant (indirect influence = 0.100, SE = 0.049, BC 95% CI = [0.004, 0.199]).

Considering social companionship, but not emotional deprivation, serves as a mediator in the association between perceived organizational support and job performance, we only examined the moderating role of extraversion in the relationship between social companionship and job performance and in the indirect influence of perceived organizational support on job performance *via* social companionship. As indicated in Model 9 of Table 5, the interaction between social companionship and extraversion had a significantly negative influence on job performance, which provided support for the moderating role of extraversion. Then, the bootstrapping analyses using Model 14 in PROCESS (Hayes, 2013), generating 5,000 samples, were conducted to examine the moderating role of extraversion in the mediating role of social companionship linking perceived organizational support to job performance, as shown in Table 6. It revealed a significant moderated mediation effect (the contrast = 0.127, SE = 0.048, BC 95% CI = [0.023, 0.211], did not include zero). Particularly, for individuals with low extraversion, the indirect influence of perceived organizational support on job performance *via*

social companionship was not significant (indirect effect = 0.079, SE = 0.046, BC 95% CI = [−0.014, 0.167], included zero); while, for individuals with high extraversion, the mediating role of social companionship relating perceived organizational support to job performance was significant indirect effect = 0.206, SE = 0.065, BC 95% CI = [0.073, 0.326], which is in accordance with the data in Table 6; other than indirect effect = 0.206, SE = 0.048, BC 95% CI = [0.023, 0.211].

## Discussion

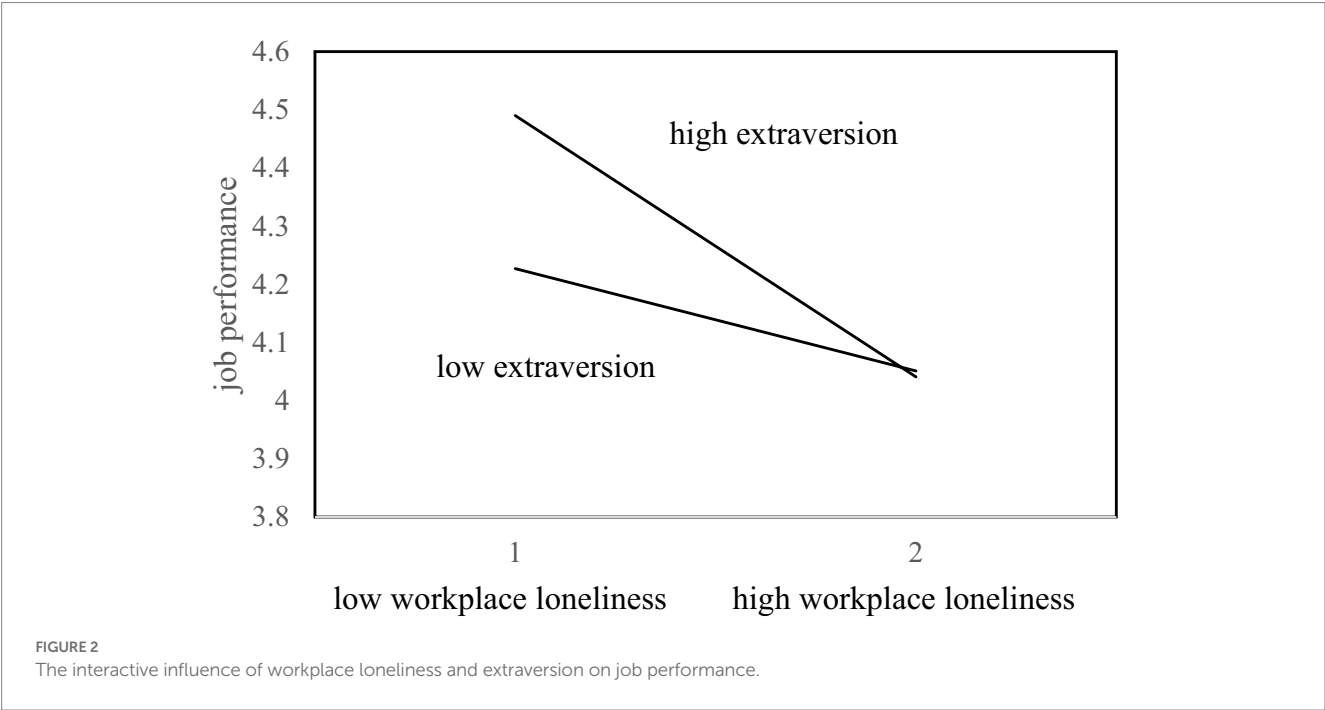
The present research examined the influence of perceived organizational support on workplace loneliness. Previous research has established the influence of interactions with others on one's perception of loneliness in the workplace (Öge et al., 2018; Arslan et al., 2020; Kloutsiniotis et al., 2022). However, our study is among the first to examine the influence of perceived organizational support on loneliness, highlighting how connection with the organization contributes to the satisfaction of employees' need for belonging. Moreover, we investigate the mediating role of workplace loneliness in the relationship between perceived organizational support and job performance. Supporting our arguments, perceived organizational support was negatively linked to workplace loneliness, thus leading to better job performance. The finding contributes to better



TABLE 3 Results of hierarchy regressions.

Variables	Job performance					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender	0.01	0.00	0.01	0.01	0.03	0.02
Age	−0.15*	−0.08	−0.07	−0.10	−0.08	−0.08
Tenure	0.41**	0.31**	0.27**	0.30**	0.28**	0.28**
Education	0.01	0.05	0.03	0.00	0.00	0.00
Position	0.04	−0.03	−0.02	0.02	0.00	0.01
Perceived organizational support		0.39**	0.25**			
Workplace loneliness			−0.26**	−0.39**	−0.36**	−0.39**
Extraversion					0.12*	0.16**
Workplace loneliness *Extraversion						−0.18**
R <sup>2</sup>	0.13	0.27	0.32	0.27	0.28	0.31
ΔR <sup>2</sup>	0.13	0.14	0.05	0.14	0.01	0.03
ΔF	9.64**	62.16**	21.76**	64.37**	5.27*	13.88**

N = 332; \*\* $p < 0.01$ , \* $p < 0.05$ .



understanding on the underlying mechanism through which perceived organizational support influences job performance. The present research also indicates extraversion functions as an important personal trait that affects employees' response to poor social ties in the workplace, such that the negative relationship between workplace loneliness and job performance was stronger for those higher on extraversion. Moreover, extraversion also moderates the mediating role of workplace loneliness linking perceived organizational support to job performance. Specifically, the indirect influence of perceived organizational support on job performance *via* workplace loneliness was only true of extravertive workers; meanwhile,

this relationship was not significant for introvertive employees. Supplementary analyses also indicated that extraversion enhanced the negative relationship between social companionship and job performance, as well as the mediating role of social companionship relating perceived organizational support to job performance.

### Theoretical contributions

The findings of the present research make significant contributions to the literature on workplace loneliness and its antecedents and

**TABLE 4 Results of moderated mediating role of extraversion in the indirect influence of perceived organizational support on job performance via workplace loneliness.**

Variables	Effect	Standard error	95% confidence interval
Low extraversion	0.076	0.043	[−0.009, 0.160]
High extraversion	0.195	0.058	[0.082, 0.307]
Difference	0.118	0.043	[0.028, 0.201]

**TABLE 5 Results of hierarchy regressions on the moderating role of extraversion in the relationship between social companionship and job performance.**

Variables	Job performance			
	Model 1	Model 7	Model 8	Model 9
Gender	0.01	0.02	0.03	0.03
Age	−0.15*	−0.08	−0.07	−0.06
Tenure	0.41**	0.27**	0.25**	0.24**
Education	0.01	0.00	0.00	0.00
Position	0.04	0.00	0.00	−0.02
Social companionship		−0.40**	−0.37**	−0.41**
Extraversion			0.11*	0.16**
Social companionship *Extraversion				−0.19**
R <sup>2</sup>	0.13	0.27	0.28	0.31
ΔR <sup>2</sup>	0.13	0.14	0.01	0.03
ΔF	9.64**	63.55**	4.20*	14.08**

**TABLE 6 Results of moderating role of extraversion in the indirect influence of perceived organizational support on job performance via social companionship.**

Variables	Effect	Standard error	95% confidence interval
Low extraversion	0.079	0.046	[−0.014, 0.167]
High extraversion	0.206	0.065	[0.073, 0.326]
Difference	0.127	0.048	[0.023, 0.211]

outcomes. First, our findings extend nascent literature on the antecedents of workplace loneliness, by examining how employees' connection to the organization (referring to perceived organizational support) functions as significant ways to satisfy employees' need for affiliation. Drawing from the COR theory, human resource co-exist in ecological systems that they would influence each other (Hobfoll, 2011). As shown in this paper, individuals' interactions with the organization contribute to their need for close social contacts, which is in accordance with the work of Wayne et al. (2002), claiming that perceived organizational support is positively related to leader-member exchange. This finding provides additional support for the tenets of COR theory, and contributes to a new view for exploring the antecedents of workplace loneliness.

Second, the results indicated that workplace loneliness is an intervening mechanism linking perceived organizational support to job performance. To be more specific, social companionship functions as a mediator in the relationship between perceived organizational support and job performance, while the mediating role of emotional deprivation is not significant. Although Chiang and Hsieh (2012) have noted that perceived organizational support is positively linked to job performance, while, the work of Ozelik and Barsade (2018) has indicated that workplace loneliness impedes job performance. In the present study, we confirmed that workplace serves as a mediator bridging perceived organizational support and job performance. In other words, perceived organizational support contributes to the satisfaction of individuals' basic need for belonging, thus leading to better job performance. This is consistent with prior empirical studies that drew on the COR theory to investigate the mediating role of workplace loneliness relating transformational leadership to burnout (Kloutsiniotis et al., 2022). This conclusion supplements the evidence of a mediated mechanism relating perceived organizational support to performance and contributes to the expansion of COR theory application to the literature on workplace loneliness.

Thirdly, we examined the moderating role of extraversion in the relationship between workplace loneliness and job performance, and in the mediating role of workplace loneliness linking perceived organizational support and job performance. Although Mishra et al. (2018) found that the positive association between loneliness and depression was stronger for students with high extraversion than for those with low extraversion, scant attention has been paid to the moderating effect of extraversion in the influence of workplace loneliness on individuals in organizational psychology (Mishra et al., 2018; Ozelik and Barsade, 2018). In response to this call, we focused on the moderating role of extraversion in the relationship between workplace loneliness and job performance. More importantly, extraversion also serves as a moderator in the indirect influence of perceived organizational support on job performance via meaningfulness. It seems to be because extraverted individuals had a higher need for belonging and more enjoy intimate interpersonal interactions, and they would be more anxious and more likely to employ avoidant emotional or behavioral coping strategies when suffering from insufficient social contact in the work context (Hogan, 1982; Depue and Collins, 1999). This finding is consistent with the emerging literature on the moderating role of personal traits in the influence of poor interpersonal relationships on individuals and enterprises (e.g., Mohapatra et al., 2020; Andel et al., 2021; Hu et al., 2021). Inferring from the SCT, not all individuals are equally influenced by the same emotional experiences (Bandura, 1991; Bandura, 2001). This finding provides additional evidence on SCT and extends its application to literature on workplace loneliness, indicating that personal traits function as moderators in the influence of emotional experiences (Bandura, 1991; Bandura, 2001). The present research is among the first to investigate the moderated mediation mechanism between perceived organizational support and job performance.

## Practical implications

The results of this study revealed that perceived organizational support is negatively related to one's perceptions of loneliness in the workplace. In this vein, enterprises are recommended to enhance

employees' perceptions of being valued or cared for by their organization, such as by providing some rewards for employees' organizational citizenship behaviors or other extra-role behaviors, and offering more training opportunities or implementation of flexible work schedules (Eisenberger et al., 1997; Chiang and Hsieh, 2012; Tian et al., 2021), to reduce their perceptions of loneliness in the workplace.

Enterprises will gain additional benefits from decreasing employees' perceptions of workplace loneliness. Supervisors can organize social and networking activities to cultivate a harmonious, interactive, corporate culture to reduce employees' feeling of loneliness, so as to enhance the positive association between perceived organizational support and job performance (Hu et al., 2021).

In addition, the results indicate that extraverts and introverts respond differently to workplace loneliness, such that the indirect influence of perceived organizational support on job performance *via* workplace loneliness is more prevalent for extraverted employees. Thus, enterprises and managers should be aware of the moderating effect of extraversion and take it into consideration in managerial practices (Mishra et al., 2018). Much attention should be paid to alleviating extraverts' perceptions of workplace loneliness, given its stronger mediating effect in relating perceived organizational support to job performance.

## Limitations and future research

There are some limitations of the present study that need to be further examined in future research. First, although a two-wave survey was employed and the results of Harman's one-factor test and CFA indicated that the common method bias was not significant in this study, it remains a limitation because of the same source of data. Future studies are recommended to invite leaders to evaluate employees' job performance or employ archival data of performance, so as to minimize the influence of the common method variance.

Second, as subjective feelings, both perceived organizational support and workplace loneliness are dynamic processes. In this study, both of them are measured at a given time, which may have some influence on the reliability of the findings. Therefore, experimental or longitudinal designs can be employed to examine whether the fluctuation or duration of perceived organizational support and workplace loneliness makes a difference, which could further support the results of this study (Shadish et al., 2002; Holgado-Tello et al., 2016).

Third, there may be other variables that influence employees' perceptions of loneliness in the workplace which were not included in the present research, such as approachableness (Ozcelik and Barsade, 2018), work at home, working hours, and work independently or interdependently (Zhang and Chen, 2022). Future studies are recommended to control these variables when investigating the mediating role of workplace loneliness relating personal or organizational resources to performance.

Finally, we only examined the moderating role of extraversion in the relationship between workplace loneliness and job performance and in the indirect influence of perceived organizational support on job performance *via* workplace loneliness. Conscientiousness may also function as a moderator in such relationship. As conscientious employees are more self-disciplined, obedient (Barrick and Mount,

1991), and better able to control their behaviors when suffering from negative emotions, thus they were less scratched by poor social ties in the workplace. In addition, self-construal may also make a difference in the relationship among perceived organizational support, workplace loneliness, and job performance, since individuals with interdependent self-construal tend to attach more importance to harmonious interpersonal relationship and are more affected by social rejection than those with independent self-construal (Markus and Kitayama, 1991). Future studies are recommended to examine whether conscientiousness, self-construal or other personal traits would serve as moderators in the relationship among perceived organizational support, workplace loneliness, and job performance.

## Conclusion

The present study contributes to better understandings of the moderated-mediation mechanism between perceived organizational support, workplace loneliness, extraversion, and job performance. It is indicated that workplace loneliness partially mediates the association between perceived organizational support and job performance, and extraversion serves as a moderator in such relationships. In particular, the indirect influence of perceived organizational support on job performance *via* workplace loneliness was stronger for individuals high in extraversion. Supplementary analyses revealed that two dimensions of workplace loneliness, social companionship, but not emotional deprivation, mediates the relationship between perceived organizational support and job performance; extraversion enhanced the relationship between social companionship and job performance, as well as the indirect effect of perceived organizational support on job performance *via* social companionship.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

This study was approved by the Ethics Committee on Human Experimentation of Xi'an University of Finance and Economics adhering to the Declaration of Helsinki. In the first-wave questionnaire, we introduced the research purposes and explained that this study welcomed voluntary participation and the data would only be used for research purposes. Informed consent was obtained from all participants included in the study before response to the questionnaire.

## Author contributions

GT designed the study, collected the data, and wrote the manuscript under the guidance of TL. TL contributed to data analysis and revision of the manuscript. RY contributed to the research design and revisions. All authors agreed on the journal to which the article

will be submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

- Abelsen, S. N., Vatne, S.-H., Mikalef, P., and Choudrie, J. (2021). Digital working during the COVID-19 pandemic: how task-technology fit improves work performance and lessens feelings of loneliness. *Inf. Technol. People*, ahead-of-print. doi: 10.1108/ITP-12-2020-0870
- Aiken, L. S., West, S. G., and Reno, R. R. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, Thousand Oaks, CA: Sage Publications Inc.
- Anand, P., and Mishra, S. K. (2021). Linking core self-evaluation and emotional exhaustion with workplace loneliness: does high LMX make the consequence worse? *Int. J. Hum. Resour. Manag.* 32, 2124–2149. doi: 10.1080/09585192.2019.1570308
- Andel, S. A., Shen, W., and Arvan, M. L. (2021). Depending on your own kindness: the moderating role of self-compassion on the within-person consequences of work loneliness during the COVID-19 pandemic. *J. Occup. Health Psychol.* 26, 276–290. doi: 10.1037/ocp0000271
- Arslan, A., Yener, S., and Schermer, J. A. (2020). Predicting workplace loneliness in the nursing profession. *J. Nurs. Manag.* 28, 710–717. doi: 10.1111/jonm.12987
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organ. Behav. Hum. Decis. Process.* 50, 248–287. doi: 10.1016/0749-5978(91)90022-L
- Bandura, A. (2001). Social cognitive theory: an agentic perspective. *Annu. Rev. Psychol.* 52, 1–26. doi: 10.1146/annurev.psych.52.1.1
- Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173
- Barrick, M. R., and Mount, M. K. (1991). The Big Five personality dimensions and job performance: a meta-analysis. *Pers. Psychol.* 44, 1–26. doi: 10.1111/j.1744-6570.1991.tb00688.x
- Basit, A. A., and Nauman, S. (2023). How workplace loneliness harms employee well-being: a moderated mediational model. *Front. Psychol.* 13:1086346. doi: 10.3389/fpsyg.2022.1086346
- Beck, A. T., Epstein, N., and Harrison, R. (1983). Cognitions, attitudes, and personality dimensions in depression. *Br. J. Cogn. Psychother.* 1, 1–16.
- Benet-Martínez, V., and John, O. P. (1998). Los cinco grandes across cultures and ethnic groups: multitrait multimethod analyses of the big five in Spanish and English. *J. Pers. Soc. Psychol.* 75, 729–750. doi: 10.1037/0022-3514.75.3.729
- Brislin, R. W. (1980). “Translation and content analysis of oral and Peng written material” in *Handbook of Cross-Cultural Psychology*. eds. H. C. Triandis and J. W. Berry (Boston: Allyn & Bacon)
- Chiang, C. F., and Hsieh, T. S. (2012). The impacts of perceived organizational support and psychological empowerment on job performance: the mediating effects of organizational citizenship behavior. *Int. J. Hosp. Manag.* 31, 180–190. doi: 10.1016/j.ijhm.2011.04.011
- Depue, R. A., and Collins, P. F. (1999). Neurobiology of the structure of personality: dopamine, facilitation of incentive motivation, and extraversion. *Behav. Brain Sci.* 22, 491–517. doi: 10.1017/S0140525X99002046
- Eisenberger, R., Cummings, J., Armeli, S., and Lynch, P. (1997). Perceived organizational support, discretionary treatment, and job satisfaction. *J. Appl. Psychol.* 82, 812–820. doi: 10.1037/0021-9010.82.5.812
- Eisenberger, R., Huntington, R., Hutchinson, S., and Sowa, D. (1986). Perceived organizational support. *J. Appl. Psychol.* 71, 500–507. doi: 10.1037/0021-9010.71.3.500
- Firoz, M., and Chaudhary, R. (2021). The impact of workplace loneliness on employee outcomes: what role does psychological capital play? *Pers. Rev.*, ahead of print 51, 1221–1247. doi: 10.1108/PR-03-2020-0200
- Gillet, N., Colombar, P., Michinov, E., Pronost, A.-M., and Fouquereau, E. (2013). Procedural justice, supervisor autonomy support, work satisfaction, organizational identification and job performance: the mediating role of need satisfaction and perceived organizational support. *J. Adv. Nurs.* 69, 2560–2571. doi: 10.1111/jan.12144
- Greenbaum, R. L., Mawritz, M. B., and Eissa, G. (2012). Bottom-line mentality as an antecedent of social undermining and the moderating roles of core self-evaluations and conscientiousness. *J. Appl. Psychol.* 97, 343–359. doi: 10.1037/a0025217
- Guan, X., and Frenkel, S. (2021). Organizational support and employee thriving at work: exploring the underlying mechanisms. *Pers. Rev.* 50, 935–953. doi: 10.1108/PR-10-2019-0569
- Guan, X., Sun, T., Hou, Y., Zhao, L., Luan, Y. Z., and Fan, L. H. (2014). The relationship between job performance and perceived organizational support in faculty members at Chinese universities: a questionnaire survey. *BMC Med. Educ.* 14:50. doi: 10.1186/1472-6920-14-50
- Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Press.
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. doi: 10.1037/0003-066X.44.3.513
- Hobfoll, S. E. (2011). Conservation of resource caravans and engaged settings. *J. Occup. Organ. Psychol.* 84, 116–122. doi: 10.1111/j.2044-8325.2010.02016.x
- Hobfoll, S. E., Johnson, R. J., Ennis, N., and Jackson, A. P. (2003). Resource loss, resource gain, and emotional outcomes among inner city women. *J. Pers. Soc. Psychol.* 84, 632–643. doi: 10.1037/0022-3514.84.3.632
- Hobfoll, S. E., and Shirom, A. (2001). “Conservation of resources theory: applications to stress and management in the workplace” in *Handbook of Organizational Behavior*. ed. R. T. Golembiewski (New York, NY: Dekker)
- Hogan, R. (1982). A socio analytic theory of personality. *Neb. Symp. Motiv.* 30, 55–89.
- Holgado-Tello, F. P., Chacón-Moscoso, S., Sanduvete-Chaves, S., and Pérez-Gil, J. A. (2016). A Simulation Study of Threats to Validity in Quasi-Experimental Designs: Interrelationship between Design, Measurement, and Analysis. *Frontiers in psychology* 7:897. doi: 10.3389/fpsyg.2016.00897
- Hu, Y., Chen, Y., and Ye, M. (2021). Eager to belong: social cyberloafing as a coping response to workplace ostracism. *Curr. Psychol.*, ahead of print. doi: 10.1007/s12144-020-01029-z
- Janssen, O. (2001). Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction. *Acad. Manag. J.* 44, 1039–1050. doi: 10.2307/3069447
- Karatepe, O. M., and Aga, M. (2016). The effects of organization mission fulfillment and perceived organizational support on job performance: the mediating role of work engagement. *Int. J. Bank Mark.* 34, 368–387. doi: 10.1108/IJBM-12-2014-0171
- Kloutsiniotis, P. V., Mihail, D. M., Mylonas, N., and Pateli, A. (2022). Transformational leadership, HRM practices and burnout during the COVID-19 pandemic: the role of personal stress, anxiety, and workplace loneliness. *Int. J. Hosp. Manag.* 102:103177. doi: 10.1016/j.ijhm.2022.103177
- Kraimer, M. L., Wayne, S. J., and Jaworski, R. A. (2001). Sources of support and expatriate performance: the mediating role of expatriate adjustment. *Pers. Psychol.* 54, 71–99. doi: 10.1111/j.1744-6570.2001.tb00086.x
- Lajoie, D., Rousseau, V., and Boudrias, J. (2022). Leader extraversion as a boundary condition in the relationship between transformational leadership, vitality, and job improvement. *Span. J. Psychol.* 25, 1–13. doi: 10.1017/SJP.2022.8
- Lam, L., and Lau, D. (2012). Feeling lonely at work: investigating the consequences of unsatisfactory workplace relationships. *Int. J. Hum. Resour. Manag.* 23, 4265–4282. doi: 10.1080/09585192.2012.665070
- Little, T. D., Cunningham, W. A., Shahar, G., and Widaman, K. F. (2002). To parcel or not to parcel: exploring the question, weighing the merits. *Struct. Equ. Model.* 9, 151–173. doi: 10.1207/S15328007SEM0902\_1
- Markus, H. R., and Kitayama, S. (1991). Culture and the self: implications for cognition, emotion, and motivation. *Psychol. Rev.* 98, 224–253. doi: 10.1037/0033-295X.98.2.224
- Matsunaga, M. (2008). Item parceling in structural equation modeling: a primer. *Commun. Methods Meas.* 2, 260–293. doi: 10.1080/19312450802458935
- Mishra, S. K., Kodwani, A. D., Kumar, K. K., and Jain, K. K. (2018). Linking loneliness to depression: a dynamic perspective. *BIJ* 25, 2089–2104. doi: 10.1108/BIJ-10-2016-0158
- Mohapatra, M., Madan, P., and Srivastava, S. (2020). Loneliness at work: its consequences and role of moderators. *Glob. Bus. Rev.*, ahead of print:097215091989271. doi: 10.1177/0972150919892714

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- Nazir, S., Shafi, A., Atif, M. M., Qun, W., and Abdullah, S. M. (2019). How organization justice and perceived organizational support facilitate employees' innovative behavior at work. *Empl. Relat.* ahead-of-print, 1288–1311. doi: 10.1108/ER-01-2017-0007
- Öge, E., Çetin, M., and Top, S. (2018). The effects of paternalistic leadership on workplace loneliness, work family conflict and work engagement among air traffic controllers in Turkey. *J. Air Transp. Manag.* 66, 25–35. doi: 10.1016/j.jairtraman.2017.10.003
- Ozcelik, H., and Barsade, S. G. (2018). No employee an island: workplace loneliness and job performance. *Acad. Manag. J.* 61, 2343–2366. doi: 10.5465/amj.2015.1066
- Peng, J., Chen, Y., Xia, Y., and Ran, Y. (2017). Workplace loneliness, leader-member exchange and creativity: the cross-level moderating role of leader compassion. *Personal. Individ. Differ.* 104, 510–515. doi: 10.1016/j.paid.2016.09.020
- Pow, J., Lee-Baggeley, D., and DeLongis, A. (2017). Who is most likely to seek and give support in the face of agentic and communal threat? The roles of extraversion and agreeableness. *J. Res. Pers.* 70, 66–72. doi: 10.1016/j.jrp.2017.04.006
- Rhoades, L., and Eisenberger, R. (2002). Perceived organizational support: a review of the literature. *J. Appl. Psychol.* 87, 698–714. doi: 10.1037/0021-9010.87.4.698
- Rice, L., and Markey, P. M. (2009). The role of extraversion and neuroticism in influencing anxiety following computer-mediated interactions. *Personal. Individ. Differ.* 46, 35–39. doi: 10.1016/j.paid.2008.08.022
- Rubaca, U., and Majid Khan, M. (2020). The impact of perceived organizational support and job resourcefulness on supervisor-rated contextual performance of firefighters: mediating role of job satisfaction. *J. Conting. Crisis Manag.* 29, 281–292. doi: 10.1111/1468-5973.12340
- Schmidt, N., and Sermat, V. (1983). Measuring loneliness in different relationships. *J. Pers. Soc. Psychol.* 44, 1038–1047. doi: 10.1037/0022-3514.44.5.1038
- Schyns, B., Maslyn, J. M., and Veldhoven, M. V. (2012). Can some leaders have a good relationship with many followers? The role of personality in the relationship between leader-member exchange and span of control. *Leadersh. Organ. Dev. J.* 33, 594–606. doi: 10.1108/01437731211253046
- Shadish, W. R., Cook, T. D., and Campbell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston, MA: Houghton, Mifflin and Company.
- Tan, L., Wang, Y., Qian, W., and Lu, H. (2020). Leader humor and employee job crafting: the role of employee-perceived organizational support and work engagement. *Front. Psychol.* 11:499849. doi: 10.3389/fpsyg.2020.499849
- Tian, A. W., Cao, J., and Newman, A. (2021). The curvilinear effects of training participation on job performance through organizational support: the moderating role of entity self-beliefs. *Asia Pac. J. Manag.* ahead of print. doi: 10.1007/s10490-021-09795-5
- Wanberg, C. R., Hoofst, E. A. J., Liu, S., and Csillag, B. (2020). Can job seekers achieve more through networking? The role of networking intensity, self-efficacy, and proximal benefits. *Pers. Psychol.* 73, 559–585. doi: 10.1111/peps.12380
- Wang, D., and Liu, H. (2021). Effects of job autonomy on workplace loneliness among knowledge workers. *Chin. Manag. Stud.* 15, 182–195. doi: 10.1108/CMS-04-2020-0175
- Wax, A., Deutsch, C., Lindner, C., Lindner, S. J., and Hopmeyer, A. (2022). Workplace loneliness: the benefits and detriments of working from home. *Front. Public Health* 10:903975. doi: 10.3389/fpubh.2022.903975
- Wayne, S. J., Shore, L. M., Bommer, W. H., and Tetrick, L. E. (2002). The role of fair treatment and rewards in perceptions of organizational support and leader-member exchange. *J. Appl. Psychol.* 87, 590–598. doi: 10.1037/0021-9010.87.3.590
- Wayne, S. J., Shore, L. M., and Liden, R. C. (1997). Perceived organizational support and leader-member exchange: a social exchange perspective. *Acad. Manag. J.* 40, 82–111. doi: 10.2307/257021
- Wright, S. L., Burt, C. D., and Strongman, K. T. (2006). Loneliness in the workplace: construct definition and scale development. *N. Z. J. Psychol.* 35, 59–68.
- Xu, D., Zhang, N., Bu, X., and He, J. (2022). The effect of perceived organizational support on the work engagement of Chinese nurses during the COVID-19: the mediating role of psychological safety. *Psychol. Health Med.* 27, 481–487. doi: 10.1080/13548506.2021.1946107
- Zhang, P., and Chen, S. (2022). Association between workplace and mental health and its mechanisms during COVID-19 pandemic: a cross-sectional, population-based, multi-country study. *J. Affect. Disord.* 310, 116–122. doi: 10.1016/j.jad.2022.05.038
- Zhang, N., Xu, D., Li, J., and Gong, Z. (2021). Effect of perceived organizational support on fatigue of Chinese nurses during the COVID-19 pandemic: resilience as a mediator. *Int. J. Ment. Health Promot.* 23, 243–254. doi: 10.32604/IJMHP.2021.015487





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# Exploring self-regulation theory as a mechanism of the effects of psychological contract fulfillment: The role of emotional intelligence

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As self-regulation theory has increasingly been used as a theoretical lens to explain the effects of psychological contract evaluations and employee outcomes, we test whether emotional intelligence (an ability for self-regulation) is a potential moderator of these relationships. More concretely, using a multiple times survey design in an education-based organization with 247 participants, we examined whether emotional intelligence moderates the mediation effect of emotional exhaustion on the relationship between psychological contract fulfillment and turnover intentions. Using a structural equations model (SEM) framework, our results support our hypotheses that individuals with low emotional intelligence do not experience the benefits of having fulfilled psychological contracts. Psychological contract fulfillment significantly reduces the likelihood of emotional exhaustion but only for individuals with high emotional intelligence. Consequently, turnover intentions are lower for emotionally intelligent individuals who experience the fulfillment of psychological contracts. Theoretical and practical implications are discussed. We conclude our study by suggesting that emotional intelligence should be considered as a relevant individual difference in future psychological contract research.

## KEYWORDS

psychological contract fulfillment, emotional intelligence, self-regulation, emotional exhaustion, turnover intention, structural equation modeling

## 1. Introduction

Decades of research on psychological contracts (PC) have shown that perceptions of positive employee-employer exchanges produce positive outcomes for organizations and individuals (Zhao et al., 2007; Rousseau, 2011). At the individual level, a central mechanism of these effects is based on self-regulation theory which posits that individuals constantly try to reach individual goals which are evaluated against real experiences. When reality does not conduce individuals to personal goals, a discrepancy is created, and an appropriate response is enacted in order to reduce the experienced discrepancy. Perceptions of discrepancies between the PC and the actual employment experience that are nonconductive to personal goals generate negative emotional responses that in turn activate reparation, renegotiation, or even exit responses (Rousseau et al., 2018). In contrast, positive perceptions of PC fulfillment activate regulatory processes that facilitate positive individual outcomes (i.e., individual behaviors, attitudes, and psychological states). A basic assumption of this theory of self-regulation and psychological contracts is the idea that individuals are indeed able to regulate themselves when high or low fulfillment is

experienced. But, does this mechanism operates for all individuals? Does psychological contract fulfillment produce positive effects even on individuals with low regulatory capacities?

In this paper, we test the boundary conditions of self-regulation approaches to the study of psychological contracts by suggesting that some individuals may not be able to exert this regulatory mechanism. In particular, we propose that the model of self-regulation is reasonable for individuals who are able to identify, regulate, and use their emotions (i.e., emotional intelligence) but not necessarily for individuals who have not developed this ability. That is, PC fulfillment should not produce the expected positive effects on individuals with low emotional intelligence. Thus, we test the moderation effect of emotional intelligence on the relationship between PC fulfillment and individual outcomes. More specifically, our model test whether emotional intelligence moderates the mediation effect of PC fulfillment, emotional exhaustion, and turnover intention (Figure 1).

With this model, we attempt to make at least two theoretical contributions. First, we test the role of a potentially important (but so far unexplored) individual difference in the PC literature, recognizing the central role of emotion regulation in this phenomenon. Second, we test how emotional intelligence can alter the mediation of PC evaluations, emotional experiences, and behavioral intentions. Thus, we expand the boundary conditions of self-regulation perspectives in the PC literature.

In the following pages, we develop a theory that supports our model, and later we present a study of 247 individuals who responded to electronic surveys using a multiple-times design in an education-based organization. We finally discuss theoretical and managerial implications.

## 2. Theory development

### 2.1. PC theory and self-regulation

PC fulfillment is defined as the “employees’ global perceptions that, overall, the organization has fulfilled its terms of the contract in an equitable manner” (Henderson et al., 2008, p. 1,209). Social exchange theory has been the main theoretical base to explain the effects of PC fulfillment at the relational level (Blau, 1964). As individuals experience positive organizational inducements, they are motivated to continue the development of mutually beneficial relationships by reciprocating the organization (i.e., the exchange

counterpart) with positive behaviors. At the individual level, however, self-regulation theory has risen recently as a more fine-tuned theory that explains the dynamics of psychological contracts (Rousseau et al., 2018). Self-regulation theory explains human behavior based on the idea of a feedback loop, where individuals monitor the achievement of personal goals, experience emotions caused by their lived experiences, and modify cognitions and behavior toward goal attainment (Lord et al., 2010).

When employment promises are fulfilled, more propitious conditions are perceived by employees, helping them reach valued personal goals, and experience positive feelings about the employment relationship and the convenience of continuing social exchanges in the future (Castanias and Helfat, 1991; Conway and Briner, 2002). The positive affect caused by PC fulfillment and perceptions of goal conduciveness have implications for the perception of exchange relationships as well (Forgas and George, 2001; Isen, 2001). Similarly, emotions play a significant role in the perceptions of fulfillment. PC fulfillment does not only create positive emotions, but it is more likely to be perceived where discrepancies do not generate negative emotions (Kiefer et al., 2022), suggesting that PC fulfillment involves both perceptions and emotions (Conway and Briner, 2002; Rousseau, 2011). Because of the important mediating role of affect in PC theory, a logical extension of these conclusions is that experiences of PC fulfillment should prevent individuals from experiencing negative emotions and exit cognitions, a result that has received meta-analytic support (e.g., Zhao et al., 2007). As Figure 1 suggests, we expect PC fulfillment to be related to turnover intention through the effects of emotional exhaustion, and we developed those relationships in the following paragraphs.

In longer periods of time, PC fulfillment should prevent individuals from having negative work experiences. For instance, previous research has shown that PC fulfillment was negatively related to emotional exhaustion (Gakovic and Tetrick, 2003; Abdalla et al., 2021), defined as the “feelings of being emotionally overextended and depleted of one’s emotional resources” (Maslach and Goldberg, 1998, p. 64). Emotional exhaustion is a phenomenon that occurs after the depletion, over time, of personal psychological resources. We expect to observe that PC fulfillment deters the occurrence of emotional exhaustion because (i) PC fulfillment injects socio-emotional resources into individuals through the effects of goal attainment and (ii) PC fulfillment reduces the need for individuals to focus on creating strategies to reduce discrepancies and obtain valued goals. To support this point, previous PC research has shown that low past PC fulfillment

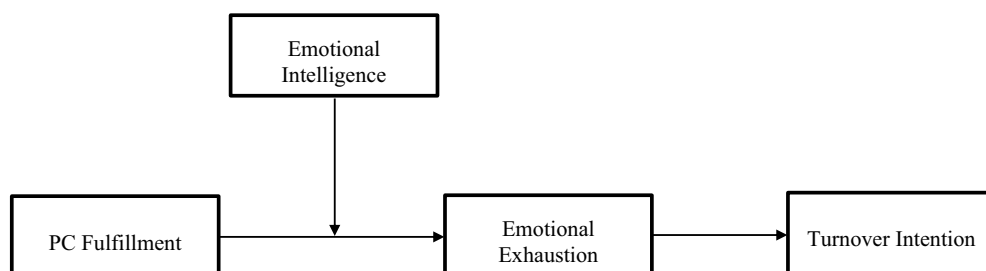


FIGURE 1  
Theoretical model.

experiences alter present PC fulfillment (Robinson et al., 1994; Coyle-Shapiro and Kessler, 2002), buffering the effects on important outcomes such as burnout (Zhong et al., 2021).

## 2.2. The moderating role of emotional intelligence

In this article, we argue that the expected effects of self-regulation in PC theory are less likely to occur for individuals who are less capable of identifying and using the additional resources that PC fulfillment brings about. In particular, we study the moderating effect of emotional intelligence on the relationship between PC fulfillment and emotional exhaustion. Although PC research has already acknowledged the role of individual differences before (e.g., Kickul and Lester, 2001; Coyle-Shapiro and Neuman, 2004; Raja et al., 2004; Hermida and Luchman, 2013), emotional intelligence has been rarely studied as a theoretically relevant moderator.

We understand emotional intelligence (EI) as “the ability to carry out accurate reasoning about emotions and the ability to use emotions and emotional knowledge to enhance thought (Mayer et al., 2008).<sup>1</sup> EI is a between-person individual difference that has been conceptualized as a multi-dimensional ability including the ability to evaluate own emotions, evaluate the emotions of others, regulate own emotions, and use emotions for goal achievement (Mayer et al., 2016). Because of these abilities, an individual’s EI has been positively associated with work performance (Joseph and Newman, 2010; O’Boyle et al., 2011) and other work criteria such as acute stress, leadership emergence, or negotiation value created (e.g., Elfenbein et al., 2007; Côté et al., 2010; Kotsou et al., 2019; Lea et al., 2019).

Moreover, EI has been a significant mechanism of self-regulation theories. It is well-established that emotional intelligence has a positive effect on emotion regulation (e.g., Laborde et al., 2014; Thomas and Zolkoski, 2020), with documented direct effects on emotional exhaustion as high IE individuals are more likely to exert higher efforts on goal striving processes, injecting positive feelings through goal achievement (e.g., Moon and Hur, 2011; Tziner et al., 2020). In addition to the direct effects of EI, individuals are also likely to interact differently with job-specific situations and contextual factors. This distinct theoretical mechanism of the effects of emotional intelligence has been dubbed the “moderation model” by EI scholars (Côté, 2014; Pradhan and Jena, 2018).

We propose that individuals with high rates of EI have a higher capacity for self-regulation that allows them to interact more positively in exchanges with the organization. First, because of their capacity to regulate their own emotions, a high EI makes individuals less vulnerable to negative disruptions, recovering faster from PC breaches. PC research suggests individuals with low self-control are more likely to be affected by PC breaches (Bal et al., 2011; Restubog et al., 2015; Balogun et al., 2018). Considering that breach is more the norm than the exception in many organizations (Robinson and Rousseau, 1994), high EI individuals are less likely to be affected by small breaches of the PC. That is, high EI may use less time in the

repair phase of the PC dynamics (Rousseau et al., 2018). On the other side, the level of reactivity of negative events in individuals with low EI is high (Bechtoldt and Schneider, 2016). Lanciano et al. (2012) found that individuals that scored low EI ruminated less about previous stressful experiences.

Second, it is expected that high EI individuals can use the socio-cognitive resources injected by high PC fulfillment in helping them to better regulate their unpleasant feelings in other domains of the working experience and the consequent effect outside the workplace. In addition, high EI individuals are more aware of unpleasant feelings caused by low PC fulfillment, valuing the fulfillment of employment promises, and creating relief in emotional demands when fulfillment occurs. Previous research has shown that individuals with high EI exert increased attention to positive emotions (Szczygieł and Mikolajczak, 2017; Lea et al., 2019). In contrast, individuals with low EI have more difficulties creating strategies for self-regulation and are less likely to perceive PC fulfillment as a relevant factor that determines goal conduciveness. The burden of emphasizing negative feelings in life events and the need to constantly ruminate about strategies to reach personal goals should affect their levels of emotional exhaustion regardless of the perceptions of the fulfillment of the PC.

These arguments are consistent with a moderation effect of emotional intelligence in the negative relationship between PC fulfillment and emotional exhaustion. The PC fulfillment-emotional exhaustion relationship is expected to be observed for individuals with high EI, but not for individuals with low EI (no significant relationship; a neutralization effect). Thus, we hypothesize:

*Hypothesis 1:* Emotional intelligence moderates the negative relationship between psychological contract fulfillment and emotional exhaustion, such that the effect is stronger for individuals with high emotional intelligence.

Previous research has provided evidence for a significant relationship between emotional exhaustion and turnover cognitions and behaviors (e.g., Boles et al., 1997; Wright and Cropanzano, 1998; Karatepe and Uludag, 2007; Gao et al., 2020). Emotional exhaustion is a personal experience of energy depletion which in many cases is solved by exiting the situation that provokes that state. At the same time, the PC literature has long sustained the mediating effect of emotional experiences in the relationship between PC evaluations (breach/fulfillment) and turnover intentions. For example, in an SEM meta-analysis, Zhao et al. (2007) showed that a model with emotions as a mediator had the best fit with the data when explaining how PC evaluations impact employee outcomes, such as turnover intentions. The dynamic model of PC processes also conceptualized negative affect as an important mediator of PC evaluations and exit behaviors [See Figure 5 in Rousseau et al. (2018)]. Basically, individuals who experience negative PC evaluations are more likely to search for different employment or occupational options in order to achieve self-set goals, taking emotion as key information to create appropriate behavioral responses (Kiefer and Antoni, 2019). These relationships suggest a mediation effect where PC fulfillment predicts turnover intentions through the effects of emotional exhaustion.

This mediation effect, however, is likely to be affected by the emotional abilities of individuals. As suggested in hypothesis 1, we expect to observe high levels of emotional exhaustion for

<sup>1</sup> We take this definition in contrast to other trait-based models (Petrides and Furnham, 2003; Petrides, 2011).

individuals with low EI in general, regardless of their perceptions of PC fulfillment. Thus, the mediation effect of PC fulfillment, emotional exhaustion, and turnover intentions is expected to occur for individuals high in EI, but not necessarily for individuals low in EI.

*Hypothesis 2:* The mediating role of emotional exhaustion in the relationship between psychological contract fulfillment and turnover intention is moderated by employee emotional intelligence, with the effect being more substantial for individuals with high emotional intelligence.

### 3. Materials and methods

#### 3.1. Data collection

To test our hypotheses, we collected quantitative data as part of a larger study about psychological contracts in teams. Participants were recruited from 8 educational institutions and one administrative department of a well-known municipality in Chile. We received support to conduct this study from the municipality as part of a series of organizational initiatives to improve HR management practices. The data was obtained using two-wave self-administered web-based surveys, which were separated by a lag time of 2 months between each survey. This was intended to reduce the potential of common method variance (Podsakoff et al., 2003). In the first survey, we collected PC fulfillment and emotional intelligence, whereas, in the second survey, we collected data about emotional exhaustion and turnover intentions. The data was matched by the research team using employee IDs, following recommendations of our Institutional Ethics Committee to protect participants' confidentiality.

The HR department provided the updated personnel records of the organization, including emails from 247 employees. Both surveys were distributed to their email addresses through Qualtrics' mailing tool. The sample size was 181 responses for the first survey and 176 responses for the follow-up survey. In sum, the sample consisted of 150 matched responses, including employees who answered both surveys. The final sample only included subjects who successfully completed the two surveys (137 individuals) and who successfully answered an attention check item (we eliminated 23 responses due to lack of attention). This decision improved the quality of the collected data, providing a final sample of 114 responses. Our final sample size was lower than we expected, although high enough to make a rigorous test of our main hypotheses. All employees were between 25 and 64 years old (Mean = 39.16 years, S.D. = 9.89). Most participants were female (82%) and the tenure ranged from 0.16 to 35 years (Mean = 7.55 years, S.D. = 8.00).

#### 3.2. Measures

All measures of this study were applied using 5-point Likert scales (1: Completely disagree – 5: Completely agree). The surveys were applied in their Spanish versions, which can all be found in [escalas.unegocios.cl](https://escalas.unegocios.cl). *Psychological contract fulfillment* was captured

using Robinson and Morrison's (2000) classic scale of global PC fulfillment. To better align our theory to our measure, we only used the fulfillment items, eliminating two negatively worded items, addressing previous concerns that Robinson and Morrison's measure capture both fulfillment and breach (Conway and Pekcan, 2019). This procedure was already utilized in Laulié (2017) in a similar population, showing excellent psychometric properties. A sample item is "Almost all of the promises made to me by my employer have been kept so far." Cronbach's alpha was 0.93. To capture *emotional intelligence*, we used an ability-based EI instrument developed by Law et al. (2004) and validated in Spanish by Madrid (2020). The instrument contemplates four dimensions, including recognition of own emotions, recognition of emotions in others, regulation of own emotions, and use of emotions. An item example is "I have good control of my emotions." Cronbach's alpha was 0.87. *Emotional exhaustion* was captured using an 8-item subscale of the Oldenburg Burnout Inventory and validated by Halbesleben and Demerouti (2005). A previous Spanish version of this scale was used by Laulié et al. (2022). An item example is "During my work, I often feel emotionally drained." Cronbach's alpha was 0.86. Finally, *turnover intention* was captured by participants using a 3-item scale developed by Cammann et al. (1983). A sample item is "I often seriously think about quitting." Alpha was 0.85. All descriptive statistics are included in Table 1.

#### 3.3. Analyses

First, we used confirmatory factor analysis (CFA) to evaluate our measurement model. To test model fit, we used typical indexes and some of the commonly used standards in the literature (CFI > 0.90, RMSEA < 0.08, SRMR < 0.08). Our theoretical model was then compared against alternative measurement models. Second, to test our main hypotheses, we used structural equation modeling (SEM). This approach can reduce bias in the calculation of estimates in a mediation or moderation analysis by managing the effects of measurement error (see Ledgerwood and Shrout, 2011). For hypothesis 1, we used a full indicator method for latent interaction constructs (Marsh et al., 2013; Collier, 2020). For this method, we created interaction terms for each pair of mean-centred indicators of the independent and moderator variables (PC fulfillment and emotional intelligence, respectively), which then serve as indicators of a latent interaction unobserved construct. Third, to test hypothesis 2, we calculated an index of moderated mediation (Hayes, 2015; Hayes et al., 2017) and observed the indirect effects of PC fulfillment on turnover intentions through the effects of emotional intelligence depending on the level of the moderator variable (emotional intelligence). All analyses were carried out using SPSS, AMOS, and the PROCESS macro.

### 4. Results

#### 4.1. Confirmatory factor analysis

We first examined the measurement model that form our key constructs (PC fulfillment, emotional intelligence, emotional exhaustion, and turnover intention). The hypothesized model (see



TABLE 1 Descriptive statistics and correlations.

Variable	Mean	SD	Min	Max	1	2	3	4
1. Psychological contract fulfillment	4.14	0.84	1.00	5.00	(0.93)			
2. Emotional intelligence	4.23	0.44	3.25	5.00	0.13	(0.87)		
3. Emotional exhaustion	2.77	0.68	1.13	4.50	−0.15	−0.40**	(0.86)	
4. Turnover intention	1.90	0.99	1.00	5.00	−0.41**	−0.11	0.15	(0.85)

The table shows means, standard deviations, minimums, maximums, and intercorrelations of Individual Psychological Contract Fulfillment, Emotional Intelligence, Emotional Exhaustion, and Turnover Intention. \*\*denotes significance at 0.01 level (2-tailed). Alpha scores on parentheses.

TABLE 2 Confirmatory factor analysis.

Model	$\chi^2$	df	p-value	CFI	RMSEA	SRMR	AIC	BIC
Hypothesized 4-factor model	111.402	107	0.366	0.995	0.019	0.076	203.402	329.267
3-factor model (EI and PCF are merged)	221.929	110	0.000	0.868	0.095	0.142	307.929	425.585
3-factor model (EI and EE are merged)	191.549	110	0.000	0.904	0.081	0.098	277.549	395.206
3-factor model (EE and PCF are merged)	367.957	110	0.000	0.697	0.144	0.195	453.957	571.614
2-factor model (PCF and EI are merged, and EE and TI are merged)	332.299	112	0.000	0.741	0.132	0.165	414.299	526.484
Single-factor model	542.058	113	0.000	0.496	0.183	0.216	622.058	731.506

N = 114; variables included: EI, Emotional Intelligence; PCF, Psychological Contract Fulfillment; EE, Emotional Exhaustion; TI, Turnover Intention; CFI, Comparative Fit Index; RMSEA, Root-Mean-Square-Error of Approximation; SRMR, Standardized Root-Mean-Square Residual; AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion.

Table 2) indicates an overall excellent fit of a four-factor model ( $\chi^2 = 111.402$ ,  $df = 107$ ,  $CFI = 0.99$ ;  $RMSEA = 0.019$ ;  $SRMR = 0.076$ ). Then, we tested several alternative models, merging some latent constructs (models 2 to 6 in Table 2). All the alternatives resulted in a worse fit to the data. These results suggest that individuals differentiate the four constructs, providing evidence for discriminant validity.

## 4.2. Hypothesis testing

We also created a structural equation model to evaluate our hypothesized relationships. These results are summarized in Table 3. The initial model containing only the predictor, mediator, and outcome shows an excellent fit to the data ( $\chi^2 = 50.282$ ,  $df = 56$ ,  $CFI = 1.00$ ;  $RMSEA = 0.00$ ;  $SRMR = 0.055$ ) and provides evidence to confirm some of the expected relationships. PC fulfillment ( $\beta = -0.20$ ,  $p < 0.10$ ) was significantly related to emotional exhaustion, with higher fulfillment reducing the levels of emotional exhaustion. At the same time, emotional exhaustion was significantly related to turnover intentions ( $\beta = 0.28$ ,  $p < 0.01$ ). These results are aligned with PC theory and previous findings in the literature.

Hypothesis 1 predicted a moderation effect of emotional intelligence on the relationship between PC fulfillment and

emotional exhaustion. Our results show that, after including emotional intelligence as a predictor of emotional exhaustion ( $\beta = -0.88$ ,  $p < 0.01$ ), the latent interaction construct was significantly related to emotional exhaustion ( $\beta = -0.81$ ,  $p < 0.05$ ), providing evidence to support our hypothesis. Figure 2 plots the shape of the moderation effect. As hypothesized, when emotional intelligence is high, there is a negative relationship between PC fulfillment and emotional exhaustion. In contrast, when emotional intelligence is low, the relationship is neutralized (not significant). Individuals with low emotional intelligence presented on average high levels of emotional exhaustion. This evidence supports hypothesis 1.<sup>23</sup>

2 As a robustness check, we tested this model with and without other controls (age, tenure, gender), but the results were not altered by the inclusion of controls (these results are also available upon request to the corresponding author).

3 An alternative explanation would be that individuals with low emotional intelligence tend to see personal situations as more negative, and thus this effect may create a negative bias in perceptions of PC fulfillment. This possibility seems less plausible as the correlation of PC fulfillment and emotional intelligence is low and not significant (Table 1).



Hypothesis 2 predicted a moderated mediation effect of emotional intelligence on the mediation of PC fulfillment, emotional exhaustion, and turnover intention. Table 4 shows the main results of this test. When emotional intelligence is low or average, the indirect effects were not significantly different from zero. In contrast, when emotional intelligence was high, the indirect effect was significant. The index of moderated mediation was also significantly different from zero, providing evidence to support hypothesis 2.

TABLE 3 SEM hypothesis testing.

Relationships	Unstandardized estimates	p-values
PCF → EE	−0.20	0.075
PCF → TI	−0.49	0.000
EE → TI	0.28	0.008
Model fit		
$\chi^2$	50.282	
df	56	
CFI	1.00	
RMSEA	0.000	
SRMR	0.055	
AIC	120.282	
BIC	216.049	
Moderation test		
EI → EE	−0.88	0.000
H1: PCF x EI → EE	−0.81	0.013

N = 114; variables included: EI, Emotional Intelligence; PCF, Psychological Contract Fulfillment; EE, Emotional Exhaustion; TI, Turnover Intention; CFI, Comparative Fit Index; RMSEA, Root-Mean-Square-Error of Approximation; SRMR, Standardized Root-Mean-Square Residual; AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion. \*\*denotes significance at 0.01 level (2-tailed).

## 5. Discussion

In this article, we proposed that emotional intelligence is a relevant individual difference that can explain the mediation of PC fulfillment, emotional exhaustion, and turnover intention. Our results support that proposition, posing interesting implications for future research.

Considering emotional intelligence as an ability that has been related to self-regulation capacities, our study provides a reasonable way to empirically test the explanatory power that self-regulation theory has on explaining how psychological contracts operate in individuals. Our results suggest that PC fulfillment is directly related to outcomes such as emotional exhaustion and turnover intentions, but only for individuals with high regulatory capacities. That is, the socio-emotional resources that PC fulfillment injects may not be sufficient for individuals with low emotional intelligence, who display higher levels of emotional exhaustion regardless of their perceptions of PC fulfillment. Thus, our results provide interesting boundary conditions of Rousseau et al. (2018) theory of PC and self-regulation.

TABLE 4 Test of moderated mediation.

Values of the moderator (EI)	Indirect effect estimate	LLCI 95%	ULCI 95%
−1 SD EI	0.059	−0.017	0.611
Mean EI	−0.039	−0.148	0.007
+1 SD EI	−0.137	−0.834	−0.022
	Estimate	LLCI 95%	ULCI 95%
Index of moderated mediation	−0.221*	−1.940	−0.027

The indirect effect is moderated by Emotional intelligence (EI). Unstandardized coefficients reported. Bootstrap sample = 5,000 with replacement.

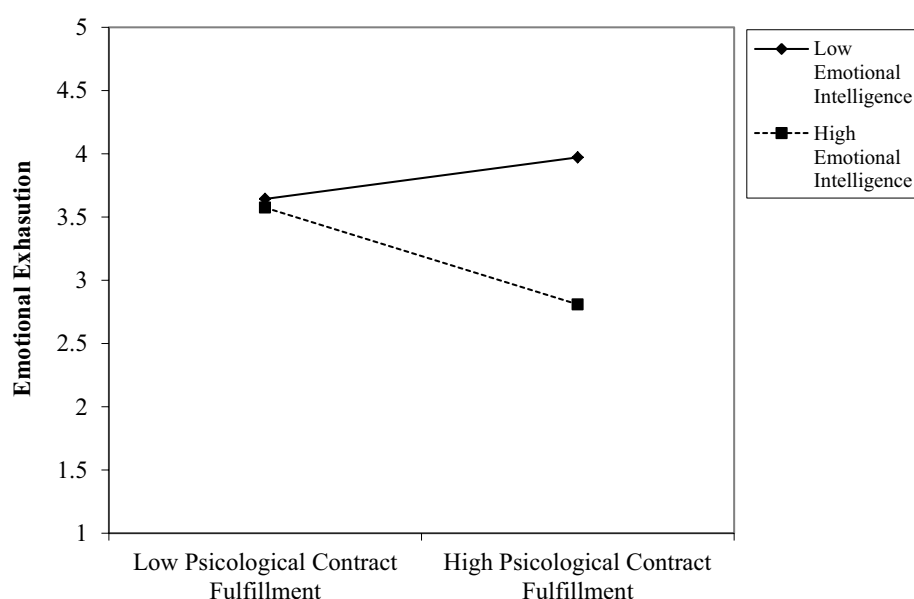


FIGURE 2 Moderation effect of emotional intelligence on PC fulfillment and emotional exhaustion.

From the point of view of social exchange theory, our results also suggest that social exchanges may be more productive for individuals with high emotional intelligence. Although decades of research have shown that creating trust in social exchanges is a ubiquitous phenomenon in social psychology (e.g., Colquitt et al., 2007), our results show that there may be individuals who are more apt to establish more beneficial social exchanges with other parties than others. These individuals are more likely to perceive organizational inducements as positive resources that can benefit their welfare. In contrast, individuals with high emotional intelligence are also more likely to exit poor exchanges. Our test of moderated mediation suggests that only individuals with high emotional intelligence are more likely to have higher turnover intentions when experiencing low PC fulfillment. That is, these individuals are more likely to exit relationships that are not fulfilling or beneficial for them. In addition, future research should explore whether other variables that could be markers of self-regulation abilities (different than emotional intelligence) may create similar boundary conditions of the effects of PC fulfillment on relevant employee outcomes.

A puzzling possibility that our findings suggest, is that as emotionally intelligent individuals are more likely to identify beneficial or detrimental relationships with the organization, they may also affect the perception of other individuals in the same group of workers (e.g., Lopes et al., 2004; Jamshed and Majeed, 2019). Based on theories of social influence, PC theory has suggested in the past that PC evaluations can be shared by specific individuals (Ho, 2005; Ho and Levesque, 2005) or teams as a whole (Laulié and Tekleab, 2016; Tekleab et al., 2020). Future research should explore whether emotionally intelligent individuals are more likely to influence other individuals' perceptions of the PC (Griep et al., 2019).

Our findings have additional implications for the PC literature. For instance, a plausible explanation of some of the weak effects of PC fulfillment on outcomes may be the result of having samples with individuals with lower emotional intelligence. For example, Zhao et al. (2007) found a small relationship between PC breach and individual performance. We speculate that that relationship should be stronger for highly emotionally intelligent individuals. We recommend future research to use emotional intelligence as a relevant control for future PC research.

Our results also show interesting and unexpected results. Although our main goal was to contrast individuals with high vs. low emotional intelligence, the results show that the mediation of PC fulfillment, emotional exhaustion, and turnover intention was not significant for average emotional intelligence. Future research should investigate whether this result was due to a lack of power or some idiosyncratic characteristic of our sample, or whether it is a more generalizable property of the effects of PC evaluations. Similarly, future research should replicate these results in samples from other countries or industries in order to study its external validity.

We would like to finish this article by acknowledging some strengths and limitations. First, our final sample size was lower than we expected, although high enough to make a rigorous test of our main hypotheses. Second, we were not able to control for job characteristics or other individual differences that may interact with our key constructs. Future research may expand this possibility. Third, our sample and methodology have several strengths worth mentioning, such as the use of attention checks to improve the quality

of our data, and the use of multiple surveys to reduce the potential problem of common method bias. We believe this study makes several contributions to the PC literature.

## 6. Conclusion

Representing the employment “deal in the mind,” PCs have been theorized to have powerful effects on employee outcomes through self-regulation processes that are activated when high or low fulfillment is experienced. In this paper, we explored whether this theoretical mechanism operates for all individuals. Our results show that the answer is “no.” Individuals with low emotional intelligence seem to be unaffected by positive or negative evaluations of the PC. We hope our results expand the PC literature and encourage future research to better understand how individual differences change the experience of the employment relationship.

## Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: [https://osf.io/csd8k/?view\\_only=f690e5bc4a454573a1672ef30f857e01](https://osf.io/csd8k/?view_only=f690e5bc4a454573a1672ef30f857e01).

## Ethics statement

The studies involving human participants were reviewed and approved by Comité de Ética de la Facultad de Economía y Negocios de la Universidad de Chile. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

Using CRediT Taxonomy, the authors declare the following contributions: LL and GH-G: conceptualization. GB-J: data curation and software. GB-J, LL, and GH-G: formal analysis and investigation. LL: methodology, project administration, resources, supervision, and original draft. LL and GB-J: validation and visualization. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Abdalla, M. J., Said, H., Ali, L., Ali, F., and Chen, X. (2021). COVID-19 and unpaid leave: impacts of psychological contract breach on organizational distrust and turnover intention: mediating role of emotional exhaustion. *Tour. Manag.* 39, 1–9. doi: 10.1016/j.tmp.2021.100854
- Bal, P. M., Chiaburu, D. S., and Diaz, I. (2011). Does psychological contract breach decrease proactive behaviors? The moderating effect of emotion regulation. *Group Organ. Manag.* 36, 722–758. doi: 10.1177/10596011114235
- Balogun, A. G., Oluyemi, T. S., and Afolabi, O. A. (2018). Psychological contract breach and workplace deviance: does emotional intelligence matter? *J. Psychol. A.* 28, 8–14. doi: 10.1080/14330237.2018.1426808
- Bechtoldt, M. N., and Schneider, V. K. (2016). Predicting stress from the ability to eavesdrop on feelings: emotional intelligence and testosterone jointly predict cortisol reactivity. *Emotion* 16, 815–825. doi: 10.1037/emo0000134
- Blau, P. M. (1964). *Exchange and power in social life*. New York: John Wiley & Sons, Inc.
- Boles, J. S., Johnston, M. W., and Hair, J. F. Jr. (1997). Role stress, work-family conflict and emotional exhaustion: inter-relationships and effects on some work-related consequences. *J. of Pers. Sell. Sales Manag.* 17, 17–28. doi: 10.1080/08853134.1997.10754079
- Cammann, C., Fichman, M., Jenkins, D., and Klesh, J. (1983). "Overall job satisfaction," in *Taking the measures of work: A guide to validate scales for organizational research and diagnosis*. ed. D. L. Fields (Thousand Oaks, CA: Sage Publications).
- Castanias, R. P., and Helfat, C. E. (1991). Managerial resources and rents. *J. Manag.* 17, 155–171. doi: 10.1177/014920639101700110
- Collier, J. E. (2020). *Applied structural equation modeling using AMOS: Basic to advanced techniques*. New York: Routledge.
- Colquitt, J. A., Scott, B. A., and LePine, J. A. (2007). Trust, trustworthiness, and trust propensity: a meta-analytic test of their unique relationships with risk-taking and job performance. *J. Appl. Psychol.* 92, 909–927. doi: 10.1037/0021-9010.92.4.909
- Conway, N., and Briner, R. B. (2002). Full-time versus part-time employees: understanding the links between work status, the psychological contract, and attitudes. *J. Voc. Behav.* 61, 279–301. doi: 10.1006/jvbe.2001.1857
- Conway, N., and Pekcan, C. (2019). "Psychological contract research: older, but is it wiser?" in *Handbook of research on the psychological contract at work*. eds. Y. Griep and C. Cooper (Northampton, MA: Edward Elgar Publishing Inc.), 10–34.
- Côté, S. (2014). Emotional intelligence in organizations. *Annu. Rev. Organ. Psychol. Organ. Behav.* 1, 459–488. doi: 10.1146/annurev-orgpsych-031413-091233
- Côté, S., Lopes, P. N., Salovey, P., and Miners, C. T. H. (2010). Emotional intelligence and leadership emergence in small groups. *Leadership. Q.* 21, 496–508. doi: 10.1016/j.leaqua.2010.03.012
- Coyle-Shapiro, J. A. M., and Kessler, I. (2002). Exploring reciprocity through the lens of the psychological contract: employee and employer perspectives. *Eur. J. of Work and Organ. Psychol.* 11, 69–86. doi: 10.1080/13594320143000852
- Coyle-Shapiro, J. A., and Neuman, J. H. (2004). The psychological contract and individual differences: the role of exchange and creditor ideologies. *J. Voc. Behav.* 64, 150–164. doi: 10.1016/S0001-8791(03)00031-9
- Elfenbein, H. A., Foo, M. D., White, J. B., Tan, H. H., and Aik, V. C. (2007). Reading your counterpart: the benefit of emotion recognition ability for effectiveness in negotiation. *J. Nonverbal Behav.* 31, 205–223. doi: 10.1007/s10919-007-0033-7
- Forgas, J. P., and George, J. M. (2001). Affective influences on judgments and behavior in organizations: an information processing perspective. *Organ. Behav. Hum. Decis. Process.* 86, 3–34. doi: 10.1006/obhd.2001.2971
- Gakovic, A., and Tetrick, L. E. (2003). Psychological contract breach as a source of strain for employees. *J. Bus. Psychol.* 18, 235–246. doi: 10.1023/A:1027301232116
- Giao, H. N. K., Vuong, B. N., Huan, D. D., Tushar, H., and Quan, T. N. (2020). The effect of emotional intelligence on turnover intention and the moderating role of perceived organizational support: evidence from the banking industry of Vietnam. *Sustainability* 12:1857. doi: 10.3390/su12051857
- Griep, Y., Cooper, C., Robinson, S., Robinson, D. M., Hansen, S. D., Tomprou, M., et al. (2019). "Psychological contracts: Back to the future," in *Handbook of research on the psychological contract at work*. eds. Y. Griep and C. Cooper (Cheltenham: Edward Elgar).
- Halbesleben, J. R., and Demerouti, E. (2005). The construct validity of an alternative measure of burnout: investigating the english translation of the Oldenburg burnout inventory. *Work Stress.* 19, 208–220. doi: 10.1080/02678370500340728
- Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behav. Res.* 50, 1–22. doi: 10.1080/00273171.2014.962683
- Hayes, A. F., Montoya, A. K., and Rockwood, N. J. (2017). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Aus. Marketing. J.* 25, 76–81. doi: 10.1016/j.ausmj.2017.02.001
- Henderson, D. J., Wayne, S. J., Shore, L. M., Bommer, W. H., and Tetrick, L. E. (2008). Leader-member exchange, differentiation, and psychological contract fulfillment: a multilevel examination. *J. Appl. Psychol.* 93, 1208–1219. doi: 10.1037/a0012678
- Hermida, R., and Luchman, J. N. (2013). The moderating role of locus of causality in the relationship between source of information and psychological contract breach perceptions. *J. Bus. Psychol.* 28, 221–232. doi: 10.1007/s10869-012-9274-5
- Ho, V. T. (2005). Social influence on evaluations of psychological contract fulfillment. *Acad. Manag. Rev.* 30, 113–128. doi: 10.5465/amr.2005.15281438
- Ho, V. T., and Levesque, L. L. (2005). With a little help from my friends (and substitutes): social referents and influence in psychological contract fulfillment. *Organ. Science* 16, 275–289. doi: 10.1287/orsc.1050.0121
- Isen, A. M. (2001). An influence of positive affect on decision making in complex situations: theoretical issues with practical implications. *J. Cons. Psychol.* 11, 75–85. doi: 10.1207/S15327663JCP1102\_01
- Jamshed, S., and Majeed, N. (2019). Relationship between team culture and team performance through lens of knowledge sharing and team emotional intelligence. *J. of Know. Manag.* 23, 90–109. doi: 10.1108/JKM-04-2018-0265
- Joseph, D. L., and Newman, D. A. (2010). Emotional intelligence: an integrative meta-analysis and cascading model. *J. Appl. Psychol.* 95, 54–78. doi: 10.1037/a0017286
- Karatepe, O. M., and Uludag, O. (2007). Conflict, exhaustion, and motivation: a study of frontline employees in northern Cyprus hotels. *Int. J. Hosp. Manag.* 26, 645–665. doi: 10.1016/j.ijhm.2006.05.006
- Kickul, J., and Lester, S. W. (2001). Broken promises: equity sensitivity as a moderator between psychological contract breach and employee attitudes and behavior. *J. Bus. Psychol.* 16, 191–217. doi: 10.1023/A:1011105132252
- Kiefer, T., and Antoni, A. (2019). "Putting emotion first—an emotion-centred approach to understanding the psychological contract," in *Handbook of research on the psychological contract at work*. eds. Y. Griep and C. Cooper (Cheltenham: Edward Elgar Publishing).
- Kiefer, T., Barclay, L. J., Conway, N., and Briner, R. B. (2022). An event-based approach to psychological contracts: the importance of examining everyday broken and fulfilled promises as discrete events. *J. Organ. Behav.* 43, 1377–1395. doi: 10.1002/job.2656
- Kotsou, I., Mikolajczak, M., Heeren, A., Grégoire, J., and Leys, C. (2019). Improving emotional intelligence: a systematic review of existing work and future challenges. *Emotion Rev.* 11, 151–165. doi: 10.1177/1754073917735902
- Laborde, S., Lautenbach, F., Allen, M. S., Herbert, C., and Achtzehn, S. (2014). The role of trait emotional intelligence in emotion regulation and performance under pressure. *Pers. Individ. Diff.* 57, 43–47. doi: 10.1016/j.paid.2013.09.013
- Lanciano, T., Curci, A., Kafetsios, K., Elia, L., and Zammuner, V. L. (2012). Attachment and dysfunctional rumination: the mediating role of emotional intelligence abilities. *Pers. Individ. Diff.* 53, 753–758. doi: 10.1016/j.paid.2012.05.027
- Laulié, L. (2017). *Toward a better understanding of psychological contract fulfillment (pcf) at the team level*. Detroit: Wayne State University.
- Laulié, L., Briceño, G., and Pavez, I. (2022). Does "good acting requires a good cast?" a replication study of how team deep acting dispersion influence individual outcomes. *Estudios de Administración* 29, 66–80. doi: 10.5354/0719-0816.2022.66826
- Laulié, L., and Tekleab, A. G. (2016). A multi-level theory of psychological contract fulfillment in teams. *Group Organ. Manag.* 41, 658–698. doi: 10.1177/1059601116668972
- Law, K. S., Wong, C. S., and Song, L. J. (2004). The construct and criterion validity of emotional intelligence and its potential utility for management studies. *J. Appl. Psychol.* 89, 483–496. doi: 10.1037/0021-9010.89.3.483
- Lea, R. G., Davis, S. K., Mahoney, B., and Qualter, P. (2019). Does emotional intelligence buffer the effects of acute stress? A systematic review. *Front. Psychol.* 10, 1–19. doi: 10.3389/fpsyg.2019.00810
- Ledgerwood, A., and Shrout, P. E. (2011). The trade-off between accuracy and precision in latent variable models of mediation processes. *J. Pers. Soc. Psychol.* 101, 1174–1188. doi: 10.1037/a0024776

- Lopes, P. N., Brackett, M. A., Nezlek, J. B., Schütz, A., Sellin, I., and Salovey, P. (2004). Emotional intelligence and social interaction. *Pers. Soc. Psych. Bull.* 30, 1018–1034. doi: 10.1177/0146167204264762
- Lord, R. G., Diefendorff, J. M., Schmidt, A. M., and Hall, R. J. (2010). Self-regulation at work. *Annu. Rev. Psychol.* 61, 543–568. doi: 10.1146/annurev.psych.093008.100314
- Madrid, H. P. (2020). Escala de inteligencia emocional WLEIS en Español. available at: <https://www.hectormadrid.cl/materiales-de-investigacion> (accessed November 1, 2022).
- Marsh, H. W., Wen, Z., Hau, K. T., and Nagengast, B. (2013). “Structural equation models of latent interaction and quadratic effects” in *Structural equation modeling: A second course*, eds. G. R. Hancock and, R. O. Mueller Charlotte, NC: Information Age Publishing.
- Maslach, C., and Goldberg, J. (1998). Prevention of burnout: new perspectives. *Appl. Prev. Psychol.* 7, 63–74. doi: 10.1016/S0962-1849(98)80022-X
- Mayer, J. D., Caruso, D. R., and Salovey, P. (2016). The ability model of emotional intelligence: principles and updates. *Emot. Rev.* 8, 290–300. doi: 10.1177/1754073916639667
- Mayer, J. D., Roberts, R., and Barsade, S. G. (2008). Human abilities: emotional intelligence. *Annu. Rev. Psychol.* 59, 507–536. doi: 10.1146/annurev.psych.59.103006.093646
- Moon, T. W., and Hur, W. M. (2011). Emotional intelligence, emotional exhaustion, and job performance. *Soc. Behav. Pers.* 39, 1087–1096. doi: 10.2224/sbp.2011.39.8.1087
- O’Boyle, E. H., Humphrey, R. H., Pollack, J. M., Hawver, T. H., and Story, P. A. (2011). The relation between emotional intelligence and job performance: a meta-analysis. *J. Organ. Behav.* 32, 788–818. doi: 10.1002/job.714
- Petrides, K. V. (2011). “Ability and trait emotional intelligence,” in *The Wiley-Blackwell handbook of individual differences*, eds. T. Chamorro-Premuzic, Stumm S. von and A. Furnham (Hoboken, NJ: Wiley Blackwell Publishing), 656–678.
- Petrides, K. V., and Furnham, A. (2003). Trait emotional intelligence: behavioural validation in two studies of emotion recognition and reactivity to mood induction. *Eur. J. Personal.* 17, 39–57. doi: 10.1002/per.466
- Podsakoff, P. M., Mac Kenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879
- Pradhan, S., and Jena, L. K. (2018). Emotional intelligence as a moderator in abusive supervision-intention to quit relationship among Indian healthcare professionals. *Asia-Pac. J. Bus. Adm.* 10, 35–49. doi: 10.1108/APJBA-09-2017-0089
- Raja, S., Johns, G., and Ntalianis, F. (2004). The impact of personality on psychological contracts. *Acad. Manag. J.* 47, 350–367. doi: 10.5465/20159586
- Restubog, S. L. D., Zagenczyk, T. J., Bordia, P., Bordia, S., and Chapman, G. J. (2015). If you wrong us, shall we not revenge? Moderating roles of self-control and perceived aggressive work culture in predicting responses to psychological contract breach. *J. Manag.* 41, 1132–1154. doi: 10.1177/0149206312443557
- Robinson, S. L., Kraatz, M. S., and Rousseau, D. M. (1994). Changing obligations and the psychological contract: a longitudinal study. *Acad. Manag. J.* 37, 137–152. doi: 10.5465/256773
- Robinson, S. L., and Morrison, W. E. (2000). The development of psychological contract breach and violation: a longitudinal study. *J. Organ. Behav.* 21, 525–546. doi: 10.1002/1099-1379(200008)21:5%3C525::AID-JOB40%3E3.0.CO;2-T
- Robinson, S. L., and Rousseau, D. M. (1994). Violating the psychological contract: not the exception but the norm. *J. Organ. Behav.* 15, 245–259. doi: 10.1002/job.4030150306
- Rousseau, D. M. (2011). “The individual–organization relationship: the psychological contract,” in *APA handbook of industrial and organizational psychology*. ed. S. Zedeck (Washington, DC: American Psychological Association).
- Rousseau, D. M., Hansen, S. D., and Tomprou, M. (2018). A dynamic phase model of psychological contract processes. *J. Organ. Behav.* 39, 1081–1098. doi: 10.1002/job.2284
- Szczygiel, D., and Mikolajczak, M. (2017). Why are people high in emotional intelligence happier? They make the most of their positive emotions. *Pers. Individ. Diff.* 117, 177–181. doi: 10.1016/j.paid.2017.05.051
- Tekleab, A. G., Laulié, L., De Vos, A., De Jong, J. P., and Coyle-Shapiro, J. A. (2020). Contextualizing psychological contracts research: a multi-sample study of shared individual psychological contract fulfillment. *Eur. J. Work Organ. Psychol.* 29, 279–293. doi: 10.1080/1359432X.2019.1608294
- Thomas, C., and Zolkoski, S. (2020). Preventing stress among undergraduate learners: the importance of emotional intelligence, resilience, and emotion regulation. *Front. Educ.* 5, 1–8. doi: 10.3389/feduc.2020.00094
- Tziner, A., Fein, E. C., Kim, S. K., Vasiliu, C., and Shkoler, O. (2020). Combining associations between emotional intelligence, work motivation, and organizational justice with counterproductive work behavior: a profile analysis via multidimensional scaling (PAMS) approach. *Front. Psychol.* 11, 1–18. doi: 10.3389/fpsyg.2020.00851
- Wright, T. A., and Cropanzano, R. (1998). Emotional exhaustion as a predictor of job performance and voluntary turnover. *J. Appl. Psychol.* 83, 486–493. doi: 10.1037/0021-9010.83.3.486
- Zhao, H. A. O., Wayne, S. J., Glibkowski, B. C., and Bravo, J. (2007). The impact of psychological contract breach on work-related outcomes: a meta-analysis. *Pers. Psychol.* 60, 647–680. doi: 10.1111/j.1744-6570.2007.00087.x
- Zhong, M., Wayne, S. J., and Michel, E. J. (2021). When the past and the present collide: contrast effect of sequential psychological contract breaches on employee outcomes. *J. Manag.* 49, 913–943. doi: 10.1177/01492063211061255





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# Alcohol misuse, health-related behaviors, and burnout among clinical therapists in China during the early Covid-19 pandemic: A Nationwide survey

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Huanzhong Liu<sup>2,3,11\*</sup> and Yi-lan Tang<sup>5,12</sup><sup>1</sup>Department of Substance-Related Disorders, Affiliated Psychological Hospital of Anhui Medical University, Hefei, China, <sup>2</sup>Department of Psychiatry, Chao hu Hospital of Anhui Medical University, Hefei, China, <sup>3</sup>Department of Psychiatry, School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei, China, <sup>4</sup>Department of Substance-Related Disorders, Hefei Fourth People's Hospital, Hefei, China, <sup>5</sup>Addiction Psychiatry Fellowship Program, Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta, GA, United States, <sup>6</sup>State Key Laboratory of Medical Molecular Biology, Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China, <sup>7</sup>Department of Psychiatry, Second Affiliated Hospital of Anhui Medical University, Hefei, China, <sup>8</sup>Research Department, School of Health Policy and Management, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China, <sup>9</sup>Research Department, School of International and Public Affairs, Shanghai Jiao Tong University, Shanghai, China, <sup>10</sup>Research Department, Institute of Healthy Yangtze River Delta, Shanghai Jiao Tong University, Shanghai, China, <sup>11</sup>Department of Psychiatry, Anhui Psychiatric Center, Hefei, China, <sup>12</sup>Mental Health Service Line, Atlanta Veterans Affairs Medical Center, Decatur, GA, United States**Objectives:** This study aimed to assess the extent of alcohol use and misuse among clinical therapists working in psychiatric hospitals in China during the early COVID-19 Pandemic, and to identify associated factors.**Methods:** An anonymous nationwide survey was conducted in 41 tertiary psychiatric hospitals. We collected demographic data as well as alcohol use using the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) and burnout using the Maslach Burnout Inventory Human Services Survey.**Results:** In total, 396 clinical therapists completed the survey, representing 89.0% of all potential participants we targeted. The mean age of participants was 33.8 years old, and more than three-quarters (77.5%) were female. Nearly two-fifths (39.1%) self-reported as current alcohol users. The overall prevalence of alcohol misuse was 6.6%. Nearly one-fifth (19.9%) reported symptoms of burnout with high emotional exhaustion in 46 (11.6%), and high depersonalization in 61 (15.4%). Multiple logistic regression showed alcohol use was associated with male gender (OR=4.392; 95% CI =2.443–7.894), single marital status (OR=1.652; 95% CI =0.970–2.814), smoking habit (OR=3.847; 95%CI =1.160–12.758) and regular exercise (OR=2.719; 95%CI =1.490–4.963). Alcohol misuse was associated with male gender (OR=3.367; 95% CI =1.174–9.655), a lower education level (OR=3.788; 95%CI =1.009–14.224), smoking habit (OR=4.626; 95%CI =1.277–16.754) and high burnout (depersonalization, OR=4.848; 95%CI =1.433–16.406).**Conclusion:** During the COVID-19 pandemic, clinical therapists' alcohol consumption did not increase significantly. Male gender, cigarette smoking, and burnout are associated with an increased risk of alcohol misuse among clinical therapists. Targeted intervention is needed when developing strategies to reduce alcohol misuse and improve clinical therapists' wellness and mental health.



## KEYWORDS

alcohol use, alcohol misuse, clinical therapists, COVID-19 pandemic, risk factor

## Introduction

The COVID-19 outbreak pandemic had a significant impact on the physical and mental health of people across the world (1, 2). Several studies demonstrated that alcohol use/misuse and other mental health problems increased with the onset of the COVID-19 pandemic (3–6). An online survey of 1,118 U.S. adults showed that there was a disproportionate increase in alcohol-related health problems among male adults, further mediated by drinking motives and social stressors (3). The COVID-19 pandemic contributed to psychological distress and burnout among healthcare workers (7–9). Front-line healthcare workers may use alcohol or other substances to cope with negative moods and stress (10, 11). Substance use was also a risk factor for increased psychological distress (8), which could lead to poorer mental and physical well-being (4, 12, 13). Different samples (occupational characteristics), working environment, work intensity, and stress level during the epidemic may be risk factors for increased alcohol consumption during the COVID-19 pandemic. Healthcare workers have reported high levels of burnout, and additional stressors related to the pandemic may further accelerate burnout (14), which may affect alcohol use and misuse among healthcare workers (15, 16).

Alcohol consumption among healthcare workers is an important area of research. Many healthcare workers play an essential role in the prevention, screening, and management of substance use disorders. Alcohol use and misuse among healthcare workers may negatively impact their psychological and physical well-being as well as patient care (17). Several recent studies from different countries showed that healthcare workers are also at risk for hazardous alcohol consumption. A cross-sectional study in the UK showed that occupational distress and work-related factors can increase physicians' alcohol consumption (18). During the pandemic, clinical therapists have had to carry the dual burden of addressing the extraordinary distress that their patients face in addition to coping with their own struggles. Yet, data describing clinical therapists' alcohol use and misuse is scarce.

Clinical therapists are a relatively new profession in China. According to the Chinese professional standards and certification system, clinical therapists' educational and training backgrounds are diverse, and they can be psychologists, social workers, or nurses as long as they have received the required training and are certified. The role of clinical therapists in China is to provide psychological counseling, therapy, and education to patients with mental disorders (19, 20). To the best of our knowledge, the present study is the first to examine the current prevalence of alcohol use/misuse and identify the risk factors that contribute to alcohol use/misuse among Chinese clinical therapists during the early COVID-19 pandemic. We hypothesized that clinical therapists would be at increased risk of alcohol misuse and use during the pandemic. A primary aim of our study is to inform policymakers and institutional leadership regarding the scope of alcohol use and misuse among healthcare workers to hopefully encourage and inform treatment interventions.

## Methods

### Study design, setting, and participants

We used cross-sectional data from a multicenter, nationally representative survey of clinical therapists in China, which was collected anonymously through WeChat from January 2021 to March 2021. We adopted whole-group sampling to investigate alcohol use and misuse among clinical therapists and their risk factors during the early Covid-19 pandemic. All clinical therapists ( $N=445$ ) from 41 tertiary psychiatric hospitals in 29 provinces in China were invited to participate in the survey. Excluding the unfinished questionnaires and the questionnaires with logical problems, a total of 396 questionnaires were finally included in the statistical analysis (the response rate was 89.0%).

In this cross-sectional study, Socio-demographic characteristics (gender, age, education levels, marital status, income), health-related behaviors (smoking or not, insomnia, regular physical exercise), alcohol use/misuse, and occupational burnout were collected with the online questionnaire. AUDIT-C was used to investigate the patterns of alcohol use, and Maslach Burnout Inventory Human-Services-Survey (MBI-HSS) was used to investigate their occupational burnout.

### Questionnaire

We developed the electronic questionnaire based on existing literature and prior studies (16, 21). AUDIT-C is a concise version of the AUDIT and was used to assess patterns of alcohol use among clinical therapists. A higher total score (ranging from 0 to 12) is associated with higher severity of alcohol use problems. Through the AUDIT-C scores, the participants were divided into probable alcohol misuse [a total score of  $\geq 3$  (women) and  $\geq 4$  (men)] and low-risk users of alcohol [a total score of  $< 3$  (women) and  $< 4$  (men)] (22, 23).

Occupational burnout was assessed using the MBI-HSS, which is a psychological assessment instrument including 22 items about occupational burnout that includes three subscales: emotional exhaustion (EE, which assesses the experience of being emotionally exhausted by the demands of work), depersonalization (DP, refers to the degree to which each one recognizes attitudes of unfeeling and impersonal response from the recipients of their care) and personal accomplishment (PA, refers to the feelings of self-efficacy and accomplishment at work). We considered the cut-off of  $EE \geq 27$  points or  $DP \geq 10$  points to define the presence of occupational burnout following previous studies (24).

### Statistical analysis

Data analysis was performed using IBM's Statistical Package of Social Sciences (SPSS version 22.0). The sample distribution was conducted using frequency for categorical variables and

mean  $\pm$  standard deviation for continuous variables. For the statistical analysis, the Chi-square test was utilized to assess the variables which were not in the normal distribution. The independent correlates of current alcohol use and alcohol misuse were examined by multiple logistic regression, and alcohol use or alcohol misuse were the dependent variables (yes = 1, no = 0). Age groups ( $\leq 34$  years old, 35–49 years old, or  $\geq 50$  years old), educational level (associate degree or less, college degree, master's degree or more), gender (male and female); marital status (single, married, divorced/widowed); smoking habit (yes/no); and other studied variables were entered as the independent variables. The level of statistical significance was set at value of  $p$ s of 0.05 (two-tailed).

## Results

### Socio-demographic characteristics of clinical therapists in China

The socio-demographic characteristics of our sample were shown in Table 1. The mean age of participants was 33.8 years old. 307 subjects (77.5%) were female, more than two-thirds (67.2%) were younger than 35, and 62.4% were married. 155 participants (39.1%) self-reported as current alcohol users. Significant differences were found between participants who did and did not report alcohol with respect to the demographic (gender, education, marital status) and health-related behaviors (smoking habit, regular exercise). Significant differences were found between those with and without alcohol misuse concerning the demographic (gender, education, smoking habit) and burnout factors (depersonalization) (all  $p < 0.05$ ) (Table 1). Nearly one-fifth (19.9%) of responding clinical therapists reported symptoms of burnout with high emotional exhaustion in 46 (11.6%), and high depersonalization in 61 (15.4%). Among 155 current alcohol users, 41 (26.5%) reported alcohol use less than before, 103 participants (66.5%) reported no change, and 11 (7.1%) reported an increase in alcohol use than before. Participation in the front-line work of treating COVID-19 was not significantly associated with alcohol use and misuse among Chinese clinical therapists.

### Alcohol use and misuse and related factors among clinical therapists

Less than one-third (30.3%) of all participants reported consuming alcohol once a month or less, 6.3% reported at least twice a month, and 2.5% reported twice a week or more. More than two-thirds (68.4%) of all current alcohol users were in the age group of  $\leq 34$  years old, and 53.8% of all alcohol misusers were  $\leq 34$  years old. The prevalence of alcohol misuse was 6.6% overall and there was a significant gender difference (16.9% in males and 3.6% in females,  $p < 0.001$ ). The overall prevalence of alcohol use among the participants was 39.1% with a significant gender difference (70.8% prevalence in males and 30% in females,  $p < 0.01$ ). Compared to those with Master's degrees or more (39.1%), those with Bachelor's degrees or less (60.9%) had significantly higher rates of alcohol use and misuse (both  $p < 0.01$ ). The smoking rate among alcohol misusers was more than 5 times higher than those who did not report alcohol misuse (30.8% vs. 4.6%,  $p < 0.001$ ). The smoking rate among alcohol users was higher than that

of non-alcohol misusers (13.5% vs. 1.7%,  $p < 0.01$ ). The rate of alcohol use was significantly higher in people with regular exercise (defined as exercising at least three times per week in the past month according to the recommendations of the National Fitness Guideline) than in those without regular exercise (44.5% vs. 22.7%,  $p < 0.01$ ). Alcohol misuse was higher among clinical therapists who reported high job burnout (depersonalization) than those who did not report such burnout (14.8% vs. 5.1%,  $p < 0.01$ ) (Table 1).

### Factors associated with alcohol use and misuse in a multiple logistic regression

We divided the samples ( $N = 396$ ) into current alcohol users (those who drank alcohol in the past 12 months;  $N = 155$ ) and non-alcohol users ( $N = 241$ ) and performed multiple logistic regression analyses to examine the associations between alcohol use and other factors. The references of the categorical variables were defined as shown in Table 2. Alcohol use among clinical therapists was associated with male gender (OR = 4.392; 95% CI = 2.443–7.894), marital status (single, OR = 1.652; 95% CI = 0.970–2.814), smoking habit (OR = 3.847; 95% CI = 1.160–12.758) and regular exercise (OR = 2.719; 95% CI = 1.490–4.963).

We also used AUDIT-C cut-off scores (alcohol misuse: the AUDIT-C score of  $\geq 3$  (women) and  $\geq 4$  (men)) to divide participants into those with probable alcohol misuse ( $N = 26$ ) and those without ( $N = 370$ ). Multiple logistic regression was used to examine the association between probable alcohol misuse and other variables (Table 3). A higher risk of alcohol misuse was associated with male gender (OR = 3.367; 95% CI = 1.174–9.655), low education level (OR = 3.788; 95% CI = 1.009–14.224), smoking habit (OR = 4.626; 95% CI = 1.277–16.754) and high burnout (depersonalization, OR = 4.848; 95% CI = 1.433–16.406).

## Discussion

To our knowledge, no prior studies have assessed alcohol use and misuse among clinical therapists in China during the COVID-19 pandemic. We found alcohol misuse was not uncommon among Chinese clinical therapists, with 6.6% reporting probable alcohol misuse and 39.1% reporting general alcohol use. We also found that nearly one-fifth (19.9%) of Chinese clinical therapists reported high levels of occupational burnout. Alcohol misuse was significantly associated with male gender, having a bachelor's degree or less, smoking habits, and high occupational burnout (depersonalization). Somewhat surprisingly, we found that working on the frontlines of treating COVID-19 was not significantly associated with either alcohol use or misuse. Additionally, unlike results from prior works, only 7.1% of individuals reported an increase in alcohol use during the COVID-19 pandemic while 26.5% of individuals reported a decrease in alcohol use and the majority of individuals (66.5%) reported that the pandemic had no significant impact on their alcohol consumption. The existing literature on this is mixed. Some studies reported an increase in alcohol consumption (25), while others showed that healthcare workers' alcohol consumption decreased significantly during the COVID-19 pandemic (16).

TABLE 1 Socio-demographic Characteristics and burnout of clinical therapists in China (N=396).

Variables	Participants	Alcohol use		Alcohol misuse		Alcohol use	Alcohol misuse
	<i>n</i> =396	Yes ( <i>n</i> =155)	No ( <i>n</i> =241)	Yes ( <i>n</i> =26)	No ( <i>n</i> =370)	$\chi^2$ (value of <i>p</i> )	$\chi^2$ (value of <i>p</i> )
Age group (N, %)	33.86 ± 7.62	34.05 ± 8.20	33.74 ± 7.24	35.50 ± 8.35	33.75 ± 7.56		
≤34	266 (67.2)	106 (39.8)	160 (60.2)	14 (5.3)	252 (94.7)		
35–49	105 (26.5)	38 (36.2)	67 (63.8)	10 (9.5)	95 (90.5)		
≥50	25 (6.3)	11 (44.0)	14 (56.0)	2 (8.0)	23 (92.0)	0.688 (0.709)	2.317 (0.314)
<i>Gender (N, %)</i>							
Male	89 (22.5)	63 (70.8)	26 (29.2)	15 (16.9)	74 (83.1)		
Female	307 (77.5)	92 (30.0)	215 (70.0)	11 (3.6)	296 (96.4)	48.262 (<0.001)	19.808 (<0.001)
<i>Education (N, %)</i>							
Bachelor degree or less	241 (60.9)	105 (43.6)	136 (56.4)	23 (9.5)	218 (90.5)		
Master degree or more	155 (39.1)	50 (32.3)	105 (67.7)	3 (1.9)	152 (98.1)	5.066 (0.024)	8.901 (0.003)
<i>Marital status (N, %)</i>							
Married	247 (62.4)	84 (34.0)	163 (66.0)	15 (6.1)	232 (93.9)		
Single	134 (33.8)	63 (47.0)	71 (53.0)	9 (6.7)	125 (93.3)		
Divorced or widowed	15 (3.8)	8 (53.3)	7 (46.7)	2 (13.3)	13 (86.7)	7.488 (0.024)	1.223 (0.543)
<i>Smoking habit (N, %)</i>							
No	371 (93.7)	134 (36.1)	237 (63.9)	18 (4.9)	353 (95.1)		
Yes	25 (6.3)	21 (84.0)	4 (16.0)	8 (32.0)	17 (68.0)	22.542 (<0.001)	28.140 (<0.001)
<i>Income (N, %)</i>							
Low (≤5000RMBs)	101 (25.5)	33 (32.7)	68 (67.3)	5 (5.0)	96 (95.0)		
Medium (5000–10000RMBs)	194 (49.0)	87 (44.8)	107 (55.2)	16 (8.2)	178 (91.8)		
High (≥10,000 RMBs)	101 (25.5)	35 (34.7)	66 (65.3)	5 (5.0)	96 (95.0)	5.278 (0.071)	1.753 (0.416)
<i>Frequent insomnia (N, %)</i>							
No	111 (28)	40 (36.0)	71 (64.0)	7 (6.3)	104 (93.7)		
Yes	285 (72)	115 (40.4)	170 (59.6)	19 (6.7)	266 (93.3)	0.624 (0.429)	0.017 (0.897)
<i>Regular exercise (N, %)</i>							
No	97 (24.5)	22 (22.7)	75 (77.3)	5 (5.2)	92 (94.8)		
Yes	299 (75.5)	133 (44.5)	166 (55.5)	21 (7.0)	278 (93.0)	14.613 (<0.001)	0.417 (0.518)
<i>Emotional Exhaustion (N, %)</i>							
No	350 (88.4)	138 (39.4)	212 (60.6)	22 (6.3)	328 (93.7)		
Yes	46 (11.6)	17 (37.0)	29 (63.0)	4 (8.7)	42 (91.3)	0.104 (0.747)	0.385 (0.535)
<i>Depersonalization (N, %)</i>							
No	335 (84.6)	131 (39.1)	204 (60.9)	17 (5.1)	318 (94.9)		
Yes	61 (15.4)	24 (39.3)	37 (60.7)	9 (14.8)	52 (85.2)	0.001 (0.972)	7.881 (0.005)
<i>Personal Accomplishment (N, %)</i>							
Low	156 (39.4)	60 (38.5)	96 (61.5)	11 (7.1)	145 (92.9)		
High	240 (60.6)	95 (39.6)	146 (60.4)	15 (6.3)	225 (93.8)	0.050 (0.823)	0.099 (0.753)
<i>Participated in the frontline work of COVID-19 (N, %)</i>							
No	313 (79.0)	120 (38.3)	193 (61.7)	22 (7.0)	291 (93.0)		
Yes	83 (21.0)	35 (42.2)	48 (57.8)	4 (4.8)	79 (95.2)	0.404 (0.525)	0.522 (0.470)

TABLE 2 Multiple logistic regression examining individual characteristics associated with alcohol use in Chinese clinical therapists.

Variables	B	p-value	OR	95% CI
<i>Age group (ref. ≤34 years old)</i>				
35–49	−0.014	0.965	0.986	0.539–1.807
≥50	−0.314	0.541	0.731	0.267–1.998
<i>Gender (ref. Female)</i>				
Male	1.480	<0.001	4.392	2.443–7.894
<i>Education (ref. Master degree or more)</i>				
Bachelor degree or less	0.391	0.119	1.479	0.904–2.418
<i>Marital status (ref. Married)</i>				
Single	0.502	0.045	1.652	0.970–2.814
Divorced or widowed	1.126	0.055	3.082	0.975–9.746
<i>Smoking habit (ref. No)</i>				
Yes	1.347	0.028	3.847	1.160–12.758
<i>Income (ref. Low)</i>				
Medium	0.471	0.100	1.601	0.914–2.804
High	0	1.000	1.000	0.502–1.991
<i>Frequent insomnia (ref. No)</i>				
Yes	0.303	0.251	1.354	0.807–2.272
<i>Regular exercise (ref. No)</i>				
Yes	1.000	0.001	2.719	1.490–4.963
<i>Emotional Exhaustion (ref. No)</i>				
Yes	−0.083	0.847	0.920	0.396–2.138
<i>Depersonalization (ref. No)</i>				
Yes	−0.264	0.494	0.768	0.361–1.636
<i>Personal Accomplishment (ref. High)</i>				
Low	0.053	0.829	1.055	0.650–1.711
<i>Participated in the frontline work of COVID-19 (ref. No)</i>				
Yes	0.164	0.565	1.179	0.673–2.063

There was no significant increase in alcohol use among clinical therapists during the COVID-19 pandemic according to our study. One potential explanation is that clinical therapists are better equipped to cope with negative emotions due to the nature of their profession (26, 27). Another potential explanation could be that individuals frequented liquor stores and other social drinking events during the COVID-19 pandemic due to social distancing (16, 28). Nonetheless, occupational burnout remains an important issue for clinical therapists.

## Socio-demographics, health-related behaviors and alcohol use/misuse

Some common variables were significantly associated with both alcohol use and alcohol misuse among clinical therapists, such as smoking habits (OR = 3.847 and 4.626 in current alcohol users and alcohol misusers, respectively) and male gender (OR = 4.392 and 3.367 in current alcohol users and alcohol misusers, respectively). Lower education level (bachelor's degree or less) and occupational burnout (depersonalization) were significantly associated only with alcohol misuse, while marital status (single) and regular exercise were significantly associated only with alcohol use.

## Male gender, smoking habits and alcohol use/misuse

The results of this study reported rates of alcohol use and misuse that were significantly higher in males (70.8 and 16.9%, respectively) compared with females (30.0 and 3.6%, respectively). In the multivariate analysis, male clinical therapists were more likely to be alcohol users (OR = 4.392; 95% CI = 2.443–7.894) and misusers (OR = 3.367; 95% CI = 1.174–9.655) than female therapists. Consistent with previous studies (29–32), male gender was a significant risk factor for alcohol use and alcohol misuse. A recent study of mental health professionals in 41 hospitals in China (3,479 males and 10,501 females) also found significant differences between male and female medical workers in alcohol misuse with nearly two-thirds (63.3%) of alcohol misusers being male (21).

We also found a significant association between smoking habits and alcohol consumption. Cigarette use was significantly associated with reported alcohol misuse (OR = 4.626; 95% CI = 1.277–16.754) and alcohol use (OR = 3.847; 95% CI = 1.160–12.758). Our finding about the association between alcohol use/misuse and cigarette use among clinical therapists is consistent

TABLE 3 Multiple logistic regression examining individual characteristics associated with alcohol misuse in Chinese clinical therapists.

Variables	<i>B</i>	<i>p</i> -value	OR	95% CI
<i>Age group (ref. ≤34 years old)</i>				
35–49	0.936	0.131	2.551	0.757–8.589
≥50	0.308	0.747	1.360	0.210–8.816
<i>Gender (ref. Female)</i>				
Male	1.214	0.024	3.367	1.174–9.655
<i>Education (ref. Master degree or more)</i>				
Bachelor degree or less	1.332	0.048	3.788	1.009–14.224
<i>Marital status (ref. Married)</i>				
Single	0.225	0.700	1.252	0.399–3.934
Divorced or widowed	1.483	0.112	4.404	0.707–27.418
<i>Smoking habit (ref. No)</i>				
Yes	1.532	0.020	4.626	1.277–16.754
<i>Income (ref. Low)</i>				
Medium	0.251	0.664	1.286	0.415–3.987
High	−0.535	0.505	0.586	0.122–2.823
<i>Frequent insomnia (ref. No)</i>				
Yes	−0.340	0.528	0.712	0.248–2.046
<i>Regular exercise (ref. No)</i>				
Yes	0.454	0.445	1.574	0.491–5.047
<i>Emotional Exhaustion (ref. No)</i>				
Yes	−0.336	0.646	0.715	0.171–2.991
<i>Depersonalization (ref. No)</i>				
Yes	1.579	0.011	4.848	1.433–16.406
<i>Personal Accomplishment (ref. High)</i>				
Low	0.040	0.936	1.041	0.392–2.763
<i>Participated in the frontline work of COVID-19 (ref. No)</i>				
Yes	−0.400	0.516	0.670	0.200–2.241

with findings from several other studies conducted in China (33, 34) and other countries (29, 35–37). The combined use of alcohol and tobacco have a multiplicative effect on the risk of health problems (38–40). Tverdal et al. (41) found that an association between higher levels of alcohol consumption (more than one alcohol glass/day) and an increased risk of pancreatic cancer could be explained by tobacco use. Some studies showed that helping patients quit and reduce smoking may reduce their alcohol use/misuse (35, 42). Therefore, addressing tobacco use could also be a way to decrease the risk of alcohol use/misuse among clinical therapists.

## Marital status, regular physical exercise, and alcohol use

Our survey found that single marital status and regular physical exercise were risk factors for alcohol use among clinical therapists. 75.5% of clinical therapists in our sample reported exercising regularly. A positive association between exercise and alcohol use is also found in prior studies of non-clinical individuals across the world, potentially

explained by social factors, personality factors, and shared reward response pathways in the mesocorticolimbic region. The positive relationship between single marital status and drinking may be explained by increased engagement in social drinking (e.g., going to bars; drinking after regular exercise) among unmarried participants (43). Consistent with prior studies, a stable marital relationship may also reduce the risk of medical staff's alcohol use and alcohol misuse (21). Compared to never-married individuals, divorced/separated individuals were significantly more likely to report binge drinking in the past year (44). However, the results of our survey do not suggest a significant association between divorced or widowed and alcohol use and misuse, which may be due in part to the specific characteristics of clinical therapists such as their ability to cope with and process through challenging situations.

## Education level, burnout, and alcohol misuse

A low education level (bachelor's degree or less) was a risk factor for alcohol misuse among clinical therapists. Studies from other



countries also suggest that education level may affect perception and use of alcohol. Individuals that attained lower education levels may consume more alcohol than those that attained higher education levels (45). Previous studies showed that healthcare workers with higher education levels might have a higher risk awareness regarding alcohol use/misuse and are less likely to misuse alcohol. However, two studies found the opposite. One study in Austria involving 400 office-based physicians showed that physicians with higher education admitted to drinking alcohol more frequently (46). Another recent study of 13,980 medical professionals in China found that those with high education levels drink more heavily than those with lower education levels, especially among doctors (21). One possible explanation is that a higher level of education usually means more disposable money and a possibly broader social network, which may in turn contribute to drinking (21, 47).

Similar to the results of previous studies (9, 48–51), occupational burnout among healthcare workers was at a relatively high level (19.9%). In our study, occupational burnout (depersonalization) was associated with an increased risk of alcohol misuse. Alcohol consumption may be a coping strategy to deal with the occupational burnout related to the COVID-19 pandemic (11). Similarly, a cross-sectional survey of 4,000 randomly selected physicians in Danish found that the association between risky alcohol consumption and alexithymia was partially mediated through depersonalization (15). As risky alcohol use and burnout may independently affect patient safety, there is also a need to stratify which risk factors are most likely to lead to occupational burnout to develop appropriate interventions during the epidemic (14, 50). Recent literature explores the impact of the COVID-19 pandemic on burnout among healthcare workers (9, 17), even among clinical therapists (17), and how it has significantly impacted the mental well-being of healthcare workers overall (7, 52). Healthcare workers have reported high levels of burnout, further exacerbated by effects from the COVID-19 pandemic (14). Stress, emotional distress, individual and psychosocial factors, and personality traits are found to be potential risk factors for burnout (53, 54). The management and prevention of occupational burnout in clinical therapists remain important issues as they may lead to turnover and affect workforce sustainability.

## Limitations

Three limitations should be considered when interpreting the findings of the current study. First, the heterogeneity of tools used to measure occupational burnout and AUDIT-C limited the ability to compare the rate of occupational burnout and alcohol misuse across different studies. Second, as a cross-section survey, we cannot infer the causal relationship between alcohol misuse/use and other factors. Third, outcomes are based on self-reports of the amount of drinking/problematic behaviors as opposed to clinical measures.

## Conclusion

Contrary to our prediction, alcohol consumption among Chinese clinical therapists showed no significant increase during

the COVID-19 pandemic. This survey identified that occupational burnout, along with male sex, and cigarette smoking, was associated with alcohol misuse during the epidemic, which may guide the development of alcohol misuse detection and intervention practices for this professional group. However, more research is needed to explore specific factors of occupational burnout underlying drinking behavior among Chinese clinical therapists during the pandemic.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

## Ethics statement

The studies involving human participants were reviewed and approved by the study was approved by the Ethical Committee (IRB) at the Chaohu Hospital of Anhui Medical University (202002-kyxm-02). Written consent was obtained before they accessed the online questionnaire from each participant. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

FJ, HL, and Y-IT: study design. RT, TL, YL, KM, DM, FG, LX, and Y-IT: collection, analyses, and interpretation of data. RT: drafting the first version of the manuscript. MH and Y-IT: critical revision of the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Zhang Y, Lange KW. Coronavirus disease 2019 (Covid-19) and global mental health. *Glob Health J.* (2021) 5:31–6. doi: 10.1016/j.glohj.2021.02.004
- Usukura H, Seto M, Kunii Y, Suzuki A, Osaka K, Tomita H. The mental health problems of public health center staff during the Covid-19 pandemic in Japan. *Asian J Psychiatr.* (2021) 61:102676. doi: 10.1016/j.ajp.2021.102676
- Tucker JS, Rodriguez A, Green HD Jr, Pollard MS. Trajectories of alcohol use and problems during the Covid-19 pandemic: the role of social stressors and drinking motives for men and women. *Drug Alcohol Depend.* (2022) 232:109285. doi: 10.1016/j.drugalcdep.2022.109285
- Leon Rojas D, Castorena Torres F, Garza Ornelas B, Rodriguez-de-Ita J. Mental health outcomes and risk factors among female physicians during the Covid-19 pandemic. *Heliyon.* (2022) 8:e09325. doi: 10.1016/j.heliyon.2022.e09325
- Nesoff ED, Gutkind S, Sirota S, McKown AL, Veldhuis CB. Mental health and economic stressors associated with high-risk drinking and increased alcohol consumption early in the Covid-19 pandemic in the United States. *Prev Med.* (2021) 153:106854. doi: 10.1016/j.ypmed.2021.106854
- Capasso A, Jones AM, Ali SH, Foreman J, Tozan Y, DiClemente RJ. Increased alcohol use during the Covid-19 pandemic: the effect of mental health and age in a cross-sectional sample of social media users in the U.S. *Prev Med.* (2021) 145:106422. doi: 10.1016/j.ypmed.2021.106422
- Wang Y, Wan X. Study on job burnout and job satisfaction of doctors in public hospitals during Covid-19 pandemic. *J Chengdu Med Coll.* (2022) 17:114–8. doi: 10.3969/j.issn.1674-2257.2022.01.025. (in Chinese)
- Sobregau Sangra P, Aguilo Mir S, Castro Ribeiro T, Esteban-Sepulveda S, Garcia Pages E, Lopez Barbeito B, et al. Mental health assessment of spanish healthcare workers during the sars-cov-2 pandemic. A cross-sectional study. *Compr Psychiatry.* (2022) 112:152278. doi: 10.1016/j.comppsy.2021.152278
- Shaikh CF, Palmer Kelly E, Paro A, Cloyd J, Ejaz A, Beal EW, et al. Burnout assessment among surgeons and surgical trainees during the Covid-19 pandemic: a systematic review. *J Surg Educ.* (2022) 79:1206–20. doi: 10.1016/j.jurg.2022.04.015
- Peltier MR, Verplaetse TL, Mineur YS, Petrakis IL, Cosgrove KP, Picciotto MR, et al. Sex differences in stress-related alcohol use. *Neurobiol Stress.* (2019) 10:100149. doi: 10.1016/j.ynstr.2019.100149
- Martinez-Cao C, de la Fuente-Tomas L, Menendez-Miranda I, Velasco A, Zurrón-Madera P, García-Alvarez L, et al. Factors associated with alcohol and tobacco consumption as a coping strategy to deal with the coronavirus disease (Covid-19) pandemic and lockdown in Spain. *Addict Behav.* (2021) 121:107003. doi: 10.1016/j.addbeh.2021.107003
- Degenhardt L, Charlson F, Ferrari A, Santomauro D, Erskine H, Mantilla-Herrara A, et al. The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990–2016: a systematic analysis for the global burden of disease study 2016. *Lancet Psychiatry.* (2018) 5:987–1012. doi: 10.1016/S2215-0366(18)30337-7
- Armas Rojas NB, Lacey B, Simadibrata DM, Ross S, Varona-Perez P, Burrett JA, et al. Alcohol consumption and cause-specific mortality in Cuba: prospective study of 120623 adults. *EClinicalMedicine.* (2021) 33:100692. doi: 10.1016/j.eclinm.2020.100692
- Zhou AY, Panagioti M, Hann M, Agius R, Van Tongeren M, Esmail A, et al. Contributors to stress and burnout in junior doctors during the Covid-19 pandemic. *Saf Health Work.* (2022) 13:S294–5. doi: 10.1016/j.shaw.2021.12.1672
- Pedersen AF, Sorensen JK, Bruun NH, Christensen B, Vedsted P. Risky alcohol use in Danish physicians: associated with alexithymia and burnout? *Drug Alcohol Depend.* (2016) 160:119–26. doi: 10.1016/j.drugalcdep.2015.12.038
- Mo D, Min K, Gluck R, Jiang F, Tao R, Geng F, et al. Alcohol use and misuse among Chinese psychiatrists during the early Covid-19 pandemic. *Front Psych.* (2022) 13:933814. doi: 10.3389/fpsy.2022.933814
- Sullivan D, Sullivan V, Weatherspoon D, Frazer C. Comparison of nurse burnout, before and during the Covid-19 pandemic. *Nurs Clin North Am.* (2022) 57:79–99. doi: 10.1016/j.cnur.2021.11.006
- Medisauskaite A, Kamau C. Does occupational distress raise the risk of alcohol use, binge-eating, ill health and sleep problems among medical doctors? A UK cross-sectional study. *BMJ Open.* (2019) 9:e027362. doi: 10.1136/bmjopen-2018-027362
- Liu M, Zhao J. Ethical behaviors among counselors and psychotherapists with different professional background. *Chin Ment Health J.* (2012) 26:819–25. doi: 10.3969/j.issn.1000-6729.2012.11.004. (in Chinese)
- He L. A Survey on the Practice Status of Psychological Counseling and Psychotherapists with Different Occupational Background in Guizhou Province. Zunyi Medical University. (2022) (MA thesis in Chinese).
- Tao R, Jiang F, Min K, Liu T, Liu Y, Xia L, et al. Alcohol use among mental health professionals in China: a nationwide cross-sectional survey. *Alcohol Alcohol.* (2021) 56:351–9. doi: 10.1093/alc/alga065
- Yip BH, Chung RY, Chung VC, Kim J, Chan IW, Wong MC, et al. Is alcohol use disorder identification test (Audit) or its shorter versions more useful to identify risky drinkers in a Chinese population? A diagnostic study. *PLoS One.* (2015) 10:e0117721. doi: 10.1371/journal.pone.0117721
- Li Q, Babor TF, Hao W, Chen X. The Chinese translations of alcohol use disorders identification test (Audit) in China: a systematic review. *Alcohol Alcohol.* (2011) 46:416–23. doi: 10.1093/alc/alcr012
- Poghossyan L, Aiken LH, Sloane DM. Factor structure of the Maslach burnout inventory: An analysis of data from large scale cross-sectional surveys of nurses from eight countries. *Int J Nurs Stud.* (2009) 46:894–902. doi: 10.1016/j.ijnurstu.2009.03.004
- Plata A, Motoki K, Spence C, Velasco C. Trends in alcohol consumption in relation to the Covid-19 pandemic: a cross-country analysis. *Int J Gastron Food Sci.* (2022) 27:100397. doi: 10.1016/j.ijgfs.2021.100397
- Wang L. *Study on the Competence Characteristics Model of Chinese Therapists.* Beijing: Capital Medical University (2007) (in Chinese).
- Shen J, Wu Z. Research review on domestic clinical psychologist competency assessment. *Med Philosophy.* (2021) 42:50–3. doi: 10.12014/j.issn.1002-0772.2021.12.12. (in Chinese)
- Patrick ME, Terry-McElrath YM, Miech RA, Keyes KM, Jager J, Schulenberg JE. Alcohol use and the Covid-19 pandemic: historical trends in drinking, contexts, and reasons for use among U.S. adults. *Soc Sci Med.* (2022) 301:114887. doi: 10.1016/j.socscimed.2022.114887
- Borges TL, Da Cruz de Sousa LP, Reisdorfer E, KGG V, Pillon SC, Miaso AI. Factors associated with alcohol use and abuse in Brazilian primary health care settings. *Arch Psychiatr Nurs.* (2021) 35:486–90. doi: 10.1016/j.apnu.2021.06.008
- Hitzemann R, Bergeson SE, Berman AE, Bubier JA, Chesler EJ, Finn DA, et al. Sex differences in the brain transcriptome related to alcohol effects and alcohol use disorder. *Biol Psychiatry.* (2022) 91:43–52. doi: 10.1016/j.biopsych.2021.04.016
- Garnett C, Kastaun S, Brown J, Kotz D. Alcohol consumption and associations with sociodemographic and health-related characteristics in Germany: a population survey. *Addict Behav.* (2022) 125:107159. doi: 10.1016/j.addbeh.2021.107159
- Dir AL, Bell RL, Adams ZW, Hulvershorn LA. Gender differences in risk factors for adolescent binge drinking and implications for intervention and prevention. *Front Psych.* (2017) 8:289. doi: 10.3389/fpsy.2017.00289
- An FR, Xiang YT, Yu L, Ding YM, Ungvari GS, Chan SW, et al. Prevalence of nurses' smoking habits in psychiatric and general hospitals in China. *Arch Psychiatr Nurs.* (2014) 28:119–22. doi: 10.1016/j.apnu.2013.11.008
- Li Y, Wang J, Zhao L, Wang Z, Yu D, He Y, et al. The drinking status and associated factors in adults in China. *Chin J Epidemiol.* (2018) 39:898–903. doi: 10.3760/cma.j.issn.0254-6450.2018.07.007. (in Chinese)
- Yonek JC, Meacham MC, Shumway M, Tolou-Shams M, Satre DD. Smoking reduction is associated with lower alcohol consumption and depressive symptoms among young adults over one year. *Drug Alcohol Depend.* (2021) 227:108922. doi: 10.1016/j.drugalcdep.2021.108922
- Garnett C, Oldham M, Shahab L, Tattan-Birch H, Cox S. Characterising smoking and smoking cessation attempts by risk of alcohol dependence: a representative, cross-sectional study of adults in England between 2014–2021. *Lancet Reg Health Eur.* (2022) 18:100418. doi: 10.1016/j.lanep.2022.100418
- Tiguman GMB, Silva MT, Galvao TF. Prevalence of depressive and anxiety symptoms and their relationship with life-threatening events, tobacco dependence and hazardous alcohol drinking: a population-based study in the Brazilian Amazon. *J Affect Disord.* (2022) 298:224–31. doi: 10.1016/j.jad.2021.10.059
- GBD 2019 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the global burden of disease study 2019. *Lancet.* (2021) 397:2337–60. doi: 10.1016/S0140-6736(21)01169-7
- Shin J, Paik HY, Joung H, Shin S. Smoking and alcohol consumption influence the risk of cardiovascular diseases in Korean adults with elevated blood pressure. *Nutr Metab Cardiovasc Dis.* (2022) 32:2187–94. doi: 10.1016/j.numecd.2022.06.004
- Huang J, Leung DK, Chan EO, Lok V, Leung S, Wong I, et al. A global trend analysis of kidney cancer incidence and mortality and their associations with smoking, alcohol consumption, and metabolic syndrome. *Eur Urol Focus.* (2022) 8:200–9. doi: 10.1016/j.euf.2020.12.020
- Tverdal A, Selmer R, Thelle DS. Alcohol consumption and incidence of pancreatic cancer. *Glob Epidemiol.* (2022) 4:100078. doi: 10.1016/j.gloepi.2022.100078
- Brown J, West R, Beard E, Brennan A, Drummond C, Gillespie D, et al. Are recent attempts to quit smoking associated with reduced drinking in England? A cross-sectional population survey. *BMC Public Health.* (2016) 16:535. doi: 10.1186/s12889-016-3223-6
- Windle M, Windle RC. Sex differences in peer selection and socialization for alcohol use from adolescence to young adulthood and the influence of marital and parental status. *Alcohol Clin Exp Res.* (2018) 42:2394–402. doi: 10.1111/acer.13894
- Evans-Polce RJ, Jang BJ, Maggs JL, Patrick ME. Gender and age differences in the associations between family social roles and excessive alcohol use. *Soc Sci Med.* (2020) 244:112664. doi: 10.1016/j.socscimed.2019.112664

45. Liu R, Chen L, Zhang F, Zhu R, Lin X, Meng X, et al. Trends in alcohol intake and the association between socio-demographic factors and volume of alcohol intake amongst adult male drinkers in China. *Int J Environ Res Public Health*. (2019) 16:573. doi: 10.3390/ijerph16040573
46. Pjrek E, Silberbauer L, Kasper S, Winkler D. Alcohol consumption in Austrian physicians. *Ann General Psychiatry*. (2019) 18:22. doi: 10.1186/s12991-019-0246-2
47. Wang X, Chen Q, Zhao Q, Zhu C. Alcohol consumption and income: evidence from one-sample and two-sample Mendelian randomizations. *Econ Lett*. (2022) 219:110788. doi: 10.1016/j.econlet.2022.110788
48. Shahi S, Paudel DR, Bhandari TR. Burnout among resident doctors: An observational study. *Ann Med Surg (Lond)*. (2022) 76:103437. doi: 10.1016/j.amsu.2022.103437
49. Kuriyama A, Shikino K, Moriya M, Sadohara M, Nonaka S, Nagasaki K, et al. Burnout, depression, anxiety, and insomnia of internists and primary care physicians during the Covid-19 pandemic in Japan: a cross-sectional survey. *Asian J Psychiatr*. (2022) 68:102956. doi: 10.1016/j.ajp.2021.102956
50. Daryanto B, Rahmadiani N, Amorga R, Kautsarani I, Susilo H, Persada Isma SP. Burnout syndrome among residents of different surgical specialties in a tertiary referral teaching hospital in Indonesia during Covid-19 pandemic. *Clin Epidemiol Glob Health*. (2022) 14:100994. doi: 10.1016/j.cegh.2022.100994
51. Acar Sevinc S, Metin S, Balta Basi N, Cinar AS, Turkel Ozkan M, Oba S. Anxiety and burnout in anesthetists and intensive care unit nurses during the Covid-19 pandemic: a cross-sectional study. *Braz J Anesthesiol*. (2022) 72:169–75. doi: 10.1016/j.bjane.2021.07.011. (in Chinese)
52. Ma X, Jiang H, Guo Y, Chang G, Zhang Y, Zhou Y. The relationship between mental health status and job burnout of medical staffs during the outbreak of Covid-19. *J Clin Psychiatry*. (2022) 32:33–8. doi: 10.3969/j.issn.1005-3220.2022.01.010
53. Navines R, Olive V, Fonseca F, Martin-Santos R. Work stress and resident burnout, before and during the Covid-19 pandemic: An up-date. *Med Clin (Engl Ed)*. (2021) 157:130–40. doi: 10.1016/j.medcle.2021.04.005
54. Zisook S, Doran N, Mortali M, Hoffman L, Downs N, Davidson J, et al. Relationship between burnout and major depressive disorder in health professionals: a hear report. *J Affect Disord*. (2022) 312:259–67. doi: 10.1016/j.jad.2022.06.047



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# Overtime work, job autonomy, and employees' subjective well-being: Evidence from China

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**Introduction:** Chinese workers suffer more from overtime than in many countries. Excessive working hours can crowd out personal time and cause work-family imbalance, affecting workers' subjective well-being. Meanwhile, self-determination theory suggests that higher job autonomy may improve the subjective well-being of employees.

**Methods:** Data came from the 2018 China Labor-force Dynamics Survey (CLDS 2018). The analysis sample consisted of 4,007 respondents. Their mean age was 40.71 (SD=11.68), and 52.8% were males. This study adopted four measures of subjective well-being: happiness, life satisfaction, health status, and depression. Confirmation factor analysis was employed to extract the job autonomy factor. Multiple linear regression methods were applied to examine the relationship between overtime, job autonomy, and subjective well-being.

**Results:** Overtime hours showed weak association with lower happiness ( $\beta = -0.002$ ,  $p < 0.01$ ), life satisfaction ( $\beta = -0.002$ ,  $p < 0.01$ ), and health status ( $\beta = -0.002$ ,  $p < 0.001$ ). Job autonomy was positively related to happiness ( $\beta = 0.093$ ,  $p < 0.01$ ), life satisfaction ( $\beta = 0.083$ ,  $p < 0.01$ ). There was a significant negative correlation between involuntary overtime and subjective well-being. Involuntary overtime might decrease the level of happiness ( $\beta = -0.187$ ,  $p < 0.001$ ), life satisfaction ( $\beta = -0.221$ ,  $p < 0.001$ ), and health status ( $\beta = -0.129$ ,  $p < 0.05$ ) and increase the depressive symptoms ( $\beta = 1.157$ ,  $p < 0.05$ ).

**Conclusion:** While overtime had a minimal negative effect on individual subjective well-being, involuntary overtime significantly enlarged it. Improving individual's job autonomy is beneficial for individual subjective well-being.

## KEYWORDS

overtime work, job autonomy, subjective well-being, involuntary overtime, China

## Introduction

Economic development does not necessarily lead to reduced working hours and extended leisure time. On the contrary, working overtime has gradually become a new normal in China in recent years, especially in some industries. In 2016, a famous Chinese Internet company claimed that it was performing the "996" working-time system, which requires the employees to work from 9 a.m. to 9 p.m. for 6 days a week. This working-time system has become an implied routine among technology companies, startups, and other private businesses. This phenomenon

has brought “working overtime” back into public view and aroused widespread concern, although it had existed for a long time in labor-intensive industrialization (1).

Since 1995, China has implemented a working-time system of 8 h a day, 5 days a week. Based on the standard working hours, overtime work was usually defined as working more than 40 h a week (2). A recent meta-analysis of working overtime among Chinese employees showed that work hours exhibited a fluctuating upward trend (3). Working overtime had become an unofficial part of life. Cooke surveyed small commercial and retail businesses in China and found that 22% of participants worked over 70 h a week (4). According to the China Labor Statistics Yearbook (NBS, 2021), the average weekly working hours of the 2020 Chinese urban employees were 47 h (48.1 h for males and 45.6 h for females). Among the 19 industries announced, 18 had average weekly working hours of more than 40 h, and 14 had more than 44 h. Workers in the lodging and catering industry and wholesale and retail industry worked 52.6 and 50.1 h a week, respectively, experiencing longer working hours than their counterparts in other industries. Chinese workers suffer from more severe overtime work than in other OECD countries (5).

Figure 1 showed the weekly working hours per week of urban employed persons by educational attainment (NBS, 2021). This indicated that the average working hours of Chinese employees had been on the rise in recent years. While employees of all educational levels worked overtime in general, there was a gap between employees of different education levels. The average weekly working hours of no-schooling and primary education employees were lower than those of higher education employees, mainly because most of them worked in agriculture, forestry, animal husbandry, and fishing industries, where the average working hours were lower. Employees with junior high and high school education levels had the highest average weekly work hours. They are low-educated and low-skilled, work mainly in labor-intensive industries and have to face severe overtime.

Tsai et al. examined the convergence and divergence pattern of working overtime in four East Asia countries/districts: Japan, South

Korea, Taiwan, and China (6). They found that professional employees experienced more working overtime in Japan, while workers in disadvantaged situations (e.g., migrant workers) experienced long work hours in China. Compared to their full-time counterparts, casual workers appeared to work longer to compensate for their wages. Based on Self-determination theory, work motivation can be classified into internal motivation (e.g., participating in activities, gaining more knowledge, improving skills, and building social connections) and external motivation (e.g., earning rewards and avoiding punishment) (7–9). Therefore, Liu et al. proposed an overtime motivation model consisting of internal and external motivation factors (5). Multiple factors can drive overtime at the same time. Working overtime is sometimes not optional for some employees, even though others choose or even pursue overtime for some reason. Previous studies documented that considerable working overtime is mandatory and often imposed by their supervisors without advance notice (10, 11).

Subjective well-being (SWB) includes cognitive assessment of whole life satisfaction and some particular aspects of life, such as job satisfaction, health status, and positive and negative emotional responses to ongoing life (12, 13). In recent years, overtime has been considered a key factor influencing people's well-being. Previous empirical literature suggested a negative relationship between overtime and well-being (14). Studies indicated that working overtime was related to increased work-life conflict (15, 16), job burnout (17), fatigue, depression, and stress (18). As a result, working overtime impairs workers' well-being (19).

Long working hours were associated with psychological impairments in various circumstances. Ahn noted that less work hours induced individuals to exercise regularly and decreased the likelihood of smoking (20). There were correlations between overwork and smoking, alcoholism, and overeating (21, 22). A meta-analysis reported a negative association between weekly work hours and health (23). Van der Hulst (24) found that long work hours might trigger physical diseases, such as cardiovascular and diabetes, and increase self-reported subjective fatigue and declining health. Caruso et al. concluded that

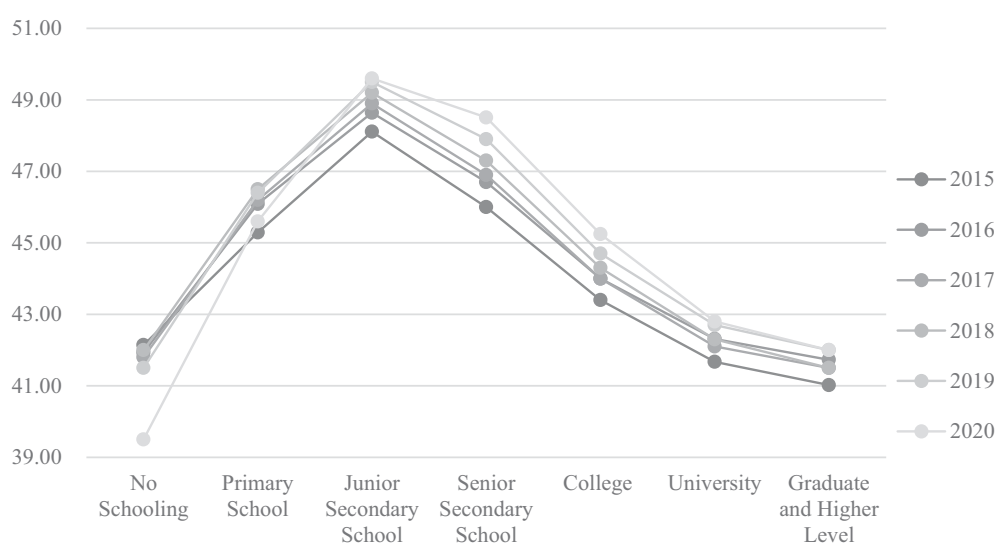


FIGURE 1

Weekly working hours of urban employed persons by educational attainment (hours/per week).



working overtime was related to ill health, higher injury rates, and higher mortality (25). The adverse effects of long working hours on the physical health of workers also included shortened sleep, musculoskeletal disorders, psychosomatic symptoms, cerebrovascular diseases, hypertension, obesity, risk of stroke, and other diseases (26–31).

The negative association between long work hours and psychological consequences is well documented. Excessive overtime work was related to a higher risk of mental health problems (32). Virtanen et al. conducted a meta-analysis and concluded that long working hours were positively associated with depressive symptoms, and this association was stronger in Asian countries than in others (33). Ma's study indicated that long working hours had positive and significant relationship with the risk of mental illness, and the effect was more significant for women, white-collar workers, and employees in micro-firms, compared with their counterparts (34). Sex-stratified analysis showed that working long hours increased the odds of depression and anxiety symptoms among females (35). Besides depression and anxiety symptoms, other psychological issues, such as stress and suicidal tendencies, were also proven to be related to long working hours (36, 37).

Though overtime had an adverse effect on well-being, the effect might be offset to some extent when workers volunteered to work overtime. A study highlighted the risks for employees' well-being associated with unregulated extended work availability – especially when it is perceived as illegitimate (38). Employees who work long hours against their will are more likely to experience a lower level of subjective well-being than those who choose to work overtime. Karhula et al. suggested that tight deadlines, performance pressure, weekend work and lack of working time autonomy are linked to impaired well-being among health care employees (39).

Self-determination theory assumes that people have basic psychological needs for autonomy, relatedness, and competence, which are essential for well-being (40). Research has suggested a relationship between autonomy and subjective well-being (41). Job autonomy, often measured by the extent to which individuals can decide what to do and how and when to do it (42), can increase workers' sense of control (43) and decrease work-life conflict (16), thereby serving as a significant predictor of well-being. Yu and Leka highlighted that control over time-off was related to decreased depression, anxiety, stress and work-family conflict, while control over daily hours was related to decreased stress and work-family conflict (41). Previous literature showed that autonomy was one of the strongest predictors of individuals' life satisfaction and happiness. It exerted direct and indirect impacts on different SWB facets in Lebanese nurses, including life satisfaction, happiness, and positive and negative emotions (44). Bastida, Neira, and Lacalle-Calderon analyzed data from the European Social Survey and found that job discretion influenced SWB, which differed between males and females (45).

The relationship between overtime, job autonomy, and subjective well-being has been well established with the growing literature. However, the evidence of this relationship was mostly limited to western countries and East Asia countries such as Japan and Korea. Few studies have been conducted on overtime, job autonomy, and well-being in China, where workers are experiencing serious overtime and less job autonomy. Moreover, in China, though overtime is a common problem faced by employees in almost all industries in China, it is more serious for low-educated and low-skilled employees, which is considerably different from the high-educated study

populations (e.g., medical staff and teachers) in previous studies in other countries. In these respects, this study aims to fill the research gap by addressing the association between overtime-related factors (particularly overtime hours, voluntary overtime, and job autonomy) and subjective well-being among Chinese employees. In view of this, the following hypotheses were formulated:

*H1: Overtime hours have a negative relationship with the subjective well-being of employees.*

*H2: Job autonomy has a positive relationship with the subjective well-being of employees.*

*H3: There are interactive effects of overtime hours and job autonomy on the subjective well-being of employees who work overtime.*

## Materials and methods

### Sample

We obtained data from the 2018 China Labor-force Dynamics Survey (CLDS 2018), a comprehensive survey focusing on the labor force aged 15–64 in China's urban and rural areas. CLDS uses a multi-stage, multi-level probability sampling method proportional to the size of the labor force, which covers 28 provinces and cities in China (excluding Xinjiang, Tibet, and Hainan). It collects information on respondents' education, employment, labor rights, occupational mobility, occupational protection and health, and occupations. The survey's core information focuses on the current work situation and changes in satisfaction and happiness. Moreover, the survey collects community information about the labor force and family information such as demographic structure and financial and property status. CLDS 2018 contains a sample size of 381 communities/villages, 9,868 households, and 16,537 individuals. The present study retained 4,081 respondents from the survey who provided information on all the key variables: overtime hours, job autonomy, voluntary overtime, and subjective well-being. After excluding samples with missing values in other variables, our analysis sample was 4,007. Their mean age was 40.71 (SD = 11.68), and 52.8% were males. Given that the voluntary overtime variable was not applicable to the non-overtime group, it was only for the overtime group, with a subsample size of 1,188 (Mean = 0.31, SD = 11.68).

### Survey questions and variables

*Subjective well-being:* Literature has suggested two common measurements of subjective well-being. One is life satisfaction orientation, including the assessment of happiness and life satisfaction in general and in specific aspects (46, 47). The other is health psychology orientation, which contains positive and negative emotions related to psychological well-being (48, 49). Therefore, the present study employed four indicators of subjective well-being: happiness, life satisfaction, health status, and depression. In the CLDS

survey, happiness was measured using the question “In general, do you think your life is happy?” with a 5-point Likert scale answer (from 0 = very unhappy to 4 = very happy). Life satisfaction was obtained using the question, “In general, are you satisfied with your life?” Options were scored from 0 (very unsatisfied) to 4 (very satisfied). Health status was constructed based on self-reported health, ranging from 0 to 4, with higher scores representing better health status. Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D), which was developed by Radloff in 1977 and verified as a valid and reliable instrument for measuring depression among Chinese individuals (50–52). CES-D has 20 measurement items. Options were coded as “0” for basically no, “1” for rarely, “2” for often, and “3” for almost often. Scores were summed at 0–60; the higher the score, the greater the depression symptoms.

*Overtime hours* referred to the total overtime hours worked by the respondents in the previous month. To reduce sample attrition, we assigned 0 to the overtime hours of workers who did not work overtime in the previous month.

*Voluntary overtime* referred to whether the respondents have the option of working overtime.

*Job autonomy* was measured using the following three questions: “To what extent is the work content determined by yourself?,” “To what extent is the progress of the work determined by yourself?,” and “To what extent is the workload/intensity determined by yourself?” Responses ranged from 1 (totally up to others) to 3 (totally up to oneself). Principal component factor analysis was employed to extract a common factor from these three questions (KMO = 0.776, Cronbach’s  $\alpha$  = 0.953). Table 1 shows the rotated standardized factor loadings of the observable variables.

Our regression models also considered covariates, mainly socioeconomic and demographic indicators. The control variables included gender (1 = male, 0 = female), age (continuous, ranging from 15 to 74), marital status (1 = unmarried, 0 = married), membership of the Communist Party of China (CPC) (1 = yes, 0 = no), hukou status (1 = urban, 0 = rural), educational years (continuous, ranging from 0 to 19), and income (personal wage income in 2017, continuous and logarithmic, ranging from 0 to 12.35). Income was winsorized at the 1 and 99% levels to reduce the impact of outliers.

## Statistical analysis

This study extracted the job autonomy factor using confirmatory factor analysis (CFA) based on related questions. The bivariate correlation method was performed to analyze the associations between the indicators of subjective well-being and other factors that might impact them. Further analyses were conducted to test the

relationships between overtime hours, job autonomy, and subjective well-being using multiple linear regression approaches. Finally, the study examined the associations between overtime hours, voluntary overtime and subjective well-being among overtime workers. The latter two analyses only involved the overtime group, with a sample size of 1,188. All analyses were conducted using Stata 16.0.

## Results

The means, standard deviations (SDs), and associations between variables are shown in Table 2. The means of happiness, life satisfaction, and health status were above the average (2.889, 2.806, and 2.896, respectively). The mean depression was 6.619 (SD = 8.939). The mean overtime hours were 22.248 in the previous month. Mean job autonomy was below zero, which means employees had lower job autonomy than other labor market participants such as employers, self-employed, and farmers. Most respondents were married, had rural hukou status, and had no affiliation with CPC.

There was a very strong correlation between happiness and life satisfaction ( $r = 0.764$ ,  $p < 0.001$ ). Overtime hours were negatively related to happiness ( $r = -0.063$ ,  $p < 0.001$ ) and life satisfaction ( $r = -0.083$ ,  $p < 0.001$ ). Job autonomy was positively related to happiness ( $r = 0.079$ ,  $p < 0.001$ ), life satisfaction ( $r = 0.077$ ,  $p < 0.001$ ), and health status ( $r = 0.056$ ,  $p < 0.001$ ); it was negatively related to depression ( $r = -0.037$ ,  $p < 0.05$ ). Regarding controlled variables, males showed fewer depressive symptoms than females. Older age was associated with bad health status. Being unmarried showed negative relationships with happiness and life satisfaction and positive relationships with health status and depression. Membership in CPC showed a similar pattern to educational years; both were positively related to happiness, life satisfaction, and health status and negatively related to depression. Urban hukou status was associated with higher happiness and life satisfaction. Income was positively associated with happiness, life satisfaction and health status and negatively associated with depressive symptoms.

Job autonomy and voluntary overtime were considered two facets of job control. To examine the relationship between overtime hours and job autonomy and well-being, we tested the independent and interactive effects of overtime hours and job autonomy, overtime hours and voluntary overtime, respectively. Table 3 presents the results of multiple linear regression analysis of overtime hours and job autonomy. Overtime hours showed significantly correlate with happiness, life satisfaction, and health status. The associations between overtime hours and happiness, life satisfaction and health status were modest ( $\beta = -0.002$ ,  $p < 0.01$ ;  $\beta = -0.002$ ,  $p < 0.01$ ;  $\beta = -0.002$ ,  $p < 0.001$ , separately). Job autonomy was positively related to happiness

TABLE 1 Standardized factor loadings of the observable variables.

Latent construct	Observed variables	Factor loading
Job autonomy	To what extent is the work content determined by yourself?	0.910
	To what extent is the progress of the work determined by yourself?	0.929
	To what extent is the workload/intensity determined by yourself?	0.929

TABLE 2 General characteristics of variables and bivariate correlation ( $N = 4,007$ ).

	Mean	S.D.	Happiness	Life satisfaction	Health status	Depression	Overtime hours	Voluntary overtime	Job autonomy	Gender	Age	Marital status	Member-ship of CPC	Hukou status	Educational years	Income
Happiness	2.889	0.836	1.000													
Life satisfaction	2.806	0.859	0.764***	1.000												
Health status	2.896	0.837	0.233***	0.252***	1.000											
Depression	6.619	8.393	-0.248***	-0.263***	-0.254***	1.000										
Overtime hours	22.248	41.071	-0.063***	-0.083***	-0.067***	0.037*	1.000									
Voluntary overtime	0.312	0.464	-0.093**	-0.103***	-0.084**	0.074*	-0.019	1.000								
Job autonomy	-0.765	0.861	0.079***	0.077***	0.056***	-0.037*	-0.042**	-0.185***	1.000							
Gender	0.528	0.499	-0.020	-0.011	0.021	-0.083***	0.068***	-0.050 <sup>+</sup>	-0.006	1.000						
Age	40.710	11.680	-0.025	0.026 <sup>+</sup>	-0.162***	-0.014	0.039**	0.049 <sup>+</sup>	-0.054***	0.144***	1.000					
Marital status	0.183	0.387	-0.073***	-0.077***	0.076***	0.043**	-0.023	-0.031	0.003	-0.025	-0.458***	1.000				
Membership of CPC	0.153	0.360	0.104***	0.104***	0.019	-0.043**	-0.093***	0.009	0.041**	0.101***	0.079***	-0.053***	1.000			
Hukou status	0.345	0.475	0.046**	0.052***	0.028 <sup>+</sup>	0.004	-0.136***	0.136***	-0.004	-0.018	0.035*	0.019	0.173***	1.000		
Educational years	11.519	3.735	0.119***	0.123***	0.136***	-0.051**	-0.237***	0.049 <sup>+</sup>	0.084***	0.000	-0.324***	0.179***	0.315***	0.366***	1.000	
Income	10.297	1.849	0.035*	0.038**	0.073***	-0.071***	-0.057***	-0.071**	0.035*	0.131***	0.031 <sup>+</sup>	-0.091***	0.117***	0.120***	0.188***	1.000

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , <sup>+</sup> $p < 0.1$ ; For the variable "voluntary overtime," the sample size is 1,188, including only overtime workers.

TABLE 3 Multiple linear regression analysis of overtime hours and job autonomy.

	Happiness		Life satisfaction		Health status		Depression	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overtime hours	−0.002** (0.001)	−0.001 (0.001)	−0.002** (0.001)	−0.002* (0.001)	−0.002*** (0.001)	−0.003*** (0.001)	0.005 (0.006)	0.006 (0.009)
Job autonomy	0.093** (0.029)	0.071+ (0.037)	0.083** (0.031)	0.080* (0.039)	0.025 (0.029)	0.066+ (0.036)	−0.161 (0.301)	−0.202 (0.381)
Overtime hours × Job autonomy		0.001 (0.001)		0.000 (0.001)		−0.001+ (0.001)		0.001 (0.007)
Gender (female = 0)	−0.073 (0.052)	−0.075 (0.052)	−0.081 (0.054)	−0.081 (0.054)	0.043 (0.050)	0.047 (0.050)	−1.658** (0.529)	−1.662** (0.530)
Age	−0.001 (0.003)	−0.001 (0.003)	0.004 (0.003)	0.004 (0.003)	−0.009*** (0.003)	−0.009*** (0.003)	−0.001 (0.028)	−0.001 (0.028)
Marital status (married = 0)	−0.155* (0.075)	−0.158* (0.075)	−0.063 (0.078)	−0.063 (0.078)	0.077 (0.073)	0.083 (0.073)	0.615 (0.770)	0.608 (0.771)
Membership of CPC (no = 0)	0.191** (0.068)	0.194** (0.068)	0.202** (0.071)	0.202** (0.071)	0.018 (0.066)	0.012 (0.066)	0.499 (0.696)	0.505 (0.697)
Hukou status (rural = 0)	−0.041 (0.057)	−0.041 (0.057)	−0.066 (0.059)	−0.066 (0.059)	−0.095+ (0.055)	−0.095+ (0.055)	1.210* (0.584)	1.210* (0.585)
Educational years	0.013 (0.009)	0.012 (0.009)	0.025** (0.009)	0.025** (0.009)	0.004 (0.008)	0.005 (0.008)	−0.055 (0.088)	−0.055 (0.089)
Income (ln)	0.001 (0.015)	0.000 (0.015)	−0.002 (0.015)	−0.002 (0.015)	0.008 (0.014)	0.010 (0.014)	−0.195 (0.150)	−0.196 (0.150)
Constant	2.956*** (0.225)	2.955*** (0.225)	2.504*** (0.233)	2.504*** (0.233)	3.150*** (0.218)	3.152*** (0.217)	10.068*** (2.297)	10.066*** (2.298)
N	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188
R <sup>2</sup>	0.037	0.038	0.045	0.045	0.035	0.038	0.017	0.017

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , + $p < 0.1$ ; Standard errors are in parentheses.

( $\beta = 0.093$ ,  $p < 0.01$ ), life satisfaction ( $\beta = 0.083$ ,  $p < 0.01$ ). The correlations between job autonomy and health and depression did not reach significance (see Model 1, Model 3, Model 5, and Model 7 in Table 3). There were significant interaction effects of overtime hours and job autonomy on health status. More overtime hours would offset the positive effect of job autonomy on health status (see Model 6 in Table 3). The interaction effects of overtime hours and job autonomy on happiness, life satisfaction, and depression did not reach significance (see Model 2, Model 4, and Model 8 in Table 3).

We analyzed the relationship between overtime hours and voluntary (or involuntary) overtime and employees' subjective well-being. The results were presented in Table 4. The results of Model 1, Model 3, Model 5, and Model 7 in Table 4 indicated a significant negative correlation between involuntary overtime and subjective well-being. Involuntary overtime might decrease the level of happiness ( $\beta = -0.187$ ,  $p < 0.001$ ), life satisfaction ( $\beta = -0.221$ ,  $p < 0.001$ ), and health status ( $\beta = -0.129$ ,  $p < 0.05$ ) and increase the depressive symptoms substantially ( $\beta = 1.157$ ,  $p < 0.05$ ). As for the interaction effect of overtime hours and voluntary overtime, the correlation of interaction term with life satisfaction was significant at the 0.1 level (see Model 4 in Table 4). Overtime hours and

involuntary overtime both reduced employees' life satisfaction, and the longer the involuntary overtime, the deeper the reduction in individual's life satisfaction. The interaction effects of overtime hours and voluntary overtime on happiness, health status, and depression did not reach significance (see Model 2, Model 6, and Model 8 in Table 4).

## Discussion

The research field of well-being is devoting much effort to identifying the influencing factors in the workplace. Company-oriented long working hours have become an important strategy for coping with human resource shortages and maximizing the exploitation of human resources, which are considered related to lower well-being. Although overtime patterns are heterogeneous across individuals in different industries and with different socio-demographic characteristics, they also have some features in common. Therefore, we introduced overtime and job control, including worktime control and job autonomy, into the study on employees' subjective well-being. Our study estimated the influence of overtime

TABLE 4 Multiple linear regression of overtime hours and voluntary overtime.

	Happiness		Life satisfaction		Health status		Depression	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overtime hours	−0.002** (0.001)	−0.002* (0.001)	−0.002** (0.001)	−0.001 (0.001)	−0.002*** (0.001)	−0.002* (0.001)	0.005 (0.006)	−0.001 (0.008)
Voluntary overtime (yes = 0)	−0.187*** (0.054)	−0.161* (0.068)	−0.221*** (0.056)	−0.140* (0.070)	−0.129* (0.052)	−0.083 (0.066)	1.157* (0.553)	0.585 (0.695)
Overtime hours × Voluntary overtime		−0.001 (0.001)		−0.003+ (0.001)		−0.002 (0.001)		0.019 (0.014)
Gender (female = 0)	−0.072 (0.052)	−0.072 (0.052)	−0.082 (0.054)	−0.083 (0.053)	0.040 (0.050)	0.039 (0.050)	−1.630** (0.528)	−1.619** (0.528)
Age	−0.001 (0.003)	−0.001 (0.003)	0.005+ (0.003)	0.005+ (0.003)	−0.009*** (0.003)	−0.009*** (0.003)	−0.004 (0.028)	−0.003 (0.028)
Marital status (married = 0)	−0.148* (0.075)	−0.149* (0.075)	−0.059 (0.078)	−0.061 (0.078)	0.076 (0.073)	0.075 (0.073)	0.631 (0.768)	0.648 (0.768)
Membership of CPC (no = 0)	0.186** (0.068)	0.189** (0.068)	0.196** (0.070)	0.203** (0.070)	0.014 (0.066)	0.018 (0.066)	0.531 (0.695)	0.481 (0.696)
Hukou status (rural = 0)	−0.026 (0.057)	−0.025 (0.057)	−0.045 (0.059)	−0.044 (0.059)	−0.081 (0.056)	−0.081 (0.056)	1.079+ (0.587)	1.073+ (0.587)
Educational years	0.016+ (0.009)	0.016+ (0.009)	0.028** (0.009)	0.028** (0.009)	0.005 (0.008)	0.005 (0.008)	−0.064 (0.088)	−0.059 (0.088)
Income (ln)	−0.002 (0.015)	−0.002 (0.015)	−0.006 (0.015)	−0.007 (0.015)	0.006 (0.014)	0.005 (0.014)	−0.172 (0.150)	−0.163 (0.150)
Constant	2.901*** (0.222)	2.901*** (0.222)	2.476*** (0.230)	2.475*** (0.229)	3.164*** (0.215)	3.164*** (0.215)	9.856*** (2.266)	9.862*** (2.266)
N	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188
R <sup>2</sup>	0.039	0.039	0.051	0.054	0.039	0.040	0.021	0.022

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , + $p < 0.1$ ; Standard errors are in parentheses.

hours, voluntary overtime, and job autonomy on subjective well-being among employees in China.

The associations between overtime hours and subjective well-being were modest in three aspects (happiness, life satisfaction, and self-reported health status) among Chinese workers. Though the relationship between overtime and well-being was documented in previous literature, a few studies found no evidence for these workhour effects (53, 54). Sparks et al. reported that the extent of association between overtime and adverse health outcome is modest (55). In this regard, the correlation between overtime hours and well-being remained suspicious. More work should be done across different population groups before firm conclusions can be drawn. Working overtime would squeeze time for family activities, leisure, and fatigue recovery and interfere with work-home balance, thereby lowering workers' well-being. However, this association was relatively weak in this study, not exerting a large effect on individuals' subjective well-being. For some employees, overtime might compensate for their low income. Given that overtime premium was relatively better in China than in other countries, overtime premium might account for 50% of employees' salary (6, 56). The increase in income might offset the negative impact of overtime, ascribed to the positive relationship between income and well-being (57, 58).

There was a significant relationship between job autonomy and employees' well-being. The more control employees had over their work content, work progress, and workload, the better their well-being (i.e., higher levels of happiness, life satisfaction, and health status). The results were consistent with the self-determination theory. Meeting the basic psychological needs for autonomy would increase the employees' well-being. The association between job autonomy and subjective well-being might differ across socio-cultural contexts. Ghazzawi et al. found that the association between job autonomy and subjective well-being can only be achieved through engagement in increasing structural job resources and increasing challenging job demands, as collectivistic culture decreases employees' perceptions of work autonomy (44).

Compared to voluntary overtime, involuntary overtime was detrimental to well-being. Involuntary overtime was related to a lower level of happiness, life satisfaction, self-reported health status, and more depression symptoms. Employees who volunteered to work long hours might make arrangements for families in advance and be mentally prepared for overtime, thus reducing the work-home conflict and offsetting the negative effect on well-being (59, 60). Employer-mandated overtime has an additional detrimental effect on individuals' well-being (61). Employees who are self-driven and have



higher achievement motivation work long hours more often (62, 63). For these people, rewards or promotion opportunities accompanied by working overtime would also counteract the negative effect on well-being. A study on work-nonwork balance also indicated that involuntary overtime had a negative effect, and voluntary overtime had a positive direct effect but a negative indirect effect (64).

## Strengths and limitations

Chinese culture is distinctive from other countries (65). Lockett proposed four main features of Chinese culture related to organization, including group orientation and respect for hierarchy (66). Thus, the overtime culture is widely accepted and has even become an important part of code in many corporates in China (67, 68). In China, overtime hours show only a moderate correlation with the well-being of employees. Meanwhile, whether voluntarily working overtime is salient for their well-being. Involuntary overtime poses more work-home imbalance to people who do not accept overtime culture, which is detrimental to their well-being. In addition, as material needs have been met, job design with high autonomy is supposed to be an important means to improve employees' well-being. This research systematically analyzed overtime, voluntary overtime, job autonomy, and employees' well-being, supplementing empirical evidence from China in related research fields. Given the deficient implementation of China's labor security system, overtime and job autonomy should receive more public attention.

This study has some limitations. First, due to data limitations, we could not identify specific overtime patterns, such as work shifts, precariousness, and weekend overtime, which have been proven related to well-being in some literature. Second, the study could not assess the causal mechanisms of overtime, job autonomy, and well-being due to the limitation of the cross-sectional data. Extending the observation period and systematically testing key time thresholds for the development of overtime and job autonomy could have increased confidence in the findings. Third, overtime and job autonomy might have a lag effect or a cumulative effect on employees' well-being when overtime was considered unacceptable and the level of job autonomy was low. However, it was difficult to construct the function between overtime, job autonomy, and well-being under the existing theoretical framework. Finally, it is important to note that although subjective well-being had some stability over time, short-term subjective well-being was susceptible to individual life events and perceptions at the moment, which might interfere with its relationship to work characteristics. In addition, the relationship between overtime, job autonomy, and well-being might be moderated by other work or individual characteristics, which can be explored in future studies.

## References

- Peng X. The 6pm struggle: the changing meaning of work, a culture of overtime work, and corporate governmentality in urban China. *Asian Anthropol.* (2020) 19:39–52. doi: 10.1080/1683478X.2019.1654499
- Kang JH, Matusik JG, Barclay LA. Affective and normative motives to work overtime in Asian organizations: four cultural orientations from Confucian ethics. *J Bus Ethics.* (2017) 140:115–30. doi: 10.1007/s10551-015-2683-4
- Liu B, Chen H, Yang X, Hou C. Why work overtime? A systematic review on the evolutionary trend and influencing factors of work hours in China. *Front Public Health.* (2019) 7:343. doi: 10.3389/fpubh.2019.00343
- Cooke F. *HRM, Work and Employment in China*. London: Routledge (2005).
- Liu B, Chen H, Hou C, Wang Y. The structure and measurement of overtime work: a scale development study among Chinese employees. *Curr Psychol.* (2021) 4:1–11. doi: 10.1007/s12144-020-01259-1
- Tsai MC, Nitta M, Kim SW, Wang W. Working overtime in East Asia: convergence or divergence? *J Contemp Asia.* (2016) 46:700–22. doi: 10.1080/00472336.2016.1144778
- Gottfried AE. Intrinsic motivation in young children. *Young Child.* (1983) 39:64–73.
- Deci EL, Ryan RM. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York, NY: Plenum Publishing Co (1985).

## Conclusion

This study estimated the impact of overtime, voluntary overtime, and job autonomy on the subjective well-being of Chinese employees. In contrast to voluntary overtime, involuntary overtime is detrimental to well-being. It was associated with lower levels of happiness, life satisfaction, self-reported health status and more depressive symptoms. The results also showed a significant relationship between job autonomy and employees' well-being. The more control employees have over the content of their work, work progress and workload, the better their well-being.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the corresponding author, without undue reservation.

## Author contributions

SY and XB: conceptualization and writing — original draft. LC: formal analysis and review and editing. All authors contributed to the article and approved the submitted version.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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9. Deci EL, Eghrari H, Patrick BC, Leone DR. Facilitating internalization: the self-determination theory perspective. *J Pers.* (2010) 62:119–42. doi: 10.1111/j.1467-6494.1994.tb00797.x
10. Zhang L. Lean production and labor controls in the Chinese automobile industry in an age of globalization. *Int Labor Work Class Hist.* (2008) 73:24–44. doi: 10.1017/S0147547908000033
11. Zeng X, Lu L, Idris S. *Working Time in Transition: The Dual Task of Standardization and Flexibilization in China*. Geneva: International Labour Organization, Conditions of Work and Employment Series No. 11 (2005).
12. Diener E. Subjective well-being. *Psychol Bull.* (1984) 95:542–75. doi: 10.1037/0033-2909.95.3.542
13. Diener E, Oishi S, Tay L. Advances in subjective well-being research. *Nat Hum Behav.* (2018) 2:253–60. doi: 10.1038/s41562-018-0307-6
14. Song YJ, Lee YS. Work hours, work schedules, and subjective well-being in Korea. *Int Sociol.* (2021) 36:25–48. doi: 10.1177/0268580920949724
15. Staines GL, Pleck JH. Nonstandard work schedules and family life. *J Appl Psychol.* (1984) 69:515–23. doi: 10.1037/0021-9010.69.3.515
16. Karhula K, Wöhrmann AM, Brauner C, Härmä M, Kivimäki M, Michel A, et al. Working time dimensions and well-being: a cross-national study of Finnish and German health care employees. *Chronobiol Int.* (2020) 37:1312–24. doi: 10.1080/07420528.2020.1778716
17. Barnett RC, Gareis KC, Brennan RT. Fit as a mediator of the relationship between work hours and burnout. *J Occup Health Psychol.* (1999) 4:307–17. doi: 10.1037/1076-8998.4.4.307
18. Yu J, Leka S. Where is the limit for overtime? Impacts of overtime on employees' mental health and potential solutions: a qualitative study in China. *Front Psychol.* (2022) 13:976723. doi: 10.3389/fpsyg.2022.976723
19. Badri M, Al Khaili M, Aldhaheeri H, Yang G, Al Bahar M, Al Rashdi A. Examining the structural effect of working time on well-being: evidence from Abu Dhabi. *Soc Sci Humanit Open.* (2022) 6:100317. doi: 10.1016/j.ssoho.2022.100317
20. Ahn T. Reduction of working time: does it lead to a healthy lifestyle? *Health Econ.* (2016) 25:969–83. doi: 10.1002/hec.3198
21. Okamoto S. Hours of work and health in Japan. *Ann Epidemiol.* (2019) 33:64–71. doi: 10.1016/j.annepidem.2019.02.003
22. Tsutsumi A. Preventing overwork-related deaths and disorders-needs of continuous and multi-faceted efforts. *J Occup Health.* (2019) 61:265–6. doi: 10.1002/1348-9585.12062
23. Sparks K, Cooper CL, Fried Y, Shirom A. The effects of hours of work on health: a meta-analytic review. *J Occup Organ Psychol.* (1997) 70:391–408. doi: 10.1111/j.2044-8325.1997.tb00656.x
24. Van der Hulst M. Long workhours and health. *Scand J Work Environ Health.* (2003) 29:171–88. doi: 10.5271/sjweh.720
25. Caruso C, Hitchcock E, Dick R, Russo J, Schmit J. *Overtime and Extended Work Shifts: Recent Findings on Illnesses, Injuries and Health Behaviors*. Cincinnati OH: NIOSH Publications Dissemination (2004).
26. Müller G, Tisch A, Wöhrmann AM. The impact of long working hours on the health of German employees. *Ger J Hum Resour Manag.* (2018) 32:217–35. doi: 10.1177/2397002218786020
27. Qiu D, Li Y, Li R, He J, Ouyang F, Luo D, et al. Long working hours, work-related stressors and sleep disturbances among Chinese government employees: a large population-based follow-up study. *Sleep Med.* (2022) 96:79–86. doi: 10.1016/j.sleep.2022.05.005
28. Takahashi M. Sociomedical problems of overwork-related deaths and disorders in Japan. *J Occup Health.* (2019) 61:269–77. doi: 10.1002/1348-9585.12016
29. Sung H, Kim J, Kim J, Punnett L, Lee H, Kim S. Association between extremely long working hours and musculoskeletal symptoms: a nationwide survey of medical residents in South Korea. *J Occup Health.* (2020) 62:e12125. doi: 10.1002/1348-9585.12125
30. Ervasti J, Pentti J, Nyberg ST, Shipley MJ, Leineweber C, Sørensen JK, et al. Long working hours and risk of 50 health conditions and mortality outcomes: a multicohort study in four European countries. *Lancet Reg Health Eur.* (2021) 11:100212. doi: 10.1016/j.lanepe.2021.100212
31. Kivimäki M, Jokela M, Nyberg ST, Singh-Manoux A, Fransson EI, Alfredsson L, et al. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603,838 individuals. *Lancet.* (2015) 386:1739–46. doi: 10.1016/S0140-6736(15)60295-1
32. Inoue Y, Yamamoto S, Stickley A, Kuwahara K, Miyamoto T, Nakagawa T, et al. Overtime work and the incidence of long-term sickness absence due to mental disorders: a prospective cohort study. *J Epidemiol.* (2021) 32:283–9. doi: 10.2188/jea.JE20200382
33. Virtanen M, Ferrie JE, Singh-Manoux A, Shipley MJ, Stansfeld SA, Marmot MG, et al. Long working hours and symptoms of anxiety and depression: a 5-year follow-up of the Whitehall II study. *Psychol Med.* (2011) 41:2485–94. doi: 10.1017/S0033291711000171
34. Ma X. Impact of long working hours on mental health: evidence from China. *Int J Environ Res Public Health.* (2023) 20:1641. doi: 10.3390/ijerph20021641
35. Virtanen M, Jokela M, Madsen IE, Hanson LLM, Lallukka T, Nyberg ST, et al. Long working hours and depressive symptoms: systematic review and meta-analysis of published studies and unpublished individual participant data. *Scand J Work Environ Health.* (2018) 44:239–50. doi: 10.5271/sjweh.3712
36. Lee K, Suh C, Kim JE, Park JO. The impact of long working hours on psychosocial stress response among white-collar workers. *Ind Health.* (2017) 55:46–53. doi: 10.2486/indhealth.2015-0173
37. Afonso P, Fonseca M, Pires JF. Impact of working hours on sleep and mental health. *Occup Med.* (2017) 67:377–82. doi: 10.1093/occmed/kqx054
38. Brauner C, Wöhrmann AM, Michel A. Work availability types and well-being in Germany—a latent class analysis among a nationally representative sample. *Work Stress.* (2022) 36:251–73. doi: 10.1080/02678373.2021.1969475
39. Karhula K, Wöhrmann AM, Brauner C, Härmä M, Kivimäki M, Michel A, et al. Working time dimensions and well-being: a cross-national study of Finnish and German health care employees. *Chronobiol Int.* (2020) 37:1312–24. doi: 10.1080/07420528.2020.1778716
40. Deci EL, Ryan RM. The “what” and “why” of goal pursuits: human needs and the self-determination of behavior. *Psychol Inq.* (2000) 11:227–68. doi: 10.1207/S15327965PLI1104\_01
41. Yu S, Levesque-Bristol C, Maeda Y. General need for autonomy and subjective well-being: a meta-analysis of studies in the US and East Asia. *J Happiness Stud.* (2018) 19:1863–82. doi: 10.1007/s10902-017-9898-2
42. Ford M, Wang YR, Huh Y. *Work, The Work-Family Interface, and Subjective Well-Being. Handbook of Well-Being*. Salt Lake City, UT: DEF Publishers (2018).
43. Wu CH, Luksyte A, Parker SK. Overqualification and subjective well-being at work: the moderating role of job autonomy and culture. *Soc Indic Res.* (2015) 121:917–37. doi: 10.1007/s11205-014-0662-2
44. Ghazzawi R, Bender M, Daouk-Öyry L, van de Vijver FJ, Chasiotis A. Job crafting mediates the relation between creativity, personality, job autonomy and well-being in Lebanese nurses. *J Nurs Manag.* (2021) 29:2163–74. doi: 10.1111/jonm.13357
45. Bastida M, Neira I, Lacalle-Calderon M. Employee's subjective-well-being and job discretion: designing gendered happy jobs. *Eur Res Manag Bus Econ.* (2022) 28:100189. doi: 10.1016/j.iadeen.2021.100189
46. Neugarten BL, Havighurst RJ, Tobin SS. The measurement of life satisfaction. *J Gerontol.* (1961) 16:134–43. doi: 10.1093/geront/16.2.134
47. George LK. Subjective well-being: conceptual and methodological issues In: C Eisdorfer, editor. *Annual Review of Gerontology and Geriatrics*, vol. 2. New York: Springer (1981)
48. Lawton MP. Environment and other determinants of well-being in older people. *Gerontologist.* (1983) 23:349–57. doi: 10.1093/geront/23.4.349
49. Diener E, Suh EM, Lucas RE, Smith HL. Subjective well-being: three decades of progress. *Psychol Bull.* (1999) 125:276–302. doi: 10.1037/0033-2909.125.2.276
50. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas.* (1977) 1:385–401. doi: 10.1177/014662167700100306
51. Boey KW. Cross-validation of a short form of the CES-D in Chinese elderly. *Int J Geriatr Psychiatry.* (1999) 14:608–17. doi: 10.1002/(SICI)1099-1166(199908)14:8<608::AID-GPS991>3.0.CO;2-Z
52. Yang W, Xiong G, Garrido LE, Zhang JX, Wang MC, Wang C. Factor structure and criterion validity across the full scale and ten short forms of the CES-D among Chinese adolescents. *Psychol Assess.* (2018) 30:1186–98. doi: 10.1037/pas0000559
53. Allen H, Slavin T, Bunn W. Do long workhours impact health, safety, and productivity at a heavy manufacturer? *J Occup Environ Med.* (2007) 49:148–71. doi: 10.1097/JOM.0b013e31802f09ee
54. Nie P, Otterbach S, Sousa-Poza A. Long work hours and health in China. *China Econ Rev.* (2015) 33:212–29. doi: 10.1016/j.chieco.2015.02.004
55. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st century workplace. *J Occup Organ Psychol.* (2001) 74:489–509. doi: 10.1348/096317901167497
56. Ngai P. Global production, company codes of conduct, and labor conditions in China: a case study of two factories. *China J.* (2005) 54:101–13. doi: 10.2307/20066068
57. Ferrer-I-Carbonell A. Income and well-being: an empirical analysis of the comparison income effect. *J Public Econ.* (2005) 89:997–1019. doi: 10.1016/j.jpubeco.2004.06.003
58. Schneider SM. Income inequality and subjective wellbeing: trends, challenges, and research directions. *J Happiness Stud.* (2016) 17:1719–39. doi: 10.1007/s10902-015-9655-3
59. Albrecht SC, Kecklund G, Rajaleid K, Leineweber C. The longitudinal relationship between control over working hours and depressive symptoms: results from SLOSH, a population-based cohort study. *J Affect Disord.* (2017) 215:143–51. doi: 10.1016/j.jad.2017.03.010

60. Nijp HH, Beckers DG, Geurts SA, Tucker P, Kompier MA. Systematic review on the association between employee worktime control and work-non-work balance, health and well-being, and job-related outcomes. *Scand J Work Environ Health*. (2012) 38:299–313. doi: 10.5271/sjweh.3307
61. Golden L, Wiens-Tuers B. Overtime work and wellbeing at home. *Rev Soc Econ*. (2008) 66:25–49. doi: 10.1080/00346760701668495
62. Michelacci C., Pijoanmas J. (2007). The Effects of Labor Market Conditions on Working Time: The US-EU Experience. CEPR Discussion Paper No. DP6314. Available at: <https://ssrn.com/abstract=1136621> (Accessed May, 2007).
63. Barrick MR, Mount MK. The big five personality dimensions and job performance: a meta-analysis. *Pers Psychol*. (1991) 44:1–26. doi: 10.1111/j.1744-6570.1991.tb00688.x
64. Watanabe M, Yamauchi K. Psychosocial factors of overtime work in relation to work-nonwork balance: a multilevel structural equation modeling analysis of nurses working in hospitals. *Int J Behav Med*. (2016) 23:492–500. doi: 10.1007/s12529-016-9563-x
65. Nathan AJ. Is Chinese culture distinctive? A review article. *J Asian Stud*. (1993) 52:923–36. doi: 10.2307/2059344
66. Kim S, Kwon K, Wang J. Impacts of job control on overtime and stress: cases in the United States and South Korea. *Int J Hum Resour Manag*. (2022) 33:1352–76. doi: 10.1080/09585192.2020.1757738
67. Yu X. Impacts of corporate code of conduct on labor standards: a case study of Reebok's athletic footwear supplier factory in China. *J Bus Ethics*. (2008) 81:513–29. doi: 10.1007/s10551-007-9521-2
68. Arnoštová M. Chinese overtime culture among white-collar workers in the first-tier cities. *Acta Asiatica Varsoviensia*. (2017) 2:7–28.



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# A longitudinal controlled signage intervention to increase stair use at university buildings: Process and impact evaluation using RE-AIM framework

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**Introduction:** Stair climbing intervention could be suggested to address low occupational physical activity amongst university students and employees. Strong evidence showed the effectiveness of signage intervention in increasing stair use in public areas. However, evidence in worksite settings, including university settings, was inconclusive. This study aimed to evaluate the process and impact of a signage intervention to increase stair use at a university building using the RE-AIM framework.

**Method:** We conducted a non-randomised controlled pretest-posttest study to examine the effect of signage intervention placed in university buildings in Yogyakarta (Indonesia) between September 2019 and March 2020. The process of designing the signage involved the employees in the intervention building. The main outcome was the change in the proportion of stair use to elevator use measured by manual observations of video recordings from closed-circuit television. A linear mixed model examined the intervention effect by controlling the total visitor count as a confounder. RE-AIM framework was used in the process and impact evaluation.

**Results:** The change in the proportion of stair climbing from baseline to the 6th-month phase at the intervention building (+0.067 (95% CI=0.014–0.120)) was significantly higher than that of the control building. However, the signs did not change the proportion of the stair descending at the intervention building. The signs were potentially viewed 15,077–18,868 times/week by visitors.

**Conclusion:** Signage intervention using portable posters could easily be adopted, implemented, and maintained in similar settings. A co-produced low-cost signage intervention was found to have a good reach, effectiveness, adoption, implementation, and maintenance dimension.

## KEYWORDS

community-based participatory research, health promotion, motor activity, stair climbing, video recording, workplace

## 1. Introduction

Several studies showed that office workers and university students were at health risk due to the high occupational sitting time and low occupational physical activity (PA) (1–4). Stair climbing, which was categorised as vigorous PA, has been associated with health benefits amongst both healthy individuals and also individuals with health conditions, including improvements in aerobic capacity, blood pressure, lipid profiles, body composition, mood states, cognitive performance, and reduced risk of several non-communicable diseases and mortality (5–13). Thus, an intervention that motivates stair climbing in university settings could be suggested to increase occupational PA to improve office workers’ and students’ health.

Several systematic reviews reported that motivational signage posted near stairs and elevators could increase stair use in public areas (14–16). However, the effectiveness of stair use intervention in worksite buildings was not consistent, particularly in university-based settings (14, 17–20). In addition, contemporary phenomena could interfere with the effect since there was no control group in previous university building studies (19, 20). Most of the available studies on the effectiveness of signage also had weak internal validity and lacked external validity reporting (14–20).

Our study aimed to examine the effectiveness of motivational signage using a specific message on stair use and to report its process evaluation using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) Framework to improve its external validity and to inform future trials (21). We examined the outcome in an identical building as a control to minimise the bias from contemporaneous phenomenons. Objective measurement using video recording by two independent observers blinded to the intervention status was employed to reduce measurement bias and Hawthorne effects.

## 2. Methods

A longitudinal non-randomised controlled quasi-experimental study was conducted to assess the change in stair use for stair climbing or descending as an effect of point-of-decision motivational signage (Figure 1). The study was retrospectively registered at [thaiclinicaltrials.org](https://www.clinicaltrials.gov/ct2/show/study?term=TCTR20220804005&rank=1) (TCTR20220804005) and was ethically approved by the Medical and Health Research Ethics Committee Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada (Ref No: KE/FK/0973/EC). This pragmatic trial was reported in line with the Consolidated

Standards of Reporting Trials (CONSORT) statements for pragmatic, pilot, and feasibility trials (22, 23). This study consisted of 1-week pre-intervention data collection to measure the baseline stair use and elevator use, followed by 6 months period of intervention monitoring (October 2019–March 2020). The second monitoring phase was conducted in the last week of the 3rd month, and the third phase was conducted in the last week of the 6th month.

### 2.1. Sample

This study was conducted in two university buildings in Universitas Gadjah Mada, Yogyakarta, Indonesia. They were located 260 m apart in two different faculties in the health science cluster. Employees and students rarely moved from one building to another, which could minimise the risk of contamination bias. In both faculties, a health promotion initiative called the Health-Promoting University (HPU) has been running since July 2019. The same team supervised health promotion programs at the two sites. They targeted the same fields of intervention, including health literacy, physical activity, nutrition, mental health, zero tolerance for smoking, alcohol consumption, and illicit drug use, zero tolerance for violence, bullying, and sexual harassment, and safe buildings and healthy environments.

In choosing the intervention and control buildings, the following characteristics were sought: (1) Two buildings with an almost similar number of occupants, (2) Two buildings with almost similar staircase and elevator design and placement, as well as the numbers of the stories (Table 1). We did not randomly assign the status of the intervention and control building because there was already an A6 motivational sticker installed just above the elevator for 3 months.

### 2.2. Measures

Manual observations from video recordings of closed-circuit television (CCTV) were independently conducted from Monday to Friday in each phase by two observers blinded to the intervention status. Therefore, visitors were not aware of being observed. The speed of the video recordings was accelerated two times to reduce observers’ burden, and the resolution was lowered to protect visitors’ privacy. In addition to counting the visitor journey, whether entering the lift, exiting the lift, climbing the stairs, or descending the stairs,

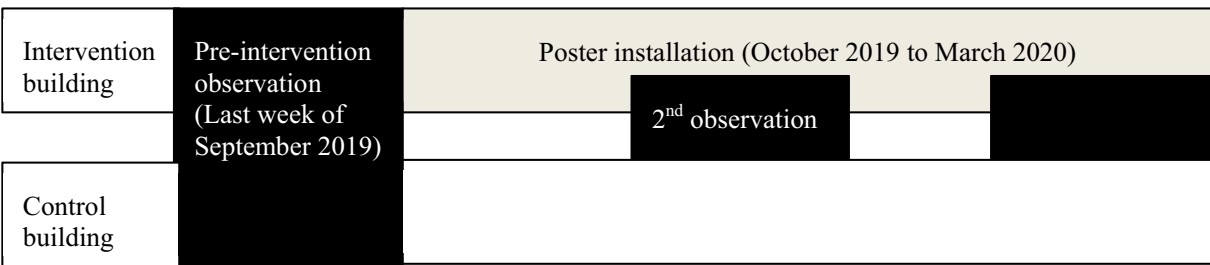


FIGURE 1  
Study flow.



TABLE 1 Characteristics of the buildings and posters.

	Control site	Intervention site
Number of employees	65	90
Type of employees' activities	Laboratory employees	30 of them are administration employees, and the rest are laboratory employees
Number of students	894	902
Type of students' activities	Laboratory works	Laboratory works
Number of floors	6	5
Stair and elevator location	Centrally located circular stair with a central elevator in a large atrium and an elevator at the opposite side	Centrally located circular stair with a central elevator in a large atrium and an elevator at the opposite side
Stair landing	2	3
Lift capacity	13 persons	11 persons
Number of lift	2	2
Poster location	–	Placed both next to elevators and also to stairs
Poster size		1.6 × 0.9 m

observers also took note of the incidence of stair accidents. The two observers statistically significantly agreed in their counts ( $W = 0.998$ ,  $p < 0.001$ ). The daily observations in workdays per 2-h time slot (07.00–09.00, 09.00–11.00, 11.00–13.00, 13.00–15.00, 15.00–17.00) were written down in a spreadsheet at all locations. The proportion of stair use per time slot was calculated by dividing the number of people taking the stair from the ground floor by the number of people entering the elevator as a proportion of stair climbing and by dividing the number of people taking the stair to the ground floor by the number of people leaving the elevator as a proportion of stair descending.

## 2.3. Analysis

The total ascending journey from the ground floor and descending journey to the ground floor were reported and grouped by the use of a staircase or elevator. Mann–Whitney  $U$ -tests were conducted to examine the baseline proportion of stair climbing and stair descending per time slot between intervention and control building. The intervention effects as a mean change per time slot in the intervention building compared to the control building were examined using linear mixed models (24). Building (intervention, control) and period (1–3, corresponding to the baseline period, 3rd-month phase, and 6th-month phase) and total visitors per 2-h time slot as covariates were included in the models as fixed effects. Interaction terms between building and period variables were added (effects at the intervention site compared to the control site for all three study periods). Results are reported as differences in mean absolute change with the 95% confidence interval (CI). Analyses were performed with SPSS version 25.

## 2.4. Process and impact evaluation

We performed process evaluation using RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) Framework (21). Reach was the total number of visitors counted over time during the study period. Effectiveness was measured by the effects of the intervention on the change of stair use proportion from baseline in the intervention building compared to the change in the control building. Adoption was described as the participation of employees in the intervention building in defining and implementing the signage and barriers to participation. The implementation dimension was examined based on the extent to which the intervention was delivered as intended. The maintenance dimension was how stair-use interventions were sustained at the intervention building over time. The head of the HPU unit and the dean are two stakeholders in the intervention building who will adopt, implement and maintain the intervention. Therefore, the adoption, implementation, and maintenance dimension were evaluated based on an informal interview with the employees using guided questions adopted from a previous study (25). The interview consisted of questions asking how the stakeholders describe the implementation of the lift signages placement, the main barriers during the placement, any difference in intervention delivery from those suggested by the researchers team, as well as their plan at the end of the study period. Informal opinions from the HPU unit from the other faculties were also captured during the dissemination of the intervention at the end of the study period through an internal social media group.

## 2.5. Intervention and the co-production stage

We used a co-production approach by involving employees at the end of the value chain to get the optimal benefits of a collaborative approach whilst minimising resource constraints (26). A survey was sent to the employees in the intervention building to pre-test the motivational messages. Three specific messages were pre-developed since they provided better effectiveness than general messages (20). Open-ended questions were asked for their opinions and feedback on the messages and designs. Six of ninety employees provided answers and returned the letter. Thematic analysis from employees' opinions and feedback was described (Table 2). The health-related message was chosen since no negative theme arose from this message. Therefore, two portable posters of 1.6 × 0.9 m containing a health-related message and a picture representing an employee climbing the stairs were placed next to the staircase and the elevator on the ground floor of the intervention building (Figure 2).

## 3. Results

### 3.1. Reach and effectiveness of intervention

A total of 93,000 counts from 75 observations resulting from five sessions per day for 5 days during three periods were analysed. There were 28,823 staircases and 64,177 elevator uses on the ground floor of two observed buildings, and no stair accidents occurred. The total visitor counts at the 3rd-month phase were lower than the baseline

TABLE 2 Employees' opinions on motivational texts.

Message type	Motivational text	Positive theme	Negative theme
Health-related message	Do you want to maintain health but do not have time to exercise? Climb 4 floors a day, and you get a 40% reduction in stroke risk Take the stairs! (In Bahasa Indonesia: Pingin Jaga Kesehatan, Tapi Nggak Sempat Olahraga? Naik Tangga 4 Lantai Sehari, 40% Risiko Stroke Terkurangi Naik Tangga Yuk!)	Motivating, Enhancing health awareness	
Weight-related message	Do you want to maintain weight but do not have time to exercise? Every time you climb 1 Floor, you burn 2.5 Calories. Take the stairs! (In Bahasa Indonesia: Pingin Jaga Berat Badan, Tapi Nggak Sempat Olahraga? Naik Tangga 1 Lantai, Bakar 2.5 Kalori Naik Tangga Yuk!)	Motivating, Easy physical activity	Unimportant
Time pressure	Are you waiting in line for the elevator and afraid to be late? It only takes 15 s to go up 1 floor by stairs. Take the stairs! (In Bahasa Indonesia: Antri Naik Lift, Tapi Keburu Terlambat? Hanya Butuh 15 Detik Untuk Naik 1 Lantai Dengan Tangga Naik Tangga Yuk!)	Motivating	Unimportant, Fear of sweaty

and 6th-month phases at both buildings (Table 3). In the intervention building, the stair posters have the potential to be viewed 15,077 times/week in the 3rd-month phase and 18,868 times/week in the 6th-month phase.

The stair climbing rate per time slot from the ground floor in the intervention building during the baseline phase was higher than that in the control building ( $p < 0.001$ ), with an unadjusted median of 0.408



FIGURE 2  
Placement and design of the poster.

(0.12–1.03) and 0.224 (0.03–0.52), respectively. In the 3rd month phase, there were decreases in the stair climbing rate per time slot in both buildings, but there was no significant difference in the change between the two buildings. In the 6th month phase, the stair climbing rate per time slot in the intervention building significantly increased by +0.067 but no change in the control building (Table 4). Total visitors during the 2-h time slot had an estimated effect of 0.0003 (95% CI 0.0001–0.0004,  $p < 0.001$ ) on the proportion of stair climbing per time slot.

There was a significant difference ( $p < 0.001$ ) between the stair descending rate to the ground floor per time slot in the intervention building (median = 0.721, 0.32–1.24) and the control building (median = 0.474, 0.12–1.50) during the baseline phase. There were decreases in descending stair proportion per time slot at the 3rd-month phase and returned to the baseline at the 6th-month phase in both intervention and control buildings. There was no significant difference in the changes between those two buildings (Table 5). Total visitors during the 2-h time did not have a significant estimated effect on the proportion of stair descending per time slot ( $p = 0.312$ ).

## 3.2. Adoption

Two faculty employees participated in the design and implementation of the stair-use intervention. The implementation of the intervention was described as easy. They found that the stair posters could be easily installed at the point of choice and moved to another place if other posters need to be placed in the same location since the motivational prompts were portable standing posters.

## 3.3. Implementation

Employees could easily implement the recommended strategy from the research team to introduce the posters at the point of choice

TABLE 3 Stair and elevator use.

		Baseline		3rd month		6th month	
		Ascending	Descending	Ascending	Descending	Ascending	Descending
Control Building	Stair	1,644	2,565	631	1,138	1,655	2,524
	Elevator	5,963	4,674	4,764	4,182	5,940	4,728
	Total	7,607	7,239	5,395	5,320	7,595	7,252
	Stair use proportion	0.216	0.549	0.117	0.214	0.218	0.348
Total journey		14,846		10,815		14,847	
Intervention Building	Stair	2,984	4,035	1811	2,549	3,178	4,110
	Elevator	6,412	5,310	5,753	4,964	6,252	5,238
	Total	9,396	9,345	7,564	7,513	9,430	9,348
	Stair use proportion	0.318	0.432	0.239	0.339	0.337	0.440
Total journey		18,741		15,077		18,868	

TABLE 4 Change in the proportion of stair use to elevator use from the ground floor (stair climbing rate) per time slot.

	Intervention	Control	Intervention effect	$p^*$	$p^{**}$
Baseline					
3rd month	−0.170 (−0.224 to −0.117)	−0.103 (−0.162 to −0.043)	−0.001 (−0.063 to 0.061)	0.975	
6th month	0.067 (0.014 to 0.120)	0.002 (−0.047 to 0.050)	0.065 (0.005 to 0.125)	0.033	0.049

\*Effect of building.

\*\*Effect of period.

without changing the strategy. The intervention cost was 450,000 IDR for each poster and was paid by the research team's funding. Employees in the intervention building considered the intervention's cost affordable.

### 3.4. Maintenance

The two stair posters were maintained after the end of the study. Considering the easy-deliver and low cost of the intervention, the employees in the intervention building planned two additional intervention phases to test the effect of different new posters with different messages designed by involving students' opinions and improving the stairwell's aesthetic by installing colourful stair stickers. Informal opinions from the HPU units from the other faculties suggested that the intervention will be implemented in their faculties.

## 4. Discussion

We described the process of designing the stair-use intervention and evaluating the intervention using the RE-AIM framework (21). A low-cost motivational prompt significantly increased the stair climbing rate at the intervention site by 6.7% during the 6th-month intervention phase. Still, it did not affect the stair use in the 3rd month and the stair descending rate during the whole study period. In contrast, the stair rate at the control site remained similar to the baseline.

The 6.7% increase in stair climbing in our study was higher than a previous systematic review reported, which showed a median increase of 0.8% with a motivational sign only (15). Our results (6.7% increase in stair climbing) almost reached the increase in stair climbing in intervention involving a combination of motivational and directional signs, which were reported to increase stair climbing by 8.1% within a worksite setting (15). Our study is also in line with a previous study that reported that the changes in stair climbing could only be observed in the second phase (25). However, the decrease in stair climbing proportion in the first phase of our study might be caused by the decrease in total visitors during this period since people were more likely to choose the elevator in the less busy period (27–29). In comparison, previous studies required additional interventions in the second phase, such as improving the aesthetic of the stair or installing music (18, 30, 31). Our study's increase in stair climbing could be observed without additional intervention. Therefore, we could identify that the positive influence on the stair climbing rate resulted from the repetition of prompts, which might be necessary to create sustainable habits in choosing the stair rather than the elevators. The stronger influence of motivational signs in our study could be attributed to the specific type of message, poster size, and the effect of co-production in designing the specific messages in the motivational sign (20, 32–34). Therefore, co-designing the intervention by involving the occupants of the buildings in designing large-size posters with specific messages since the early phase of intervention development could be suggested to improve the effectiveness as an alternative to using multiple intervention components.

TABLE 5 Change in the proportion of stair use to elevator use on the ground floor (stair descending rate) per time slot.

	Intervention	Control	Intervention effect	$p^*$	$p^{**}$
Baseline					
3rd month	−0.221 (−0.315 to −0.127)	−0.262 (−0.365 to −0.158)	0.041 (−0.068 to 0.149)	0.461	
6th month	0.072 (−0.022 to 0.166)	−0.030 (−0.115 to 0.056)	0.102 (−0.004 to 0.207)	0.059	0.164

\*Effect of building.

\*\*Effect of period.

Our study also found that employees easily adopted portable stair posters. This sign might solve overcoming adoption barriers reported by a previous study (25). Portable signage could still be located in the visible section of the building without interfering with the needs of corporate communications (25). Therefore, the placement of the stair posters could also be overtime during the study period.

Our study had several strengths. It employed a controlled design with two identical buildings and objective monitoring with less burden of observers, less observer bias, and less contamination bias. In addition, we also controlled total visitors as a confounder (20, 30, 32, 35, 36). However, there were several limitations of this study. Using double speed and reduced video recording resolution, our observers could not identify visitors' characteristics, including gender, age, and whether visitors were students or employees. Previous studies found that gender, age, and status of visitors (students or employees) could influence the signage effect (29, 31, 36, 37). Therefore, future studies should consider controlling these confoundings. The difference in the number of floors, lift capacity, and the stair landing between the two buildings might also influence the visitors' decision in choosing the stair for their journey, which could be examined in future studies. Whilst the number of flights was associated with health outcomes (10), the nature of the CCTV monitoring also did not allow for monitoring the number of flights the visitor took. We also examined the implementation process based on informal interviews and opinions, which could produce more naturalistic data but could be prone to bias and unreliable data (38). More rigorous mixed-method studies with a more representative sample involved in the development process of the intervention should also be considered in future process and impact evaluation studies. In addition, the effects of the intervention on individual or population health outcomes were also important to be examined in future studies.

## 5. Conclusion

Our study strengthens previous works on the usefulness of low-cost stair-use interventions at worksites using signage. Based on process evaluation using the RE-AIM framework, co-producing the intervention with employees was associated with the intervention's effectiveness, adoption, and implementation. Effects of intervention on stair use amongst various genders, ages, and statuses of visitors, as well as effects on health outcomes, need to be elucidated in future studies.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by Medical and Health Research Ethics Committee Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

ZM: conceptualization, funding acquisition, and supervision. WW: conceptualization, funding acquisition, methodology, and writing–review and editing. MS: methodology, investigation, project administration, funding acquisition, and writing–review and editing. RW: conceptualization, methodology, investigation, formal analysis, writing–original draft, and writing–review and editing. DA: conceptualization, writing–review and editing, and supervision. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Prince SA, Elliott CG, Scott K, Visintini S, Reed JL. Device-measured physical activity, sedentary behaviour and cardiometabolic health and fitness across occupational groups: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act.* (2019) 16:30. doi: 10.1186/s12966-019-0790-9
- Cooper K, Barton GC. An exploration of physical activity and wellbeing in university employees. *Perspect Public Health.* (2016) 136:152–60. doi: 10.1177/1757913915593103
- Haase A, Steptoe A, Sallis JF, Wardle J. Leisure-time physical activity in university students from 23 countries: associations with health beliefs, risk awareness, and national economic development. *Prev Med.* (2004) 39:182–90. doi: 10.1016/j.ypmed.2004.01.028
- Irwin JD. Prevalence of university students' sufficient physical activity: a systematic review. *Percept Mot Skills.* (2004) 98:927–43. doi: 10.2466/pms.98.3.927-943
- Meyer P, Kayser B, Kossovsky MP, Sigaud P, Carballo D, Keller PF, et al. Stairs instead of elevators at workplace: cardioprotective effects of a pragmatic intervention. *Eur J Cardiovasc Prev Rehabil.* (2010) 17:569–75. doi: 10.1097/HJR.0b013e328338a4dd
- Arafa A, Kokubo Y, Shimamoto K, Kashima R, Watanabe E, Sakai Y, et al. Stair climbing and incident atrial fibrillation: a prospective cohort study. *Environ Health Prev Med.* (2022) 27:10. doi: 10.1265/ehpm.21-00021
- Chow BC, Li S, Zhu X, Jiao J, Quach B, Baker JS, et al. Effects of descending or ascending stair exercise on body composition, insulin sensitivity, and inflammatory markers in young Chinese women with obesity: a randomised controlled trial. *J Sports Sci.* (2021) 39:496–502. doi: 10.1080/02640414.2020.1829362
- Michael E, White MJ, Eves FF. Home-based stair climbing as an intervention for disease risk in adult females: a controlled study. *Int J Environ Res Public Health.* (2021) 18:603. doi: 10.3390/ijerph18020603
- Dunford EC, Valentino SE, Dubberley J, Oikawa SY, McGlory C, Lonn E, et al. Brief vigorous stair climbing effectively improves cardiorespiratory fitness in patients with coronary artery disease: a randomised trial. *Front Sports Act Living.* (2021) 3:630912. doi: 10.3389/fspor.2021.630912
- Sanchez-Lastra MA, Ding D, Dalene KE, Del Pozo Cruz B, Ekelund U, Tarp J. Stair climbing and mortality: a prospective cohort study from the UK biobank. *J Cachexia Sarcopenia Muscle.* (2021) 12:298–307. doi: 10.1002/jcsm.12679
- Lee IM, Paffenbarger RS Jr. Physical activity and stroke incidence: the Harvard alumni health study. *Stroke.* (1998) 29:2049–54. doi: 10.1161/01.str.29.10.2049
- Honda H, Igaki M, Hatanaka Y, Komatsu M, Tanaka S, Miki T, et al. Stair climbing/descending exercise for a short time decreases blood glucose levels after a meal in people with type 2 diabetes. *BMJ Open Diabetes Res Care.* (2016) 4:e000232. doi: 10.1136/bmjdc-2016-000232
- Stenling A, Moylan A, Fulton E, Machado L. Effects of a brief stair-climbing intervention on cognitive performance and mood states in healthy young adults. *Front Psychol.* (2019) 10:2300. doi: 10.3389/fpsyg.2019.02300
- Jennings CA, Yun L, Loitz CC, Lee EY, Mummery WK. A systematic review of interventions to increase stair use. *Am J Prev Med.* (2017) 52:106–14. doi: 10.1016/j.amepre.2016.08.014
- Bellicha A, Kieusseian A, Fontvieille AM, Tataranni A, Charreire H, Oppert JM. Stair-use interventions in worksites and public settings – a systematic review of effectiveness and external validity. *Prev Med.* (2015) 70:3–13. doi: 10.1016/j.ypmed.2014.11.001
- Bauman A, Milton K, Kariuki M, Fedel K, Lewicka M. Is there sufficient evidence regarding signage-based stair use interventions? A sequential meta-analysis. *BMJ Open.* (2017) 7:e012459. doi: 10.1136/bmjopen-2016-012459
- Adams J, White M. A systematic approach to the development and evaluation of an intervention promoting stair use. *Health Educ J.* (2002) 61:272–86. doi: 10.1177/001789690206100308
- Olander EK, Eves FF. Effectiveness and cost of two stair-climbing interventions-less is more. *Am J Health Promot.* (2011) 25:231–6. doi: 10.4278/ajhp.090325-QUAN-119
- Grimstvedt ME, Kerr J, Oswalt SB, Fogt DL, Vargas-Tonsing TM, Yin Z. Using signage to promote stair use on a university campus in hidden and visible stairwells. *J Phys Act Health.* (2010) 7:232–8. doi: 10.1123/jpah.7.2.232
- Eckhardt MR, Kerr J, Taylor WC. Point-of-decision signs and stair use in a university worksite setting: general versus specific messages. *Am J Health Promot.* (2015) 29:291–3. doi: 10.4278/ajhp.120816-ARB-398
- Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health.* (1999) 89:1322–7. doi: 10.2105/AJPH.89.9.1322
- Zwarenstein M, Treweek S, Gagnier JJ, Altman DG, Tunis S, Haynes B, et al. Improving the reporting of pragmatic trials: an extension of the CONSORT statement. *BMJ (Clin Res ed).* (2008) 337:a2390. doi: 10.1136/bmj.a2390
- Eldridge SM, Chan CL, Campbell MJ, Bond CM, Hopewell S, Thabane L, et al. CONSORT 2010 statement: extension to randomised pilot and feasibility trials. *BMJ (Clin Res ed).* (2016) 355:i5239. doi: 10.1136/bmj.i5239
- Seltman HJ. *Experimental design and analysis.* 1st ed. Pittsburgh, PA: Carnegie Mellon University (2012) Available at: <https://www.stat.cmu.edu/~hseltman/309/Book/Book.pdf>
- Bellicha A, Kieusseian A, Fontvieille AM, Tataranni A, Copin N, Charreire H, et al. A multistage controlled intervention to increase stair climbing at work: effectiveness and process evaluation. *Int J Behav Nutr Phys Act.* (2016) 13:47. doi: 10.1186/s12966-016-0371-0
- Vargas C, Whelan J, Brimblecombe J, Allender S. Co-creation, co-design, co-production for public health – a perspective on definition and distinctions. *Public Health Res Pract.* (2022) 32:3222211. doi: 10.17061/phrp3222211
- Kerr J, Eves F, Carroll D. Six-month observational study of prompted stair climbing. *Prev Med.* (2001) 33:422–7. doi: 10.1006/pmed.2001.0908
- Webb OJ, Eves FF, Kerr J. A statistical summary of mall-based stair-climbing interventions. *J Phys Act Health.* (2011) 8:558–65. doi: 10.1123/jpah.8.4.558
- Lewis AL, Eves FF. Prompts to increase stair climbing in stations: the effect of message complexity. *J Phys Act Health.* (2012) 9:954–61. doi: 10.1123/jpah.9.7.954
- Lewis A, Eves F. Prompt before the choice is made: effects of a stair-climbing intervention in university buildings. *Br J Health Psychol.* (2012) 17:631–43. doi: 10.1111/j.2044-8287.2011.02060.x
- Boutelle KN, Jeffery RW, Murray DM, Schmitz MK. Using signs, artwork, and music to promote stair use in a public building. *Am J Public Health.* (2001) 91:2004–6. doi: 10.2105/ajph.91.12.2004
- Kerr J, Eves FF, Carroll D. The influence of poster prompts on stair use: the effects of setting, poster size and content. *Br J Health Psychol.* (2001) 6:397–405. doi: 10.1348/135910701169296
- Kerr NA, Yore MM, Ham SA, Dietz WH. Increasing stair use in a worksite through environmental changes. *Am J Health Promot.* (2004) 18:312–5. doi: 10.4278/0890-1171-18.4.312
- Webb OJ, Eves FF. Promoting stair climbing: effects of message specificity and validation. *Health Educ Res.* (2007) 22:49–57. doi: 10.1093/her/cyl045
- Engelen L, Gale J, Chau JY, Bauman A. Are motivational signs to increase stair use a thing of the past? A multi-building study. *Health Promot J Austr.* (2017) 28:178–84. doi: 10.1071/HE16107
- Yoon A, Choi S, Mun J, Hong J, Hahn D, Kang M, et al. Motivational signage increases stair usage on a Hispanic serving institution. *J Am Coll Health.* (2020) 68:236–41. doi: 10.1080/07448481.2018.1539000
- Nomura T, Yoshimoto Y, Akezaki Y, Sato A. Changing behavioral patterns to promote physical activity with motivational signs. *Environ Health Prev Med.* (2009) 14:20–5. doi: 10.1007/s12199-008-0053-x
- Swain J, King B. Using informal conversations in qualitative research. *Int J Qual Methods.* (2022) 21:160940692210850. doi: 10.1177/16094069221085056





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# The moderation of satisfaction with working conditions in the association between workload and mental health among healthcare workers collecting test samples in the post-COVID-19 era

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**Background:** This study aimed to examine the associations between workload and satisfaction with working conditions and mental health (i.e., anxiety disorder, depression, and somatization) of healthcare workers collecting test samples during the local outbreaks of COVID-19, and explore satisfaction with working conditions as a moderator of these relationships.

**Methods:** A total of 1,349 participants were obtained via an online survey in Zhengzhou, Henan Province, China. Multivariate regression was used to assess the associations between workload and satisfaction with working conditions and anxiety disorder, depression, and somatization. The simple slope analysis and Johnson-Neyman technique were used to assess the effect value and change trend of the moderator.

**Results:** The prevalence of anxiety disorder, depression, and somatization were 8.6, 6.9, and 19.2% of healthcare workers collecting test samples, respectively. High levels of workload were associated with an increased risk of an anxiety disorder (OR = 1.81, 95%CI = 1.17–2.78), depression (OR = 1.92, 95%CI = 1.19–3.10), and somatization (OR = 1.90, 95%CI = 1.40–2.57), while high satisfaction of working conditions was associated with a reduction in the risk of these outcomes, and ORs (95%CI) were 0.35 (0.20–0.64), 0.27 (0.13–0.56), and 0.32 (0.21–0.48), respectively. The findings also indicated that a weaker association between workload and anxiety disorder, as well as depression and somatization, has been reported in those with a high level of satisfaction with working conditions.

**Conclusion:** Workload significantly increased the risk of healthcare workers suffering from psychological problems, while satisfaction with working conditions alleviated these negative effects, and effective resource support was crucial for healthcare workers.

## KEYWORDS

anxiety disorder, depression, somatization, satisfaction with working conditions, workload, healthcare workers, COVID-19

# 1. Introduction

The COVID-19 pandemic has presented an unprecedented challenge to healthcare workers (HCWs) (1). Studies indicated that healthcare workers reported poorer health outcomes and greater exposure to psychosocial risks (2). Studies also found that healthcare workers had experienced serious anxiety, depression, insomnia, somatization, post-traumatic stress disorder, and other mental problems during the pandemic (3). The sources of psychological challenges for healthcare workers include not only the explosive increase of workload in the short term, but also fears about infection or contagion for families, insufficient personal protective equipment (PPE), and poor working environment conditions (4, 5), among which work overload was a key source affecting physical and mental health (6). For example, many frontline healthcare workers work more than 16 h a day on average to care for patients infected by COVID-19 during the outbreak of the pandemic (7).

In the post-pandemic era, local outbreaks and distributions of COVID-19 have become a new pandemic pattern. When positive patients appeared in a region or city, nucleic acid testing of close contacts or indirect possible contacts was an important strategy for the early detection of positive patients. Notably, the incubation period of the virus or errors in the test may lead to a misleading result in a single test and an increased risk of epidemic spread. Therefore, repeated nucleic acid sampling and testing have become the primary strategy for the identification of positive cases. In addition, the increased rate of transmission of mutated viruses in the population means that nucleic acid sample collectors need to complete the testing of millions of people in a short period to identify infected individuals in a timely manner, which was undoubtedly a huge challenge for healthcare workers.

The Job Demand—Control Model (JD-C) believed that work stress comes from the joint influence of characteristics that the job demands and job control (8). Job demand refers to the factors existing in the work situation that reflect the number and difficulty of work tasks undertaken by employees, mainly including workload, role conflict, and problem-solving requirements (8), where the workload, referred to the amount of work performed or capable of being usually performed within a specific period, was considered the most important work predictor of psychosocial effect (e.g., working pressure, burnout, and anxiety) (9–11). The Job Demands-Resources Model (JD-R) suggested that work resources refer to the factors that help workers achieve their work objectives and reduce work requirements and physical and mental consumption (12), such as autonomy, social support, working conditions, rewards, and development opportunities (13). The buffering hypothesis of the JD-R theory proposes an interactive effect, that is, various resources buffer the pressure and mental problems caused by various demands, and the results were partly verified in previous studies (14). Working conditions, one of the job resources provided by managers, referred to working facilities, the working system, and the working environment and might be an important predictor of employees' mental health problems. Studies have suggested that positive measures in the workplace can improve the working life of employees, which in turn can improve mental wellbeing even though they are not explicitly mental health support

services (1, 15). Satisfaction with working conditions (SWC) shows the subjective feeling of working resources and more directly reflects the psychological status of employees. Studies have shown that job satisfaction was not only a predictor of great mental health (16) but also moderated the relationship between work and mental health (17). Therefore, based on previous research evidence, we propose two hypotheses: Hypothesis 1: workload negatively predicts mental problems, while satisfactory working conditions predicts positive mental states. Hypothesis 2: satisfaction with working conditions moderates the relationship between working conditions and mental health.

The present study aimed to examine workload and satisfaction with working conditions and mental health (i.e., depression, anxiety, and somatization) and explore satisfaction with working conditions as a moderator of these relationships.

# 2. Materials and methods

## 2.1. Participants

The data of the present study were obtained from an online survey conducted in Zhengzhou, Henan Province of China, from 1 September 2021 to 7 September 2021 when a wave of local epidemics had just been confined in Henan Province. The participants of this study were healthcare workers who participated in nucleic acid detection when a local epidemic occurred. The questionnaire was distributed via an online platform, called [www.wjx.cn](http://www.wjx.cn). First, a questionnaire introduction and explanation document were provided to indicate the purpose and object of this survey. Then, participants who met the inclusion criteria and were willing to participate in the survey could complete and submit the questionnaire through the link in the attachment. To ensure the quality of the questionnaire, we filled out and estimated the time to complete the questionnaire in advance, and then the time spent by participants filling out the questionnaire was used to evaluate the quality of the questionnaire. Those participants who completed the questionnaire in <180 s were excluded, and a total of 1,349 valid questionnaires were obtained for analysis (88.2% were women).

This study was following the ethical standards of the responsible committee on human experimentation, and all participants read the instructions and informed consent before filling in the questionnaire. Participants could stop answering and quit at any time if they were unwilling to continue answering.

## 2.2. Measurement

### 2.2.1. Dependent variables

#### 2.2.1.1. Anxiety disorder

The 20-item Self-rating Anxiety Scale (SAS) was used to assess anxiety disorder over the previous 2 weeks (18) in terms of somatic (e.g., arm and leg shaking and trembling) and psychological (e.g., feeling afraid for no reason) symptoms. Responses were given on a 4-point scale, and scores ranged from 1 (none, or a little of the time) to 4 (most, or all of the time). The total score of the SAS ranged from 20 to 80, which was converted to an index score with a potential

range of 25 to 100, and an index score of  $\geq 50$  was classified as an anxiety disorder (19). Cronbach's alpha in the present survey was 0.800.

### 2.2.1.2. Depression

The 9-item Patient Health Questionnaire (PHQ-9) was used to assess depression (20). The scale consists of nine items that measure the frequency of depressive symptoms, such as depressed or desperate, over the last 2 weeks. Responses were given on a 4-point scale, and scores ranged from 0 (not at all) to 3 (nearly every day). The total score of the PHQ-9 ranged from 0 to 27, and scores ranging from 0 to 4, 5 to 9, 10 to 14, and 15 or above are classified as minimal, mild, moderate, and severe depression, respectively. In this study, the total score,  $\geq 10$  were classified as depression. Cronbach's alpha in the present survey was 0.902.

### 2.2.1.3. Somatization

The 15-item Patient Health Questionnaire (PHQ-15) was employed to assess the severity of somatization (21). The scale consists of 15 items that asked whether somatic symptoms, such as stomach pain, constipation or diarrhea, back pain, headache, chest pain, feeling heart pound or race, and dizziness, were present in the last 4 weeks with varying levels of severity. Responses were given on a 4-point scale, and scores ranged from 0 (not bothered at all) to 2 (bothered a lot). The total score of the PHQ-15 ranged from 0 to 30, and scores ranging from 0 to 4, 5 to 9, 10 to 14, and 15 or above are classified as minimal, low, medium, and severe somatic symptoms, respectively. We divided the total score, and scores  $\geq 10$

were classified as somatization. Cronbach's alpha in the present study was 0.865.

## 2.2.2. Independent variables

### 2.2.2.1. Workload

In this study, the workload of healthcare workers was measured by the number of tasks and continuous working time (22), which were measured using two items, respectively: "How many waves of sampling did you take part in during this local outbreak?" and "How often do you work shifts?". We define working tasks as mild (once), moderate (twice), and severe (three or more times) according to the answers given by the participants during sampling, and scores range from 1 (mild) to 3 (severe). Available options for shift time were short (3 h or less), moderate (4–6 h), and long (7 h or more), and scores range from 1 (short) to 3 (long). The sum of the scores of the two items was used to evaluate the workload of the healthcare worker. The *Pearson* correlation coefficient of the two items was 0.122 ( $p < 0.05$ ). In addition, we further divided the workload into a binary variable, if any variable reported as "severe" or "long" of the number of participating waves and shift time, then it was divided into high workload (coded as 1), and others were divided into low workload (coded as 0).

### 2.2.2.2. Satisfaction with working conditions

Satisfaction with the working condition was accessed via seven items (preparation of personal protective equipment, sites of work, the process for disposal of medical waste, on-site disinfection, maintain order on site, cooperation level of collected objects, life support (transportation, meals and proper rest)

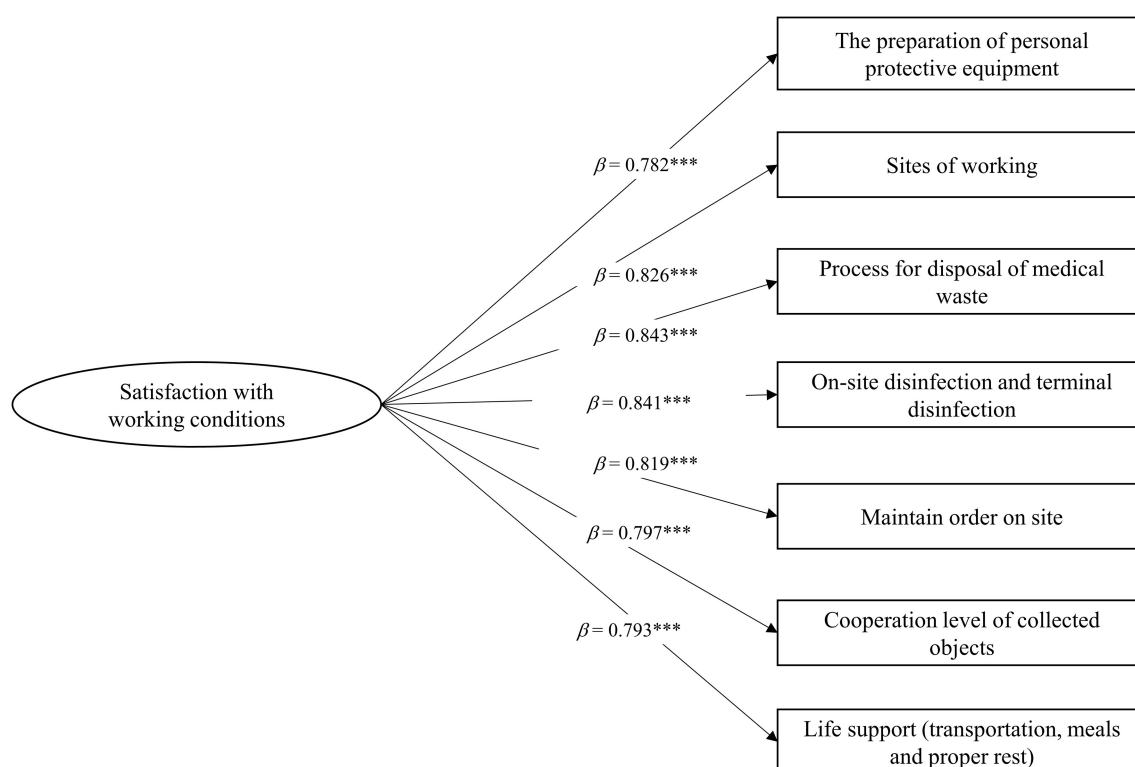


FIGURE 1

Standardized factor loadings of satisfaction with working conditions latent factor items. \*\*\* $p < 0.001$ .

and terminal disinfection, maintaining order on-site, life support (transportation, meals, and proper rest), and cooperation level of collected objects). Healthcare workers reported their satisfaction with these conditions during their work. Responses were given on a 5-point scale, and scores ranged from 1 (very dissatisfied) to 5 (very satisfied). A confirmatory factor analysis using SPSS AMOS 25.0 (IBM Corporation, Armonk, NY, USA) revealed that four of the seven items loaded significantly onto one factor (Figure 1). Model fitting index: CMIN/DF = 0.272,  $p > 0.05$ , CFI = 1.00, TLI = 1.00, RMSEA = 0.001, SRMR = 0.002. Satisfaction with working condition latent factor was used for subsequent analyses. Satisfaction with working conditions was measured by the total score of the seven items. Cronbach's alpha in the present study was 0.938. The last 27th percentile of the total score was further divided into a high group and defined as high satisfaction (coded as 1), and others were divided into low satisfaction (coded as 0).

### 2.2.3. Covariates

Variables including age, gender (male vs. female), occupation (physician vs. nurse), marriage status, self-rated health, and prior participation in the first-line anti-epidemic were considered in the study. Self-rated health was assessed by an item: "How do you evaluate your health?". Available options ranged from 1 (poor) to 4 (great). We assessed whether health workers participated in the first wave outbreak in early 2020, and the responses were divided into two categories (yes or no).

## 2.3. Statistical analysis

Sample characteristics, such as gender, occupation, age, marriage status, self-rated health, and prior participation in the first-line anti-epidemic were described using  $n$  (%), and continuity variables (workload, satisfaction with working conditions, anxiety disorder, depression, and somatization) were described using mean  $\pm$  standard deviation ( $M \pm SD$ ). First, binary logistic regression analysis was used to evaluate the associations between workload and satisfaction and outcomes (anxiety disorder, depression, and somatization). Two models were constructed to explore these effects: Model 1 was the crude model and no variables were adjusted, and Model 2 was an adjusted model of controlling for age, gender, marriage status, self-rated health, and prior participation in the first-line anti-epidemic. Next, multiple linear regression was used to assess the relationships between workload and satisfaction with working conditions with outcomes (anxiety disorder, depression, and somatization) after adjusting for a series of covariates, and moderation of the relationship between workload and mental health outcomes (anxiety disorder, depression, and somatization) by satisfaction with working conditions was assessed using regression models with an interaction term (workload  $\times$  satisfaction with working conditions). Finally, a simple slope analysis was used to assess the associations between workload and psychological outcomes, respectively for low and high SWCs (mean  $\pm$  one SD, respectively). Furthermore, the Johnson-Neyman method was used to assess trends in the effects of

workload on mental outcomes at different values of moderating variables (23).

The variables of workload and satisfaction with working conditions were transformed into z-scores before the regression analysis. All statistical analyses were performed using SPSS 25 (IBM Corporation, Armonk, NY, USA), and PROCESS v3.3 (24) was used

**TABLE 1** Sociodemographic characteristics of frontline nucleic acid sampling personnel during the local outbreak of COVID-19 ( $n = 1,349$ ).

Characteristics	<i>N</i> (%)	95% CI
<b>Gender</b>		
Male	159 (11.8)	10.1–13.5
Female	1,190 (88.2)	86.5–89.9
<b>Age, years</b>		
$\leq 25$	168 (12.5)	10.7–14.2
26~	499 (37.0)	34.4–39.6
31~	429 (31.8)	29.3–34.3
36~	253 (18.7)	16.7–20.8
<b>Occupation</b>		
Physician	297 (22.0)	19.8–24.2
Nurse	1,052 (78.0)	75.8–80.2
<b>Participating in the first-line anti-epidemic before</b>		
No	620 (46.0)	43.3–48.6
Yes	729 (54.0)	51.4–56.7
<b>Education level</b>		
College	199 (14.8)	12.9–16.6
Bachelor	977 (72.4)	70.0–74.8
Master and above	173 (12.8)	11.0–14.6
<b>Marriage status</b>		
Unmarried	508 (37.7)	35.1–40.2
Married	841 (62.3)	59.8–64.9
<b>Self-rated health</b>		
Bad	44 (3.3)	2.3–4.2
Moderate	173 (12.8)	11.0–14.6
Good	1,132 (83.9)	82.0–85.9
Workload, mean (SD)	4.15 (0.97)	4.10–4.20
High-workload, <i>n</i> (%)	739 (54.8)	52.1–57.4
Satisfaction with working conditions, mean (SD)	29.27 (5.33)	28.99–29.56
High-satisfaction, <i>n</i> (%)	376 (27.9)	25.5–30.3
Anxiety disorder, mean (SD)	41.22 (7.38)	40.82–41.61
Anxiety disorder, <i>n</i> (%)	116 (8.6)	7.1–10.1
Depression, mean (SD)	3.22 (4.07)	3.00–3.44
Depression, <i>n</i> (%)	93 (6.9)	5.5–8.2
Somatization, mean (SD)	4.79 (5.38)	4.50–5.08
Somatization, <i>n</i> (%)	259 (19.2)	17.1–21.3

CI, Confidence Intervals; SD, standard deviation.

TABLE 2 Logistic analysis of workload and satisfaction with working conditions on anxiety disorder, depression, and somatization.

	Characteristics	OR(95% CI)		
		Anxiety disorder	Depression	Somatization
Model 1	Workload [ref: low workload]	1.96 (1.29–2.96)	2.04 (1.28–3.24)	2.02 (1.51–2.70)
	SWC [ref: low satisfaction]	0.34 (0.19–0.60)	0.27 (0.13–0.54)	0.33 (0.22–0.48)
Model 2	Female [ref: males]	1.30 (0.55–3.05)	1.43 (0.57–3.61)	1.96 (1.09–3.53)
	Age, years [Ref: ≤25]			
	26~	2.40 (1.08–5.36)	1.16 (0.55–2.43)	1.30 (0.78–2.14)
	31~	2.58 (1.05–6.34)	0.95 (0.40–2.26)	1.13 (0.63–2.02)
	36~	1.36 (0.49–3.83)	0.60 (0.22–1.66)	0.98 (0.21–1.87)
	Nurse [ref: physician]	2.13 (1.00–4.52)	1.50 (0.70–3.23)	1.17 (0.74–1.87)
	Participating in the first-line anti-epidemic [ref: no]	1.08 (0.72–1.61)	1.00 (0.65–1.56)	1.39 (1.03–1.87)
	Education level [ref: college]			
	Bachelor	0.39 (0.24–0.63)	0.47 (0.28–0.79)	0.45 (0.31–0.66)
	Master and above	0.51 (0.21–1.25)	0.53 (0.20–1.40)	0.53 (0.28–0.99)
	Married status [ref: unmarried]	0.83 (0.51–1.36)	1.05 (0.61–1.82)	1.02 (0.71–1.48)
	Self-rated health [ref: bad]			
	Moderate	0.35 (0.15–0.79)	0.24 (0.10–0.58)	0.50 (0.24–1.00)
	Good	0.20 (0.09–0.41)	0.17 (0.08–0.37)	0.25 (0.13–0.48)
	Workload [ref: low workload]	1.81 (1.17–2.78)	1.92 (1.19–3.10)	1.90 (1.40–2.57)
	SWC [ref: low satisfaction]	0.35 (0.20–0.64)	0.27 (0.13–0.56)	0.32 (0.21–0.48)

Model 1 means crude model; Model 2 adjusted for gender, age, occupation, participating in the first-line anti-epidemic, education level, married status, and self-rated health. CI, Confidence Intervals; SWC, Satisfaction with working conditions.

TABLE 3 Multiple linear analysis of workload and satisfaction with working conditions on anxiety disorder, depression, and somatization.

Model	Variables	Anxiety disorder			Depression			Somatization		
		<i>b</i>	<i>t</i>	<i>P</i>	<i>b</i>	<i>t</i>	<i>P</i>	<i>b</i>	<i>t</i>	<i>P</i>
Model 1	Workload	0.73	3.607	<0.001	0.39	3.706	<0.001	0.88	6.438	<0.001
	SWC	−1.30	−6.441	<0.001	−1.31	−12.410	<0.001	−1.66	−12.138	<0.001
	<i>F</i>	14.241			31.717			38.454		
	<i>R</i> <sup>2</sup>	0.087			0.176			0.205		
Model 2	Workload	0.75	3.734	<0.001	0.40	3.836	<0.001	0.90	6.580	<0.001
	SWC	−1.26	−6.219	<0.001	−1.29	−12.146	<0.001	−1.63	−11.866	<0.001
	Workload × SWC	−0.35	−1.782	0.075	−0.19	−1.832	0.067	−0.27	−2.027	0.043
	<i>F</i>	13.156***			28.931***			35.100***		
	<i>R</i> <sup>2</sup>	0.090			0.178			0.208		

\*\*\*  $p < 0.001$ . All models adjusted for gender, age, occupation, participation in the first-line anti-epidemic, education level, married status, and self-rated health. SWC, Satisfaction with working conditions. The workload and SWC were transformed into z-scores for moderating effect analysis.

to conduct the simple slope analysis and Johnson-Neyman analysis using a significance level of  $p < 0.05$ .

### 3. Results

Among the 1,349 participants, 88.2% were women and more than half were between 20 and 40 years old. More than half of the participants (78.0%) were nurses, and 54.0%

of the participants had participated in the first-line anti-epidemic (Table 1). The results showed that 8.6%, 6.9%, and 19.2% of healthcare workers collecting test samples during the local outbreaks of COVID-19 reported anxiety disorder, depression, and somatization, respectively. Approximately 27.9% of healthcare workers reported high satisfaction with working conditions.

The results showed that a high level of workload significantly increased the risk of an anxiety disorder (OR = 1.81, 95% CI



= 1.17–2.78), depression (OR = 1.92, 95% CI = 1.19–3.10), and somatization (OR = 1.90, 95% CI = 1.40–2.57), while high level of satisfaction reduced these risks, and OR and 95% CI were 0.35 (0.20–0.64), 0.27 (0.13–0.56), and 0.32 (0.21–0.48) after adjusting for gender, age, occupation, participating in the first-line anti-epidemic, education level, married status, and self-rated health (Table 2).

The results also suggested that women reported a higher risk of somatization than men (OR = 1.96, 95% CI = 1.09–3.53). Healthcare workers aged 26–30 years old (OR = 2.40, 95% CI = 1.08–5.36) and 31–35 years old (OR = 2.58, 95% CI = 1.05–6.34) reported a higher risk of anxiety disorder. The results also suggested that participants who participated in the first-line anti-epidemic before reported a higher risk of somatization (OR = 1.39, 95% CI = 1.03–1.87). Compared with the education level of college, those with the education level of bachelor's degree and master's degree or above reported lower odds of anxiety disorder, depression, and somatization, but for anxiety disorders and depression, the statistical significance only was observed in the education level of bachelor's degree, and OR (95%CI) were 0.39 (0.24–0.63) and 0.47 (0.28–0.79). In addition, participants with moderate and good self-reported health were more likely to report a lower risk of anxiety disorder, depression, and somatization than those who had poor health.

Similar to logistic regression analysis, multiple-line regression results showed that workload positively predicted anxiety disorder ( $b = 0.73$ ,  $p < 0.001$ ), depression ( $b = 0.39$ ,  $p < 0.001$ ), and somatization ( $b = 0.88$ ,  $p < 0.001$ ) in healthcare workers, even after adjusting a series of covariates, while satisfaction with working conditions was negatively associated with anxiety disorder, depression, and somatization (Model 1 in Table 3). Three multiple regression models that included interactive items of satisfaction with working conditions and workload were run to assess satisfaction with working conditions as a potential moderator (Model 2 in Table 3). The results showed that workload  $\times$  satisfaction with working conditions was negatively correlated with an anxiety disorder ( $b = -0.35$ ,  $p = 0.075$ ), depression ( $b = -0.19$ ,  $p = 0.067$ ), and somatization ( $b = -0.27$ ,  $p = 0.043$ ).

Figure 2 shows the simple slope of SWC moderating the association between workload and anxiety disorder, as well as depression and somatization. The results suggested that for healthcare workers with low SWC, the high workload was associated with an anxiety disorder ( $b_{\text{simple}} = 1.10$ ,  $p < 0.001$ ) (Supplementary Table 1; Figure 2A). However, for healthcare workers with high SWC, high workload was not significantly associated with an anxiety disorder ( $b_{\text{simple}} = 0.40$ ,  $p = 0.134$ ). Similarly, for healthcare workers with low SWC, high workload was associated with depression ( $b_{\text{simple}} = 0.59$ ,  $p < 0.001$ ). However, for healthcare workers with high SWC, high workload was not significantly associated with depression ( $b_{\text{simple}} = 0.22$ ,  $p = 0.124$ ) (Supplementary Table 1; Figure 2B). Healthcare workers with a high workload were associated with somatization both for low SWC ( $b_{\text{simple}} = 1.17$ ,  $p < 0.001$ ) and high SWC ( $b_{\text{simple}} = 0.63$ ,  $p < 0.001$ ) (Supplementary Table 1; Figure 2C).

Furthermore, the results in the Johnson-Neyman method showed that the cut-off value for SWC moderating the association between workload and anxiety disorder was 0.79 (Supplementary Figure 1; Supplementary Table 2), which was 0.81

for depression (Supplementary Figure 2; Supplementary Table 3). When the SWC value was below 0.79 and 0.81, the workload was associated with anxiety disorder and depression, respectively, but this effect was no longer significant when the value was above the cut-off values. The workload was always associated with somatization, regardless of the value of SWC (Supplementary Figure 3; Supplementary Table 4).

## 4. Discussion

This study examined the association between workload and the mental (including depression and anxiety disorder) and physical health of healthcare workers during a local outbreak of COVID-19 and explored whether satisfaction with working conditions moderated this association. The results of the study showed that workload was positively related to anxiety disorder, depression, and somatization among healthcare workers collecting test samples, and this effect was moderated by healthcare workers' satisfaction with their working conditions. Understanding the associations among these factors had a heuristic value for public planning and interventions aiming to reduce the negative psychological and physical outcomes of healthcare workers.

In addition, the results also suggested that women reported higher levels of anxiety disorders, depression, and anxiety disorders compared to men but only reached significant levels of somatization.

The findings suggested that women were more likely to report somatization as compared to men, and that the risk of anxiety and depression was comparable in men and women, which could be explained by the fact that the overall physical fitness of women and the body's ability to bear the load was weaker than that of men (25). It was worth noting that nurses were the main staff for nucleic acid sample collection and that the majority of the composition of this group was women. Similarly, healthcare workers who had participated before in the first-line anti-epidemic reported a higher risk of somatization, which indicated that the burden on the body from previous intense workloads had not been fully recovered and that the current workload might exacerbate this negative effect. These findings have highlighted the need for providing mental and physical health services for healthcare workers, especially for those women and participants who participated in the first-line anti-epidemic before, and it was essential to provide more somatic services and adequate rest to promote somatic health.

The results also showed that healthcare workers aged 26–35 years reported a higher risk of higher anxiety disorder. The possible reasons for this were that healthcare workers in this age group had just entered the workforce and were on the rise in their careers, thus health concerns and career confusion might have increased their anxiety levels. Compared with college, healthcare workers with undergraduate and graduate education or above have a lower risk of depressive symptoms, as well as somatic symptoms, but a significant difference was only observed in undergraduate education. Studies indicated a U-shaped association between depression and education level, the perceived subjective wellbeing from a graduate degree was much lower compared to getting a college degree (26, 27). In

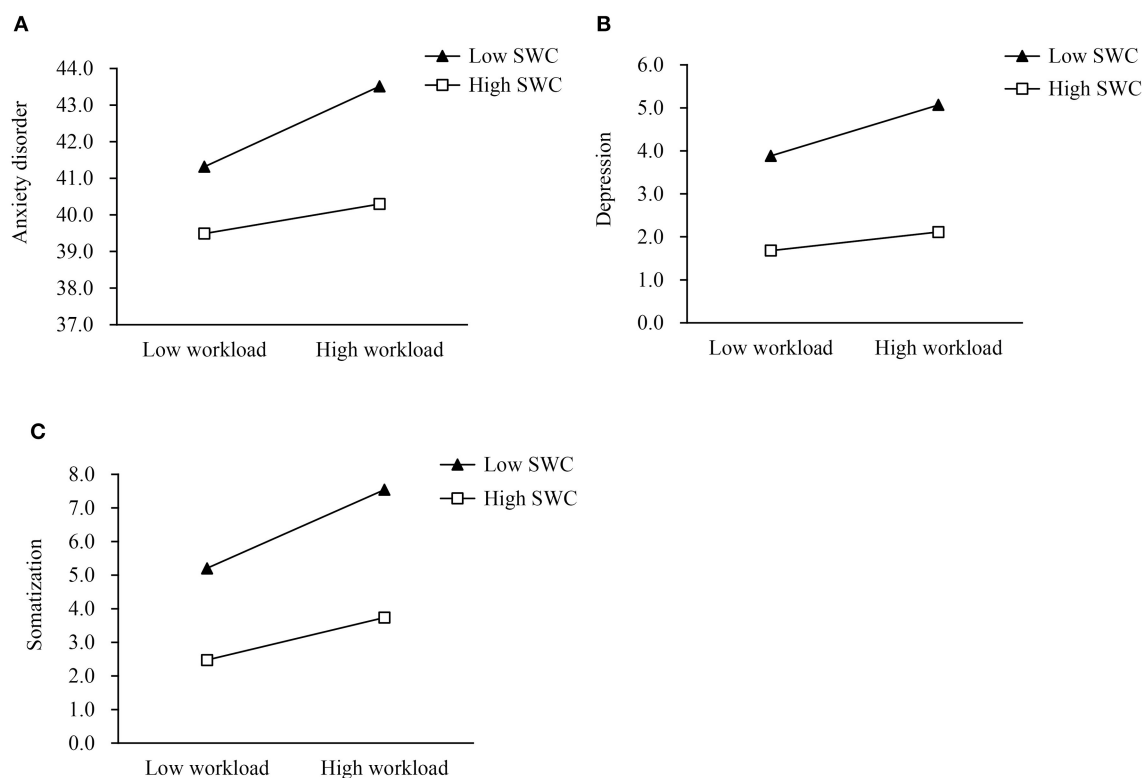


FIGURE 2

The simple slope of satisfaction with working conditions moderated the associations between workload and anxiety disorder (A), depression (B), and somatization (C). SWC, Satisfaction with working conditions.

addition, the results from this study suggested higher self-rated health was associated with a lower risk of anxiety disorder, depression, and somatization, which was consistent with previous results (28). Self-rated health is widely accepted as a means of reporting physical health and psychological health (29, 30). These findings suggested that the mental and somatic services provided by health providers need to take into account differences in characteristics.

The findings of the present study indicated that workload was a significant predictor of anxiety disorder, depression, and somatization of healthcare workers collecting test samples. This was consistent with previous studies in which excessive workload during a new coronary pneumonia outbreak was strongly associated with the mental health of medical staff, such as anxiety disorder, depression, insomnia, and somatization (6, 31, 32). Overloads, including extended working hours and high workloads, left healthcare workers without good rest and prone to occupational fatigue, which affected their mental and physical health (33). The work requirement control model theory suggested that the amount of work tasks was an important factor in the characteristics of work requirements and was one of the important sources of work stress (8, 34). Overwork and psychological disorders among healthcare workers were important social issues and have been an important concern for the researcher (35). The COVID-19 pandemic in 2019 was undoubtedly unprecedented and greatly increased the risk of mental health problems, which might last for a longer time, and has highlighted concerns about the mental and physical health of

healthcare workers. More health services should be provided to mitigate this challenge.

This study found that a higher level of satisfaction with working conditions negatively predicted the mental problems of healthcare workers. Not only that, but satisfaction with working conditions also mitigated the negative effects of workload on the poor mental health of healthcare workers. The results of this study confirmed the theoretical hypothesis of the J-R model. On the one hand, more resources positively impacted the level of psychological health and reduced emotional exhaustion and negative idleness in healthcare workers, thus improving psychological health. On the other hand, such resources also alleviated the negative effects of work characteristics on psychological symptoms. As Bakker et al. (14) pointed out, adequate work resources could help employees successfully achieve their work goals, motivate their learning and growth, promote their development, and bring positive effects to them. The findings highlighted the importance of providing frontline healthcare workers with adequate medical resources, efficient and good work processes, and working conditions, which were essential for reducing the psychological burden of healthcare workers and mitigating the negative mental health effects of high work intensity.

There are several limitations to this study. First, this study was a cross-sectional investigation, and this kind of study limited the ability of causal inference. Further longitudinal studies are needed to replicate and reproduce these findings. Second, data were collected based on a web-based questionnaire, which could not

guarantee the response rate. Finally, the measurement of workload in this study was limited only in terms of shift duration and the number of nucleic acid tests participated in; therefore, future studies should be conducted using more refined instruments to evaluate these associations.

## 5. Conclusion

Overall, this study highlighted the negative impact of workload on the psychological health of sampled healthcare workers in the post-epidemic era, which could be moderated by satisfaction with working conditions. Healthcare workers still faced beyond-neglect psychological challenges, and proactive health service measures should be considered to alleviate these challenges.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by Zhengzhou University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

KW: conceptualization, data analysis, writing—original draft, and visualization. BY: methodology, data curation, writing—review, and editing. LZ: investigation, data curation,

writing—review, and editing. CW: conceptualization, resources, formal analysis, supervision, and project administration. All authors read and approved the final manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1106299/full#supplementary-material>

## References

- Gold JA. Covid-19: adverse mental health outcomes for healthcare workers. *BMJ*. (2020) 369:m1815. doi: 10.1136/bmj.m1815
- Moreno Martínez M, Fernández-Cano MI, Feijoo-Cid M, Llorens Serrano C, Navarro A. Health outcomes and psychosocial risk exposures among healthcare workers during the first wave of the COVID-19 outbreak. *Saf Sci*. (2022) 145:105499. doi: 10.1016/j.ssci.2021.105499
- Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsis E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav Immun*. (2020) 88:901–7. doi: 10.1016/j.bbi.2020.05.026
- Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open*. (2020) 3:e203976. doi: 10.1001/jamanetworkopen.2020.3976
- Walton M, Murray E, Christian MD. Mental health care for medical staff and affiliated healthcare workers during the COVID-19 pandemic. *Eur Heart J Acute Cardiovasc Care*. (2020) 9:241–7. doi: 10.1177/2048872620922795
- Mo Y, Deng L, Zhang L, Lang Q, Liao C, Wang N, et al. Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. *J Nurs Manag*. (2020) 28:1002–9. doi: 10.1111/jonm.13014
- Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res*. (2020) 288:112954. doi: 10.1016/j.psychres.2020.112954
- Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Administr Sci Quart*. (1979) 24:285–308. doi: 10.2307/2392498
- Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol*. (2001) 52:397–422. doi: 10.1146/annurev.psych.52.1.397
- Adriaenssens J, De Gucht V, Maes S. Causes and consequences of occupational stress in emergency nurses, a longitudinal study. *J Nurs Manag*. (2015) 23:346–58. doi: 10.1111/jonm.12138
- Too LS, Leach L, Butterworth P. Cumulative impact of high job demands, low job control and high job insecurity on midlife depression and anxiety: a prospective cohort study of Australian employees. *Occup Environ Med*. (2021) 78:400–8. doi: 10.1136/oemed-2020-106840
- Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. *J Appl Psychol*. (2001) 86:499–512. doi: 10.1037/0021-9010.86.3.499
- Crawford ER, Lepine JA, Rich BL. Linking job demands and resources to employee engagement and burnout: a theoretical extension and meta-analytic test. *J Appl Psychol*. (2010) 95:834–48. doi: 10.1037/a0019364
- Bakker AB, Demerouti E, Euwema MC. Job resources buffer the impact of job demands on burnout. *Journal of occupational health psychology*. (2005) 10:170–80. doi: 10.1037/1076-8998.10.2.170
- Joyce K, Pabayo R, Critchley JA, Bambra C. Flexible working conditions and their effects on employee health and wellbeing. *Cochrane Database Syst Rev*. (2010) 2010:CD008009. doi: 10.1002/14651858.CD008009.pub2

16. Faragher EB, Cass M, Cooper CL. The relationship between job satisfaction and health: a meta-analysis. *Occup Environ Med.* (2005) 62:105–12. doi: 10.1136/oem.2002.006734
17. Allan BA, Dexter C, Kinsey R, Parker S. Meaningful work and mental health: job satisfaction as a moderator. *J Mental Health.* (2018) 27:38–44. doi: 10.1080/09638237.2016.1244718
18. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics.* (1971) 12:371–9. doi: 10.1016/S0033-3182(71)71479-0
19. Dunstan DA, Scott N. Norms for Zung's self-rating anxiety scale. *BMC Psychiatry.* (2020) 20:90. doi: 10.1186/s12888-019-2427-6
20. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* (2001) 16:606–13. doi: 10.1046/j.1525-1497.2001.016009606.x
21. Kroenke K, Spitzer RL, Williams JB. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosom Med.* (2002) 64:258–66. doi: 10.1097/00006842-200203000-00008
22. Alghamdi MG. Nursing workload: a concept analysis. *J Nurs Manag.* (2016) 24:449–57. doi: 10.1111/jonm.12354
23. Hayes AF, Matthes J. Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behav Res Methods.* (2009) 41:924–36. doi: 10.3758/BRM.41.3.924
24. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach.* New York, NY: The Guilford Press (2013).
25. Courtright SH, McCormick BW, Postlethwaite BE, Reeves CJ, Mount MK. A meta-analysis of sex differences in physical ability: revised estimates and strategies for reducing differences in selection contexts. *J Appl Psychol.* (2013) 98:623–41. doi: 10.1037/a0033144
26. Nikolaev B. Does higher education increase hedonic and eudaimonic happiness? *J Happiness Stud.* (2018) 19:483–504. doi: 10.1007/s10902-016-9833-y
27. Zhilei S, Yuze Y. Are people with higher education more likely to get depression? The effect of education on adults' depressive symptoms. *J Beijing Normal Univ.* (2020) 148–60.
28. Xu W, Sun H, Zhu B, Yu X, Niu Y, Kou C, et al. The prevalence of depressive symptoms and its determinants among adults in mainland China: results from a national household survey. *J Affect Disord.* (2021) 281:220–7. doi: 10.1016/j.jad.2020.12.009
29. Badawi G, Pagé V, Smith KJ, Gariépy G, Malla A, Wang J, et al. Self-rated health: a predictor for the three year incidence of major depression in individuals with Type II diabetes. *J Affect Disord.* (2013) 145:100–5. doi: 10.1016/j.jad.2012.07.018
30. Miilunpalo S, Vuori I, Oja P, Pasanen M, Urponen H. Self-rated health status as a health measure: the predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *J Clin Epidemiol.* (1997) 50:517–28. doi: 10.1016/S0895-4356(97)00045-0
31. Mosheva M, Hertz-Palmor N, Dorman Ilan S, Matalon N, Pessach IM, Afek A, et al. Anxiety, pandemic-related stress and resilience among physicians during the COVID-19 pandemic. *Depress Anxiety.* (2020) 37:965–71. doi: 10.1002/da.23085
32. Zhou Y, Wang W, Sun Y, Qian W, Liu Z, Wang R, et al. The prevalence and risk factors of psychological disturbances of frontline medical staff in china under the COVID-19 epidemic: workload should be concerned. *J Affect Disord.* (2020) 277:510–4. doi: 10.1016/j.jad.2020.08.059
33. McEwen BS, Akil H. Revisiting the stress concept: implications for affective disorders. *J Neurosci.* (2020) 40:12–21. doi: 10.1523/JNEUROSCI.0733-19.2019
34. Huang C, Xie X, Cheung SP, Zhou Y. Job demands and resources, positive and negative affect, and psychological distress of social workers in China. *Front Psychiatry.* (2021) 12:752382. doi: 10.3389/fpsy.2021.752382
35. Weigl M, Stab N, Herms I, Angerer P, Hacker W, Glaser J. The associations of supervisor support and work overload with burnout and depression: a cross-sectional study in two nursing settings. *J Adv Nurs.* (2016) 72:1774–88. doi: 10.1111/jan.12948



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# Hidden work, frustration and multiple layers of occupational health in emergency situations: a longitudinal study during the COVID-19 pandemic

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This study examines the effects of the COVID-19 pandemic over time. Specifically, we derive from the organizational model of frustration to propose and test a model of pandemic-induced hidden work affecting employees' emotional responses of frustration along with behavioral responses and outcomes with respect to occupational health. We thereby develop a concept of multiple layers of occupational health that spans across stress, satisfaction with work-life balance (SWLB), burnout, subjective well-being, and physical health. Based on a longitudinal web-based survey of 198 working professionals conducted at seven points in time (1,143 data points, with 118 fully completed responses across all time points) for a wide range of industries in 2020, the study tests the proposed relationships using random coefficient modeling. The results show that COVID-19-situation-induced hidden work invokes emotional responses of frustration, which in turn influence outcomes referring to multiple layers of occupational health—positively affecting stress and burnout, and negatively influencing SWLB, subjective well-being, and physical health. Implications for research and practice are discussed.

## KEYWORDS

hidden work, frustration, occupational health, stress, burnout, well-being, satisfaction with work-life balance, COVID-19

## Introduction

The COVID-19 pandemic fundamentally altered many aspects of working and non-working life. Almost overnight, a 'new normal' has emerged characterized by a fear of the unknown, increased stress due to global health risk, and lockdowns. As the entire world was affected by various measurements and restrictions, there was no way for businesses to continue their typical office-based tasks. In order to maintain business operations, organizations were forced to adopt home-office practices, also known as remote working, wherever possible (Angelucci et al., 2020; Brynjolfsson et al., 2020; Hobbs and Hawkins, 2020).<sup>1</sup> When working

<sup>1</sup> Also labeled as teleworking, virtual working, distance working, telecommuting, or working from home. It is an important aspect of the changed nature of work during the pandemic and, as evidenced by our research, the majority (62%) of the respondents did work from home during it. However, the model presented and tested in our study is not only applicable to remote work.



from home was not an option (e.g., for essential workers like medical staff, supermarket and production workers), organizations had to find ways to adjust workflows to make them as smooth yet safe as possible.

The pandemic-related situation was uncertain, permeating every aspect of our lives. Employees found the circumstances to be frustrating and were required to be flexible by adapting to different modes and demands of the quickly altering work processes and contexts. At the same time, employees were pushed to be even more competitive and work harder to preserve their individual positions and keep their organizations afloat (Contreras et al., 2020). Amid such uncertainty, employees who were fortunate enough to retain their jobs during the pandemic reported working more and outside of regular hours (Collins et al., 2020; DeFilippis et al., 2020; ILO Monitor, 2020). These pressures prevented individuals from meeting their individual needs, leading to frustration and disengagement (Chong et al., 2020; Serafini et al., 2020; Yu et al., 2023).

While the long-term impacts of the COVID-19 turmoil have yet to become clear, the immediate impacts, such as stress and challenges related to work–life balance due to the changing work hours, can be seen in practice. However, the mechanisms and effects of this situation on health considerations across the span of the (hitherto) two major periods of the pandemic remain virtually unexplored. This absence of insight is important because the short- and long-term effects on multiple dimensions of occupational health (physical, psychological, psycho-social; Burton and WHO, 2010) hold important implications not just for individuals, but their families and communities as well. One should also not overlook the long-term performance of organizations, which vitally depends on the health of their human capital (Slaski and Cartwright, 2002; Ongori and Agolla, 2008).

In an attempt to capture insights related to the ever changing working modes during the pandemic, we narrow in on the aforementioned idea that at times when a national epidemic is declared employees are more likely to work longer and irregular hours (Hill et al., 2003). Such hidden work, i.e., answering work-related phones or emails outside of formal working hours without receiving compensation for that (Fenner and Renn, 2004; Kost et al., 2023), is a relatively understudied phenomenon in the literature, albeit present in practice for a long time. Namely, digitalization has encouraged an “always-on” workplace culture denoted by 24/7 access to information and connectedness with each other anytime, anywhere in the world. Receiving, checking and responding to work-related emails, calls and other messages after office hours has become routine for many employees. During the COVID-19 pandemic, the “always-on” work culture became the *modus operandi*, further blurring the already fuzzy boundaries between work performed within and outside of formal working hours (Penado Abilleira et al., 2021; Aleksić et al., 2023).

Recent research shows that hidden work behaviors are positively related to negative outcomes like family-to-work conflict and decreased perceptions of well-being, while actually contributing positively to work performance ratings (Fenner and Renn, 2010; Eichberger et al., 2021; Kost et al., 2023). Nonetheless, a comprehensive investigation of the ways hidden work affects multiple aspects of occupational health is missing, as is a study of the mechanisms according to which these effects unfold. In so doing, based on prior work on this matter (Pettersson and Arnetz, 1998; Mikkelsen et al., 2005; Campbell Quick et al., 2007; Hill et al., 2019) we develop the concept of multiple layers of occupational

health that encompass physical, psychological and psycho-social aspects. The presented research is based on the organizational model of frustration (Spector, 1978; Fox and Spector, 1999; Reio, 2011), which describes the effects of environmental sources of frustration on affective responses (i.e., frustration), which in turn affects behavioral responses and outcomes. In line with this model, we treat hidden work as a source of frustration, which stems from a superior source of frustration arising from environmental uncertainty and change (Serafini et al., 2020), where both act as enablers or inhibitors in achieving individual and organizational goals. Specifically, hidden work (i.e., increased workload) and frustration were chosen because the literature suggests that they influence important physical and mental health outcomes (e.g., Fox and Spector, 1999; Whingther et al., 2008). In a longitudinal study repeated at seven points in time across a seven-time longitudinal study across two periods of the COVID-19 epidemic, the objective of the study was to test the effects of hidden work via the emotional response of frustration on five aspects of occupational health (i.e., stress, satisfaction with work–life balance—SWLB, burnout, subjective well-being, and physical health).

The study attempts to contribute theoretically in three ways, to three distinct yet related fields. First, we aim to contribute to the occupational health literature by conceptualizing and testing the concept of multiple layers of occupational health. Prior research on the matter is scattered across different conceptualizations and considerations of this phenomena. For example, integrative ones include Psychosocial Work Quality and Health (Pettersson and Arnetz, 1998) or look at health outcomes from individual (sickness, presentism, absenteeism) and organizational (vigor, vitality, productivity) perspectives (Campbell Quick et al., 2007). In contrast, the majority of occupational health research concentrates on particular dimensions of the concept, like stress, burnout, subjective perceptions of health etc. (e.g., Cooper and Cartwright, 1994; Schaufeli and Greenglass, 2001; Mikkelsen et al., 2005). The presented study attempts to integrate this research and conceptualize a multi-layered concept of occupational health, one that encompasses physical, psychological and psycho-social aspects.

Second, we seek to advance research on work frustration by examining it in the COVID-19 pandemic context. While the original model of work frustration specifies different sources of either mild or severe frustration (Spector, 1978), we complement it by proposing that hidden work arises from environmental sources of frustration due to an uncertain situation, thereby proposing a dual-layered model of sources of frustration. Moreover, we add a novel set of tested outcomes to the model of frustration, i.e., multiple dimensions of occupational health.

Third, we add to research on hidden work. While prior research indicated that hidden work leads to negative outcomes (Barley et al., 2011; Kost et al., 2023), no particular emotional or behavioral responses have been specified, nor consequent health outcomes. We enhance understanding of its effects on occupational health-related outcomes, thereby complementing existing research on hidden work that reveals it contributes to a less favorable work–life balance and perceptions of work overload (Barley et al., 2011; Kost et al., 2023). We advance this stream of research by conceptualizing and testing a mechanism of how hidden work relates to multiple layers of

occupational health outcomes by specifically conceptualizing hidden work as a source of frustration.

## Theory and hypotheses

### Hidden work and employee frustration

The COVID-19 pandemic created uncertainty and many work-related challenges that required employees to be adaptable (Bailey and Breslin, 2021). For many, remote working was obligatory rather than being an optional flexible work arrangement, enabling staff to retain their positions and keep contributing to the organization's goals. Many employees were thrown into an uncertain situation without any clear idea of what the future would bring and how they would need to adapt. In many instances, adapting to the 'new normal' was left to them, who frequently experienced greater autonomy and independence (Galanti et al., 2021). Research indicates that having the autonomy to work anywhere at any time increases the frequency of work, and thus work becomes everywhere and all the time (Mazmanian et al., 2013; Chung and van der Horst, 2020). This situation led to increases in hidden work (Angelucci et al., 2020; Brynjolfsson et al., 2020).

Although being able to answer emails anytime and anywhere increases work flexibility, doing so is associated with work overload and stress (Barley et al., 2011). Hidden work has been linked to family-to-work conflict (Kost et al., 2023). Volini et al. (2020, p. 5) argue the pandemic "put more hours into the working day, creating exhaustion and burnout and simultaneously exposing the stress that many workers face in balancing professional and personal demands, as personal commitments and roles (such as being a parent or caregiver) could no longer be separated from work." Working longer, faster and with an 'always-on' work culture, manifested as constantly monitoring work-related information (e.g., via emails and social media), causes feelings of anxiety, insomnia and inefficiency (Salanova et al., 2007; Derks et al., 2015), which we propose acts as a source of frustration.

Workload itself has been empirically demonstrated to act as a source of frustration (Spector et al., 1988; Spector, 1994); the feeling of being upset or annoyed when an instigated goal-response (or expected behavioral sequence) is interrupted or interdicted (Fox and Spector, 1999). For individuals who hold cognitively demanding and autonomous jobs, quantitative workload levels are often high and stem from multiple sources, which frequently can produce negative affective reactions (Whinghter et al., 2008). Indeed, frustration at work can occur when individuals feel disappointed and dissatisfied with factors such as workplace morale, work arrangements (e.g., work hours) and inappropriate use of their resources (Beckman and Simms, 1992; Chang et al., 2014), or when they fall behind on work tasks (Carver, 2004) such as because of the COVID-19-induced situation and the ensuing adaptations required. Indeed, many psychological problems and important consequences in terms of mental health (including stress, anxiety, depression, frustration and uncertainty) during the COVID-19 outbreak emerged gradually (Duan and Zhu, 2020). Studies reported that the spatial distancing, self-isolation, quarantine, social and economic discord, and misinformation (notably on social media) were among the biggest factors contributing to unusual levels of sadness, fear, frustration, feelings of helplessness, loneliness, and nervousness (Ahorsu et al., 2020; Khan et al., 2020; Sakib et al., 2020).

In the organizational model of frustration (Spector, 1978), frustrated events may be understood as situational constraints in the immediate work situation that block individuals from achieving valued work goals or effectively performing (Berkowitz, 1978; Peters and O'Connor, 1980; Lazar et al., 2006). Such constraints may also be viewed as an external environment of the COVID-19 situation and resulting levels of hidden work. They are expected to induce employees' emotional response of frustration with both the *broad* COVID-19-induced situation and the *work itself*. We therefore propose:

*H1: Hidden work was positively related to frustration during the COVID-19 pandemic.*

### Hidden work, frustration and multiple layers of occupational health

With employees bearing much of the burden of coping with a crisis like the COVID-19 pandemic, creating a healthy and safe workplace for employees should be a top priority for organizations. Still, this seems to be easier said than done. A healthy workplace calls for a holistic approach to health, encompassing physical, psychological and social contributing factors (Kelloway and Day, 2005). According to the WHO (2011), a healthy workplace is one in which workers and managers collaborate to protect and promote the health, safety and well-being of all workers, along with the sustainability of the workplace. It considers four discrete, yet linked, areas (WHO, 2011): (1) health and safety concerns of the physical work environment; (2) health, safety and well-being concerns in the psychosocial work environment; (3) personal health resources in the workplace; and (4) ways of participating in the community to improve the health of workers, their families, and members of the community.

COVID-19 exposed employees to numerous serious threats to their occupational health (Sinclair et al., 2020). These threats included increased physical risk of infection in the workplace, isolation practices (International Federation of Red Cross and Red Crescent Societies, 2020), quarantine and social isolation, disrupted work routines (Javadi et al., 2020), uncertainty (Shanafelt et al., 2020), a weakened immune system due to high stress levels (Segerstrom and Miller, 2004), physical exhaustion, sleep disruption, and fear (Li et al., 2020), as well as feelings of personal danger (Lai et al., 2020). These may be negatively related to multiple areas of what is considered to constitute a healthy workplace.

We have learned from previous crises that employees exposed to unfavorable working conditions are more likely to experience mental health symptoms (Ten Have et al., 2015). Recent studies show that unhealthy workplace conditions related to COVID-19 have already manifested as deteriorating health (Sinclair et al., 2020; Kniffin et al., 2021). Stress, defined as an emotional response depending on an individual's perspective (Lazarus, 1990; Bonanno and Burton, 2013), is a normal psychological response to an abnormal situation, which COVID-19 certainly is. In turbulent times, stress can bring out unhealthy extremes in people's attitudes and behaviors (Weinberg and Cooper, 2012). This means it not surprising that employees reported higher levels of hidden work (i.e., workload) and experienced considerable stress during COVID-19 (Stankovska et al., 2020). The relationship between hidden work, frustration and high stress levels

can be explained by the health impairment process arising from demands and resources imposed by one's job (Bakker and Demerouti, 2007). Job demands create a strain for employees, and this strain is exacerbated by a lack of work resources. Uncertainty, financial, public health and job insecurity, together with new risks that require additional activities and efforts to perform a job safely and efficiently (i.e., increased hidden work), lead to escalating job demands. Employees are faced with high workload demands, with little control over their work (Sinclair et al., 2020), causing them to experience feelings of powerlessness and frustration, which in turn can lead to higher levels of stress. The current conditions of frustration require the investing of energy, which can deplete employees' psychological resource reservoir, thereby increasing work-related stress. We thus propose:

*H2a: Hidden work was positively related to stress via frustration during the COVID-19 pandemic.*

We further propose that hidden work is negatively associated with SWLB via frustration. SWLB is defined as the "overall level of contentment resulting from an assessment of one's degree of success at meeting work and family role demands" (Valcour, 2007, p. 1512). To assure satisfying experiences in all life domains, individuals must properly allocate their personal resources like energy, time and commitment across several domains (Kirchmeyer, 2000). During the COVID-19 pandemic, many employees experienced an increase in work and family demands, which can drastically exacerbate work-family conflict (Sinclair et al., 2020), which in step increases frustration and decreases SWLB.

According to Valcour (2007), working hours have a negative impact on SWLB. The pandemic increased workloads and caused stress related to balancing work and personal demands (Volini et al., 2020) since employees were often compelled to work extra hours and overtime to complete their tasks (Irawanto et al., 2021). In the early stages of the COVID-19 pandemic, employees were still adjusting to the new setting and, fearful of losing their jobs, may have been doing more hidden work. To lower their stress levels and find solutions to achieve their goals in these challenging times, employees tended to adopt informal and even uncontrollable practices, completing work-related tasks in the private sphere and beginning to engage in work-related thinking and planning in their free time. This often led to frustration, which refers to negative emotions or passive behavior that occur when motivations and needs are not being met because the individual's goals are hindered (Wang et al., 2016). A recent study found that during COVID-19 employees were often frustrated by the need to prioritize work at the expense of everything else, which decreased their SWLB (Humphries et al., 2020). Employees who perform considerable hidden work are often focused on work-related activities due to the frustration it causes, thus dedicating more time and energy to work activities and hence neglecting social, family and other activities. The literature suggests that individuals who spend too much or too little time in different domains of their lives have a poorer work-life balance (Kuhnle et al., 2012). Thus:

*H2b: Hidden work was negatively related to satisfaction with work-life balance via frustration during the COVID-19 pandemic.*

Building on literature suggesting that adverse working conditions experienced for a longer period cause a strong sense of frustration and resulting occupational burnout (Kuo and Tsai, 2012), we also argue that hidden work is positively related to burnout via frustration. In a stage model of burnout, frustration is placed prior to burnout (Lewandowski, 2003), defined as a prolonged response to chronic emotional and interpersonal stressors on one's job (Maslach et al., 2001). This phenomenon is made up of emotional exhaustion (i.e., the feeling of being emotionally over-extended and exhausted at work), depersonalization (i.e., the feeling of callousness and cynicism) and professional inefficacy (i.e., a decline in experienced competence and achievement in one's work; Schaufeli et al., 1993).

The literature suggests that a heavy workload is most directly related to the exhaustion aspect of burnout (Maslach et al., 2001). Too many demands may exhaust employees' energy to the extent that recovery becomes impossible. Maslach et al. (2001) argue that emotional work is especially draining when an employee's job requires them to display emotions inconsistent with their feelings. As discussed above, the COVID-19 situation increased workloads and increased job demands of all kinds, including emotional ones (del Carmen Giménez-Espert et al., 2020). Employees accordingly often feel they have too many things to do in a given time period. Recent studies also suggest that emotional demands and workload were among the most prominent psychological risks during COVID-19 (del Carmen Giménez-Espert et al., 2020). Many employees experienced work stressors, threats of job insecurity, feelings of isolation, which together led to emotional exhaustion (Hwang et al., 2020). The uncertainty and constantly changing work environments saw employees perform higher levels of hidden work, resulting in work-related frustration. Preventing employees from coping with work requirements may further affect not only their short-term, but long-term health indicators. Taken together, we propose:

*H2c: Hidden work was positively related to burnout via frustration during the COVID-19 pandemic.*

The COVID-19 isolation measures, uncertainty, online education of children at home, coupled with job insecurity and health and safety concerns have posed unprecedented challenges to maintaining high levels of subjective well-being, defined as an individual's positive evaluation of life, experiencing pleasurable emotions, high life satisfaction and fulfillment, and a rewarding life (Diener et al., 2002). Recent studies examining the impact of the COVID-19 pandemic on well-being almost universally show that subjective well-being dropped significantly during the pandemic (e.g., Gray et al., 2020; Wanberg et al., 2020; Ruiz et al., 2021). On top of the obvious COVID-19-related reasons for this, we propose that hidden work, followed by frustration, places an additional strain on employees' perceived well-being. The literature suggests that a high workload is associated with low subjective well-being (Pace et al., 2021) and that the quality of work and non-work life influences overall subjective well-being (Edwards and Rothbard, 1999; Hart, 1999; Erdogan et al., 2012), suggesting the importance of experiencing pleasant emotions in all domains of life. Hidden work is typically a result of time pressure, tight deadlines, and a heavy workload (Ojala, 2011), which were often present in the work context during the COVID-19 pandemic. As mentioned, these unfavorable working conditions produced a strong sense of frustration, i.e., negative emotions resulting from obstacles or



disruptions encountered by employees (Fox and Spector, 1999) that, in turn, reduced the quality of their work life. These negative emotions may also spill over from work to non-work life, thereby affecting the quality of non-work life (e.g., spending less time with family, transferring a bad mood and frustration to family members etc.). This leads us to propose:

*H2d: Hidden work was negatively related to subjective well-being via frustration during the COVID-19 pandemic.*

Overwhelming workloads and stress for an extended period of time can bring about emotional and physical exhaustion if individuals fail to improve or cope with their difficult working conditions (Wang et al., 2016). The pandemic caused unprecedented measures to be introduced to curb the virus, which further worsened working conditions. The economic consequences and job insecurity put additional pressure and frustration on employees, who were often willing to work longer hours and sacrifice their physical health just to perform well in those uncertain times, allowing them to retain their jobs and financial security.

Employees' responses to the stress of perceived job insecurity in the shorter term can be emotional (anxiety, tension, dissatisfaction), psychological (increased heart rate, greater catecholamine secretion) and behavioral (substance use, lack of concentration). In the long term, the accumulation of these responses can bring more permanent adverse mental and physical health consequences (Heaney et al., 1994; Burgard et al., 2009). Namely, workload and time pressures often require constant physical or mental effort and impose potential physical and psychological costs (Sabagh et al., 2022), while job stressors (e.g., job insecurity and work–life conflict) predict the frustration of needs (Sabagh et al., 2022). It is no surprise then that studies show employees were frustrated and highly susceptible to physical exhaustion, depressive symptoms, anxiety, and sleep disorders during the pandemic because of excessive workload and isolation (e.g., Li et al., 2020; Shaukat et al., 2020). Studies also suggest that employees who experience frustration at work, as was common during COVID-19, have lower levels of physical health (De Castro et al., 2010) (see Figure 1). Therefore:

*H2e: Hidden work was negatively related to physical health via frustration during the COVID-19 pandemic.*

Figure 1 summarizes our research model.

## Methods

### Research context

The research was conducted in Slovenia where the first case of the virus was confirmed on 4 March 2020. The growing number of infections saw Slovenia declare an epidemic for the first time on 12 March 2020. Like many other countries around the world, the Slovenian authorities adopted various measures to contain the virus' spread, such as closing educational institutions, applying restrictions while crossing the border, restrictions on public life, and a ban on all non-essential health service activities.

To limit the economic costs of the COVID-19 pandemic and help employers (and indirectly employees) mitigate the effects of

COVID-19, the government adopted the Wage and Contribution Measures Intervention Act (which entered into force on 29 March 2020). This Act regulated the right of employers (and indirectly employees) to apply for a reimbursement of salary compensation paid to employees either unable to work due to business reasons or under the mandatory quarantine. That is, during the time a COVID-19 epidemic was declared in Slovenia, employers could order the absence of workers from work by: (1) arranging work from home due to exceptional circumstances; (2) relying on the use of annual leave by the worker and collective leave; (3) being put on furlough at home (in case of a reduced workload); (4) absence from work to care for children following the closure of kindergartens and schools; and (5) the performance of other work due to the exceptional circumstances. While some enterprises decided to shut down production, many companies switched to remote working, thus causing a boom in remote working across Slovenia. In late April 2020, Slovenia passed the first peak of its COVID-19 epidemic and the government eased its lockdown measures. On 15 May 2020, Slovenia became the first European country to officially declare the end of the COVID-19 epidemic.

Toward the end of summer, the number of COVID-19-infected people began to rise sharply. In October 2020, the situation in Slovenia was much worse than during the first period. On 19 October 2020, a second period of COVID-19 cases occurred in Slovenia, causing the government to again declare an epidemic, activate the National Protection and Rescue Plan, and tighten measures, including a curfew between 21:00 and 06:00. On the same day, primary school students in 6th grade and up together with secondary and university students switched back to distance learning.

As the COVID-19 situation remained serious, in early November the government extended restrictions on movement outside municipalities, extended the distance learning, closed kindergartens, suspended public transport and closed non-essential shops. All gatherings were also banned, except for persons living in the same household. On 16 November 2020, the declaration of an epidemic was formally extended by 30 days. After nearly 2 months of strict restrictions, a temporary relaxation of measures was enacted between 15 December 2020 and 23 December 2020 (i.e., public transport resumed, hair salons, flower shops, car washes and dry cleaners were allowed to reopen). On 22 December 2020, mass antigen testing began in a dozen urban areas across Slovenia, whereas on 27 December 2020, vaccination against COVID-19 started at nursing homes.

### Sample and procedure

We conducted a seven-time [in two periods: Period 1 (before, beginning, peak and end of the first COVID-19 epidemic wave, between February and May 2020) and Period 2 (beginning, peak and softening of the second epidemic wave between October and December 2020)] longitudinal web-based questionnaire study. Table 1 summarizes the COVID-19-related situation in Slovenia in 2020 during each period of the data collection. With the help of a national research agency, using a nationally representative (by age, gender, industry) quota sampling strategy we collected data from 198 employees (who responded to our survey at all seven time points) working in a wide range of industries. Those were sampled from the agency's registered pool of potential participants who were working

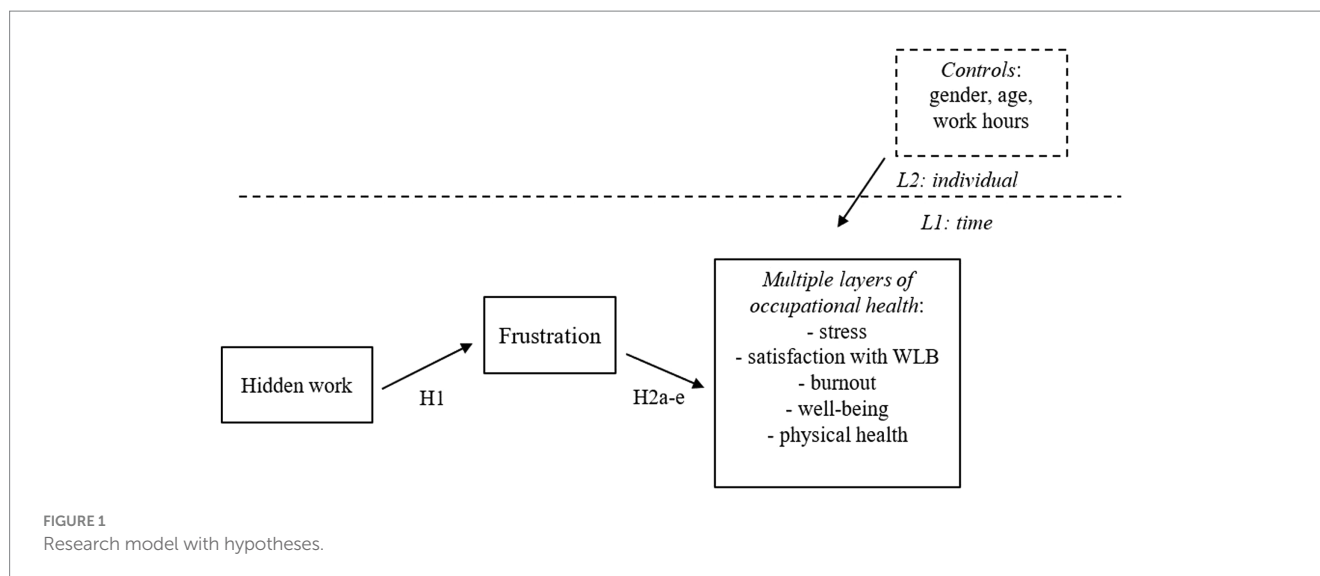


TABLE 1 COVID-19-related situation in Slovenia in 2020 during each period of the data collection.

Time	Month	Situation
<i>Period 1</i>		
Time 1	Late February	Before the epidemic; preparation of potential measures
Time 2	Mid March	An epidemic officially declared in Slovenia; first phase of the infection spreading; several measures adopted
Time 3	Mid April	peak of the wave-1 epidemic, the most restrictive measures adopted
Time 4	Late May	Official end of the COVID-19 epidemic; lockdown measures gradually eased
<i>Period 2</i>		
Time 5	Mid October	An epidemic again declared in Slovenia; infection spreading; several measures adopted
Time 6	Mid November	Peak of the wave-2 epidemic, the most restrictive measures adopted
Time 7	Mid-to-late December	The official epidemic persists, but the lockdown measures gradually and temporarily eased

professionals. Unique IDs were constructed to ensure the anonymity of participants' responses and to match responses across the time waves.

The sample consisted of 46% of respondents working in public companies, 50% in private companies, with the remaining respondents working in joint ventures. Overall, about 11% of respondents were working in micro-companies with up to 9 employees, 20% in small companies with up to 49 employees, 25% in medium-sized ones with up to 249 employees, and 45% working in large companies with at least 250 employees. The respondents operated mainly in the following industries: education, culture and sport (13%), administration (13%), production (13%), health (10%) and sales (8%). Among the respondents, 42% held a high school diploma and 55% at least an undergraduate diploma.

## Measures

All the focal variables were self-reported and measured on all seven occasions.

**Hidden work** was measured with two items proposed by Kost et al. (2023)— $\alpha = 80$ . Respondents were asked to indicate how often they were working outside their normal working hours without being

compensated in the form of extra and/or overtime pay and how often they were responding to work-related emails beyond working hours without being compensated in the form of extra and/or overtime pay. The responses ranged from 1 = never to 5 = very often.

**Frustration** was measured with the following item from Peters et al.'s (1980) scale: "Overall, I experienced very little frustration at work" (reverse scored). The responses ranged from 1 = strongly disagree to 5 = strongly agree.

**Job stress.** Elo et al. (2003) found that the content validity of the single-item measure used for stress symptoms was satisfactory for monitoring stress in different contexts. Job stress was accordingly measured with a single item. We asked the following question: how much stress have you experienced in the last month? A five-point scoring key was used (1 = I was not under stress at all, 5 = I was under extreme stress).

**Satisfaction with work-life balance (SWLB).** We measured SWLB using a five-item measure developed by Putrevu and Ratchford (1997). Response options ranged from 1 ("very dissatisfied") to 7 ("very satisfied"). A sample question is, "In the last month, how satisfied were you with the way you divided your time between work and personal or family life?" ( $\alpha = 0.96$ ).

**Burnout** was assessed with two items taken from the Maslach Burnout Inventory (MBI) that evaluate emotional exhaustion (i.e., the



feeling of being emotionally overextended and exhausted by work) (Maslach et al., 1986). Options for respondents ranged from 1 (“a few times a year or less”) to 6 (“every day”). A value of zero was also added, enabling the respondents to indicate that they had never experienced the described feeling or attitude. A sample item is the following: “I feel tired when I get up in the morning and have the next working day ahead of me” ( $\alpha=0.88$ ).

*Subjective well-being* was measured with the following item from Su et al.’s (2016) scale: “Compared to most of my peers, I consider myself more happy.” The responses ranged from 1 = strongly disagree to 5 = strongly agree.

*Self-rated physical health* was measured with an item asking respondents to rate their overall physical health in the past month. Responses ranged from 1 = poor to 5 = excellent.

*Gender, age and expected average work hours/week* were measured in the first period and incorporated in the model as individual-level control variables.

## Results

### Descriptive statistics

Table 2 shows the means, standard deviations, and correlations of/between the focal variables. Figure 2 portrays the means of our focal constructs over the seven time points of the data collection, across the two periods. As evidenced, frustration ( $M_{\text{period1}}=2.69$ ;  $M_{\text{period2}}=3.44$ ;  $t=9.48$ ;  $p<0.01$ ), stress ( $M_{\text{period1}}=2.46$ ;  $M_{\text{period2}}=3.38$ ;  $t=13.55$ ;  $p<0.01$ ) and burnout ( $M_{\text{period1}}=2.37$ ;  $M_{\text{period2}}=2.83$ ;  $t=5.87$ ;  $p<0.01$ ) significantly increased from Period 1 to Period 2, while other variables exhibit a slight positive trend. In the second period (questionnaire repetitions 5–7), we also collected data on remote work (with 62% of the respondents working remotely at time 6) and various COVID-19-related information, such as care for children at home (50%) or having received state aid benefit (13%).

### Hypotheses testing

Our dataset consisted of two hierarchically nested levels: observations spanning the seven time points (Level 1  $n=1,143$ ) were nested into individuals (Level 2  $n=198$ , with 118 individuals having responded to all seven surveys). We used hierarchical linear modeling (random coefficient modeling) to test our longitudinal model using MLmed (Beta 2), a computational macro for SPSS (v25) (Hayes and Rockwood, 2020; Rockwood and Hayes, in press).

The results of these analyses appear in Table 3. The first column presents frustration as an outcome variable. Hidden work was positively related to frustration at the between-individuals level (effect size = 0.08,  $se=0.04$ ,  $p<0.04$ ), supporting Hypothesis 1, but not at the within level (across time).

Turning to mediation analyses, on the between-individuals level frustration was shown to carry a positive indirect effect of hidden work on stress, with confidence intervals excluding zero (indirect effect size = 0.03,  $LLCI=0.0001$ ,  $ULCI=0.0649$ ), supporting Hypothesis 2a. The indirect effect of hidden work on SWLB via frustration was also significant at the between level (indirect effect size = -0.04,  $LLCI=0.0771$ ,  $ULCI=0.0006$ ), giving support for

Hypothesis 2b. Moreover, the indirect effect of hidden work on burnout via frustration was also significant at the between level (indirect effect size = 0.03,  $LLCI=0.0001$ ,  $ULCI=0.1142$ ), supporting Hypothesis 2c. Finally, the indirect effect of hidden work on subjective well-being via frustration was significant at the between level as well (indirect effect size = -0.03,  $LLCI=-0.0666$ ,  $ULCI=-0.0001$ ), lending support for Hypothesis 2d. Supporting Hypothesis 2e, the indirect effect of hidden work on physical health via frustration, was also significant at the between level (indirect effect size = -0.02,  $LLCI=-0.0436$ ,  $ULCI=-0.0001$ ). No indirect effect on the within level (across time) was significant, indicating that noteworthy variation in the variables driving the relationships we studied occurs between individuals, not within individuals, and changes over time.<sup>2</sup>

## Discussion

Based on the organizational model of frustration, we proposed and tested the relationships between hidden work, frustration, and multiple layers of health. The results of our longitudinal (seven-repetition) study, conducted during the first and second periods of the pandemic showed that COVID-19-situation-induced hidden work invoked emotional responses of frustration that then influenced outcomes consisting of multiple layers of occupational health—positively affecting stress and burnout, and negatively influencing SWLB, subjective well-being, and physical health. In summary, our findings suggest that employees who adhere to the “show must go on” philosophy in these challenging times, as reflected in higher levels of hidden work, are thereby undermining their health on multiple levels. These findings could change the attitudes of employees, employers and other key stakeholders to recognize hidden work as an important source of occupational health problems.

### Theoretical contributions

This study seeks to contribute to theory in three distinct, yet interrelated ways. First, we contribute to the occupational health literature by theoretically developing and empirically testing the concept of multiple layers of occupational health as an outcome of the COVID-19-induced work changes and emotional responses. Prior research on occupational health outcomes is scattered across different conceptualizations and considerations of this phenomena, which often stem from different disciplines like organizational behavior/psychology, and occupational health and safety. Previous attempts to reconcile and integrate off outcomes that cover multiple dimensions of health vis-à-vis work-related occurrences still largely focus on a single aspect such as psychosocial health (Pettersson and Arnetz, 1998), or focus predominantly on a specific level or output beneficiary of health considerations, such as an individual or an organization (Campbell Quick et al., 2007).

<sup>2</sup> The results of testing the hypotheses also hold for each period separately, and for the second period when controlling for the dummy of working remotely or not.

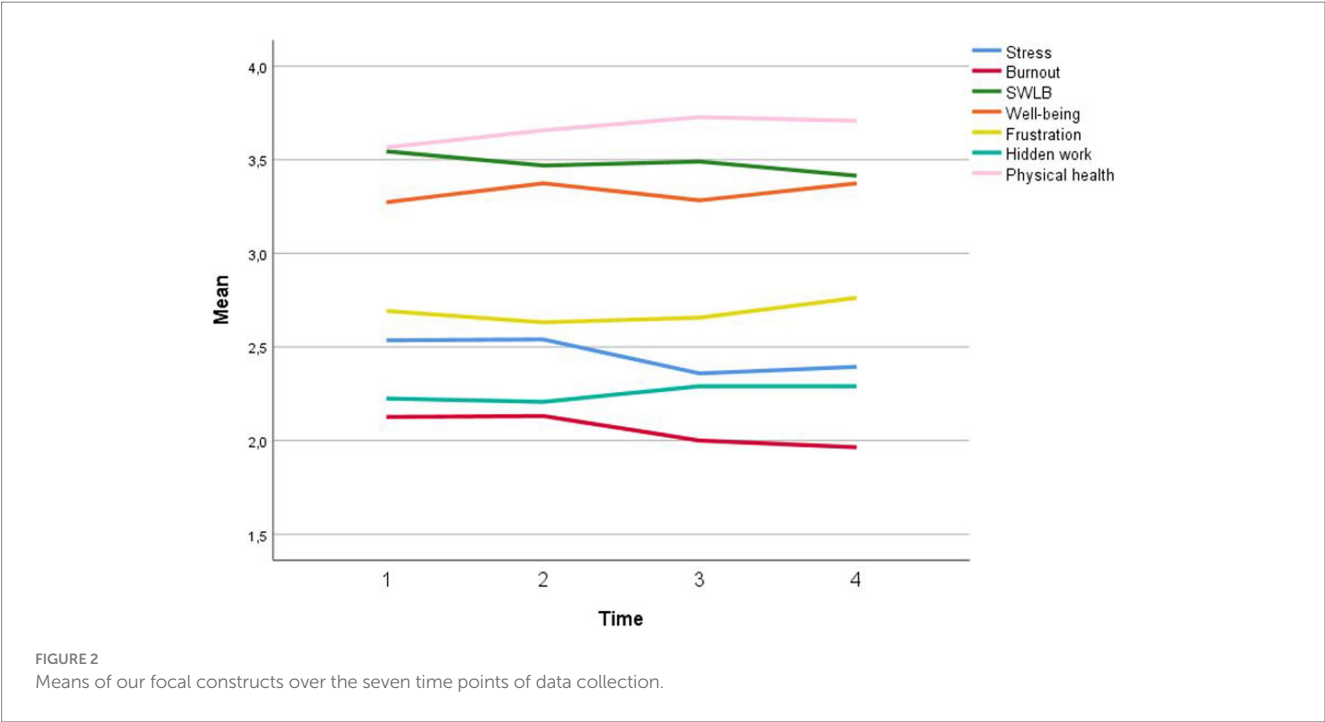


TABLE 2 Descriptive statistics and correlations.

	Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Hidden work	2.27	1.18	(0.80)									
2	Frustration	2.92	1.29	0.05	–								
3	Stress	2.74	1.14	0.32**	0.15**	–							
4	Burnout	2.51	1.25	0.31**	0.26**	0.64**	(0.88)						
5	SWLB	3.52	0.94	–0.31**	–0.17**	–0.35**	–0.49**	(0.96)					
6	Well-being	3.35	1.04	–0.14**	–0.13**	–0.20**	–0.31**	0.49**	–				
7	Gender	1.51	0.50	–0.08	0.05	0.02	–0.06*	0.07*	0.05	–			
8	Age	46.07	9.82	–0.04	–0.09**	–0.12**	–0.08**	0.04	0.10*	–0.03	–		
9	Average weekly work hours	42.92	118.72	0.02	0.04	–0.01	–0.01	0.02	0.01	–0.04	0.02	–	
10	Physical health	3.70	0.91	–0.15**	–0.10**	–0.27**	–0.39**	0.35**	0.35**	0.08**	–0.05	0.01	–

\*\*Correlation is significant at the 0.01 level (2-tailed). \*Correlation is significant at the 0.05 level (2-tailed). Variables 1–6 are reported as averages across the whole timespan. For gender, 1 = male, 2 = female. Reliabilities (coefficient alphas) appear on the diagonal in parentheses.

Advancing the majority of occupational health research, which considers individual dimensions of this concept (Cooper and Cartwright, 1994; Schaufeli and Greenglass, 2001; Mikkelsen et al., 2005), we offer an integrative, multi-layered concept of occupational health that encompasses physical, psychological and psycho-social aspects. In so doing, we followed the WHO’s four-layered healthy workplace model (Burton and WHO, 2010). This holds important implications for the field of occupational health across different disciplines that concentrate on these phenomena. Such a multi-layered conceptualization provides a more comprehensive view of health-related phenomena that can be applied while examining its determinants in setting up a

workplace that considers the human factor and places individuals at the center of the investigation, rather than merely organizationally-relevant outcomes. While most recent studies examined the pandemic’s impact on a specific group of employees (e.g., healthcare workers, remote workers) during the pandemic’s first wave, we extend the growing body of literature on occupational health during COVID-19 by examining the pandemic’s influence on a nationally representative quota sample of employees working in a broad of industries and conducting a longitudinal study during the first and second waves of the pandemic.

Second, we view the organizational model of work frustration as a backbone for identifying different sources of frustration (Spector,

TABLE 3 Results of longitudinal mediation analyses using MLmed.

Predictors / outcome variable	Frustration (mediator)	Stress	SWLB	Burnout	Well-being	Physical health
<i>Within-effects (across time)</i>						
Constant	3.06** (0.26)	1.15** (0.37)	5.40** (0.34)	−0.00 (0.45)	4.39** (0.43)	5.40** (0.34)
Hidden work	−0.03 (0.07)	0.19** (0.04)	−0.17** (0.03)	0.22** (0.04)	−0.06 <sup>†</sup> (0.03)	−0.17** (0.03)
Frustration		0.15** (0.02)	−0.02 (0.02)	0.09** (0.02)	−0.01 (0.02)	−0.02 (0.02)
<i>Between-effects (between individuals)</i>						
Hidden work	0.08* (0.04)	0.31** (0.05)	−0.21** (0.05)	0.29** (0.06)	−0.07 (0.05)	−0.21** (0.05)
Frustration		0.38** (0.07)	−0.48** (0.07)	0.71** (0.09)	−0.39** (0.08)	−0.48** (0.07)
Age	−0.01 <sup>†</sup> (0.00)	−0.01 (0.01)	−0.00 (0.01)	−0.00 (0.01)	0.01 (0.01)	−0.00 (0.01)
Gender	0.13 <sup>†</sup> (0.08)	0.09 (0.07)	0.07 (0.06)	0.09 (0.08)	−0.02 (0.07)	0.07 (0.06)
Work hours	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Within indirect effect of hidden work via frustration on outcomes		−0.0044 (LLCI = −0.0247; ULCI = 0.0152)	−0.0005 (LLCI = −0.0025; ULCI = 0.0044)	−0.0028 (LLCI = −0.0165; ULCI = 0.0099)	0.0004 (LLCI = −0.0024; ULCI = 0.0041)	0.0005 (LLCI = −0.0025; ULCI = 0.0044)
Between indirect effect of hidden work via frustration on outcomes		0.03 (LLCI = 0.0001; ULCI = 0.0649)	−0.04 (LLCI = −0.0771; ULCI = −0.0006)	0.03 (LLCI = −0.0001; ULCI = 0.1142)	−0.03 (LLCI = −0.0666; ULCI = −0.0001)	−0.02 (LLCI = −0.0436; ULCI = −0.0001)
Model fit (AIC)		7073.54	6401.15	6978.78	6589.09	6328.98
Model fit (BIC)		7096.46	6432.06	7001.70	6612.01	6351.89

\* $p < 0.05$ ; \*\* $p < 0.01$ ; <sup>†</sup> $p < 0.10$ . LLCI, lower-level confidence interval; ULCI, upper-level confidence interval.

1978) to advance subsequent research on the matter by examining it in the COVID-19 pandemic context. We complement existing research on frustration at work by proposing that hidden work occurs because of environmental sources of frustration due to an uncertain situation, thereby proposing a dual-layered model of sources of frustration. On one hand, frustration has been related to work occurrences, which is a much more prevalent line of investigation in the extant literature (*cf.*, Fox and Spector, 1999; Harvey et al., 2010; Vander Elst et al., 2012). Despite this rich body of literature concerned with the relationships of frustration with important negative work-related outcomes, frustration as a form of psychological strain has received very little empirical attention (Whinghter et al., 2008).

In accordance with frustration theory (Maier, 1949), stressors (e.g., quantitative workload) act as frustrating agents (Whinghter et al., 2008). Nevertheless, previous literature has not directly investigated how individual work-related characteristics might influence the development of affective outcomes like frustration over time. Our longitudinal study provides causal evidence for the effects of workload/overload (hidden work) on the development of the emotional response of frustration and subsequent outcomes, which not only empirically but also theoretically relevant given that it provides a rigorous test of the directionality of the effects proposed in the literature.

On the other hand, one overlooked area is sources of frustration arising from the broader situation, in our case, the uncertainty and anxiety resulting from the general COVID-19-induced atmosphere in societies and organizations. We focus directly on the role of context

above and beyond the organization, complementing research on organizational climate (Chang et al., 2018), evaluative context, and direct supervision (Morbée et al., 2020), or bureaucracy (Lewandowski, 2003) as sources of frustration. We apply a dual-layered conceptualization derived from the original model of work frustration (Spector, 1978) to enrich the nomological net of tested outcomes of the frustration model with regard to the aforementioned multiple dimensions of occupational health. Although frustration refers to an individual feeling, the majority of studies examined the influence of frustration on organizationally-relevant outcomes such as job performance, work engagement, absenteeism, and organizational and interpersonal aggression (e.g., Fox and Spector, 1999), thereby neglecting the potential negative individual-level consequences. We go beyond existing studies by making a theoretical and empirical attempt to establish a critical link between frustration and health outcomes (i.e., individual-level consequences) during the COVID-19 (and similar/potential) crises.

Third, we add to the research on hidden work and workload/overload in general. Prior research indicated that hidden work brings certain negative outcomes (Barley et al., 2011; Kost et al., 2023), but also found positive consequences for workers and organizations like task performance (Fenner and Renn, 2004, 2010). However, this research has not specified particular emotional responses resulting from hidden work, nor has it explained the mechanisms through which they affect outcomes. We add to understanding of its effects on occupational health-related outcomes, thereby complementing existing research on hidden

work that shows it contributes to a less favorable work–life balance and perceptions of work overload (Barley et al., 2011; Kost et al., 2023), as well as lowering perceptions of well-being (Eichberger et al., 2021). We advance this stream of research by conceptualizing and testing a mechanism of how hidden work relates to multiple layers of occupational health outcomes by specifically identifying hidden work as a source of frustration, thereby also addressing calls for further examination of the potential negative effects of workload and overload generally (Györfy et al., 2016). As digitalization increases and thus also the consequent potential for hidden work outside working hours, these findings are extremely relevant also beyond the current pandemic situation.

## Practical implications

The presented findings also hold important practical implications for setting up work-related policies regarding workload, especially in the light of urgent situations. To survive the COVID-19 crisis, or crises of a similar nature, organizations often (intentionally or unintentionally) force employees to make extraordinary efforts to keep the business running. In order to hold on to their job and the financial stability that comes with it, employees are often willing to follow the “show must go on” philosophy and work long hours even in their personal time without receiving any additional compensation. At first glance, while this seems to be a rational strategy, our findings suggest that in the long run it can negatively influence employees’ mental and physical health, in turn seriously jeopardizing the continuity of business processes. Organizations should therefore do more to keep after-hours work to a minimum (e.g., by implementing a “no after-hours” or “limited timeframe email” policy). For example, organizations can ensure that formal expectations of employees’ availability at all times and places remain low (Piszczyk, 2017), and encourage them to take time off from work. It is important to make it clear that this will not cause them to miss work-related opportunities or fall behind in their work activities.

The issues with hidden work are especially prevalent when it comes to remote work arrangements, even now that the effects of the COVID-19 pandemic are fading. The opportunity for individuals to work from home and the resulting autonomy can encourage hidden work and negative health-related outcomes. Still, reducing the opportunity for employees to work from home has also been shown to bring negative consequences (Raghuram et al., 2019). Such a situation therefore induces a paradox concerning how much flexibility is actually enabled. This paradox may be alleviated by promoting explicit separation norms regarding the separation of work from personal life (Kossek et al., 2006; Kost et al., 2023). Due to the potential negative impact of hidden work via frustration on employees’ health on multiple levels, protective mechanisms should be introduced to systematically prevent the occurrence of hidden work. This would constitute an important step towards creating a healthy workplace in times of crisis and in the light of the potential negative effects of digitalization, and hence in protecting employees’ health. In addition to formalized norms, managers and leaders in particular must act as role models for their employees by not answering emails and not being present on other work-related channels.

## Limitations

Like any study, ours is not without limitations. While our longitudinal seven-time-points investigation has great advantages in terms of causal statements, a possible limitation of the research design is that we refer exclusively to self-reports. However, earlier research has reported that by focusing on these perceptions, rather than the objective reality that would be expected to lead to experienced frustration and associated affective and behavioral responses, self-report measures may more adequately capture critical features of the situation than more objective, non-incumbent measures would (Fox and Spector, 1999). Wherever the research aim is to understand how people view, feel about, and respond to their jobs, self-report methodology may be most useful (Howard, 1994; Schmitt, 1994; Spector, 1994). Still, such research could be supplemented by the inclusion of additional objective measures of health-related outcomes, such as sick leave days, objective investment by organizations in workplace health and safety initiatives etc. In terms of the measurement instruments, we only used single-item measures for several constructs (i.e., for frustration, stress, subjective well-being, physical health). While prior research has demonstrated the validity of such single-item measures (cf., Elo et al., 2003), and this approach may prove particularly useful in longitudinal research to avoid overwhelming respondents with research instruments that are too long, enabling them to maintain concentration on the content while responding (Lucas and Donnellan, 2012; Fisher et al., 2016). Future research could further improve the validity of our study by employing longer and multi-dimensional scales.

Another limitation of our research can be seen in the fact that we did not control for different flexibility arrangements among employees prior to the occurrence of the COVID-19 pandemic and other contractual agreements concerning overtime. Various types of flexible work arrangements may increase the amount of hidden work employees perform (Chung and van der Horst, 2020). This can potentially affect the relationship between hidden work and its outcomes and, although we measured these in the second period of our data collection (time points 5–7) and it was evidenced that it did not play a role there, a comprehensive investigation of these factors is nonetheless warranted. If flexible working arrangements are introduced to improve employee performance, this may be a factor in the effects of hidden work on various outcomes.

Further, segmentation norms may also affect the extent to which employees engage in hidden work (Derks et al., 2015). Future research should consider these factors while additionally explore the effects of hidden work on proximal and distal work outcomes, potentially look at the interplay among occupational health outcomes to test the proposed sequence in which they occur (with respect to temporality and the severity of their impact), and continue to focus on outcomes beyond occupational health-related ones, such as multiple layers of performance (task, contextual, creativity etc.).

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.



## Ethics statement

Ethical approval was not required for the studies involving humans because at our institution, we do not require ethics committee approval for behavioral perception studies that are noninvasive, fully anonymized, and confidential. Therefore, when conducting our non-interventional study (i.e., survey), we fully informed all participants that their anonymity was guaranteed, why the study was being conducted, and how the data would be used. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

MČ and DA designed the model and computational framework, conceived the study, and drafted the manuscript. MČ performed the calculations. All authors discussed the results, commented on the manuscript, and worked on the final version of the manuscript.

## References

- Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., and Pakpour, A. H. (2020). The fear of COVID-19 scale: development and initial validation. *Int. J. Ment. Heal. Addict.*, 1–9.
- Aleksić, D., Černe, M., and Batistič, S. (2023). Understanding meaningful work in the context of technostress, COVID-19, frustration, and corporate social responsibility. *Hum. Relat.*:001872672211397. doi: 10.1177/00187267221139776
- Angelucci, M., Angrisani, M., Bennett, D. M., Kapteyn, A., and Schaner, S. G. (2020). Remote work and the heterogeneous impact of covid-19 on employment and health. *National Bureau of Economic Research*, w27749.
- Bailey, K., and Breslin, D. (2021). The COVID-19 pandemic: what can we learn from past research in organizations and management? *Int. J. Manag. Rev.* 23, 3–6. doi: 10.1111/ijmr.12237
- Bakker, A. B., and Demerouti, E. (2007). The job demands-resources model: state of the art. *J. Manag. Psychol.* 22, 309–328. doi: 10.1108/02683940710733115
- Barley, S. R., Meyerson, D. E., and Grodal, S. (2011). E-mail as a source and symbol of stress. *Organ. Sci.* 22, 887–906. doi: 10.1287/orsc.1100.0573
- Beckman, J. S., and Simms, L. M. (1992). *A guide to redesigning nursing practice patterns*. Chicago, IL: Health Administration Press.
- Berkowitz, L. (1978). Whatever happened to the frustration-aggression hypothesis? *Am. Behav. Sci.* 21, 691–708. doi: 10.1177/000276427802100505
- Bonanno, G. A., and Burton, C. L. (2013). Regulatory flexibility: an individual differences perspective on coping and emotion regulation. *Perspect. Psychol. Sci.* 8, 591–612. doi: 10.1177/1745691613504116
- Brynjolfsson, E., Horton, J. J., Ozimek, A., Rock, D., Sharma, G., and TuYe, H. Y. (2020). COVID-19 and remote work: an early look at US data (No. w27344). *National Bureau of Economic Research*.
- Burgard, S. A., Brand, J. E., and House, J. S. (2009). Perceived job insecurity and worker health in the United States. *Soc. Sci. Med.* 69, 777–785. doi: 10.1016/j.socscimed.2009.06.029
- Burton, J. WHO (2010). *WHO Healthy workplace framework and model: background and supporting literature and practices*. Geneva: World Health Organization.
- Campbell Quick, J., Macik-Frey, M., and Cooper, C. L. (2007). Managerial dimensions of organizational health: the healthy leader at work. *J. Manag. Stud.* 44, 189–205. doi: 10.1111/j.1467-6486.2007.00684.x
- Carver, C. S. (2004). Negative affects deriving from the behavioral approach system. *Emotion* 4, 3–22. doi: 10.1037/1528-3542.4.1.3
- Chang, Y. P., Lee, D. C., and Wang, H. H. (2018). Violence-prevention climate in the turnover intention of nurses experiencing workplace violence and work frustration. *J. Nurs. Manag.* 26, 961–971. doi: 10.1111/jonm.12621
- Chang, Y. P., Wang, H. H., Huang, C., and Wang, H. I. (2014). Interaction effect of work excitement and work frustration on the professional commitment of nurses in Taiwan. *J. Nurs. Res.* 22, 51–60.
- Chong, S., Huang, Y., and Chang, C. H. D. (2020). Supporting interdependent telework employees: a moderated-mediation model linking daily COVID-19 task setbacks to next-day work withdrawal. *J. Appl. Psychol.* 105, 1408–1422. doi: 10.1037/apl0000843
- Chung, H., and van der Horst, M. (2020). Flexible working and unpaid overtime in the UK: the role of gender, parental and occupational status. *Soc. Indic. Res.* 151, 495–520. doi: 10.1007/s11205-018-2028-7
- Collins, C., Landivar, L. C., Ruppanner, L., and Scarborough, W. J. (2020). COVID-19 and the gender gap in work hours. *Gend. Work Organ.* 28, 101–112. doi: 10.1111/gwao.12506
- Contreras, F., Baykal, E., and Abid, G. (2020). E-leadership and teleworking in times of COVID-19 and beyond: what we know and where do we go. *Front. Psychol.* 11:590271. doi: 10.3389/fpsyg.2020.590271
- Cooper, C. L., and Cartwright, S. (1994). Healthy mind; healthy organization—a proactive approach to occupational stress. *Hum. Relat.* 47, 455–471. doi: 10.1177/001872679404700405
- De Castro, A. B., Rue, T., and Takeuchi, D. T. (2010). Associations of employment frustration with self-rated physical and mental health among Asian American immigrants in the US labor force. *Public Health Nurs.* 27, 492–503. doi: 10.1111/j.1525-1446.2010.00891.x
- DeFilippis, E., Impink, S. M., Singell, M., Polzer, J. T., and Sadun, R. (2020). Collaborating during coronavirus: the impact of COVID-19 on the nature of work. *NBER Working Paper*, w27612.
- del Carmen Giménez-Espert, M., Prado-Gascó, V., and Soto-Rubio, A. (2020). Psychosocial risks, work engagement, and job satisfaction of nurses during COVID-19 pandemic. *Front. Public Health* 8:566896. doi: 10.3389/fpubh.2020.566896
- Derks, D., van Duin, D., Tims, M., and Bakker, A. B. (2015). Smartphone use and work-home interference: the moderating role of social norms and employee work engagement. *J. Occup. Organ. Psychol.* 88, 155–177. doi: 10.1111/joop.12083
- Diener, E., Oishi, S., and Lucas, R. (2002). “Subjective well-being: the science of happiness and life satisfaction” in *The handbook of positive psychology*. eds. C. R. Snyder and S. J. Lopez (New York: Oxford University Press), 63–73.
- Duan, L., and Zhu, G. (2020). Psychological interventions for people affected by the COVID-19 epidemic. *Lancet Psychiatry* 7, 300–302. doi: 10.1016/S2215-0366(20)30073-0
- Edwards, J. R., and Rothbard, N. P. (1999). Work and family stress and well-being: an examination of person-environment fit in the work and family domains. *Organ. Behav. Hum. Decis. Process.* 77, 85–129. doi: 10.1006/obhd.1998.2813
- Eichberger, C., Derks, D., and Zacher, H. (2021). Technology-assisted supplemental work, psychological detachment, and employee well-being: a daily diary study. *Ger. J. Hum. Resour. Manag.* 35, 199–223. doi: 10.1177/2397002220968188
- Elo, A. L., Leppänen, A., and Jahkola, A. (2003). Validity of a single-item measure of stress symptoms. *Scand. J. Work Environ. Health* 29, 444–451. doi: 10.5271/sjweh.752

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Erdogan, B., Bauer, T. N., Truxillo, D. M., and Mansfield, L. R. (2012). Whistle while you work: a review of the life satisfaction literature. *J. Manag.* 38, 1038–1083. doi: 10.1177/0149206311429379
- Fenner, G. H., and Renn, R. W. (2004). Technology-assisted supplemental work: Construct definition and a research framework. *Hum. Res. Manag.* Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management 43, 179–200.
- Fenner, G. H., and Renn, R. W. (2010). Technology-assisted supplemental work and work-to-family conflict: the role of instrumentality beliefs, organizational expectations and time management. *Hum. Relat.* 63, 63–82. doi: 10.1177/0018726709351064
- Fisher, G. G., Matthews, R. A., and Gibbons, A. M. (2016). Developing and investigating the use of single-item measures in organizational research. *J. Occup. Health Psychol.* 21, 3–23. doi: 10.1037/a0039139
- Fox, S., and Spector, P. E. (1999). A model of work frustration-aggression. *J. Organ. Behav.* 20, 915–931. doi: 10.1002/(SICI)1099-1379(199911)20:6<915::AID-JOB918>3.0.CO;2-6
- Galanti, T., Guidetti, G., Mazzei, E., Zappalà, S., and Toscano, F. (2021). Work from home during the COVID-19 outbreak: the impact on employees' remote work productivity, engagement, and stress. *J. Occup. Environ. Med.* 63:e426, –e432. doi: 10.1097/JOM.0000000000002236
- Gray, N. S., O'Connor, C., Knowles, J., Pink, J., Simkiss, N. J., Williams, S. D., et al. (2020). The influence of the COVID-19 pandemic on mental well-being and psychological distress: impact upon a single country. *Front. Psych.* 11:594115. doi: 10.3389/fpsyg.2020.594115
- Györfi, Z., Dweik, D., and Girasek, E. (2016). Workload, mental health and burnout indicators among female physicians. *Hum. Resour. Health* 14, 1–10. doi: 10.1186/s12960-016-0108-9
- Hart, P. M. (1999). Predicting employee life satisfaction: a coherent model of personality, work, and nonwork experiences, and domain satisfactions. *J. Appl. Psychol.* 84, 564–584. doi: 10.1037/0021-9010.84.4.564
- Harvey, P., Harris, K. J., and Booth, S. L. (2010). Who abuses their coworkers? An examination of personality and situational variables. *J. Soc. Psychol.* 150, 608–627.
- Hayes, A. F., and Rockwood, N. J. (2020). Conditional process analysis: concepts, computation, and advances in the modeling of the contingencies of mechanisms. *Am. Behav. Sci.* 64, 19–54. doi: 10.1177/0002764219859633
- Heaney, C. A., Israel, B. A., and House, J. S. (1994). Chronic job insecurity among automobile workers: effects on job satisfaction and health. *Soc. Sci. Med.* 38, 1431–1437. doi: 10.1016/0277-9536(94)90281-X
- Hill, N. S., Dorow, S., Barnetson, B., Martinez, J. F., and Matsunaga-Turnbull, J. (2019). Occupational health and safety for migrant domestic workers in Canada: dimensions of (im) mobility. *J. Environ. Occup. Health Policy* 29, 397–421. doi: 10.1177/1048291119867740
- Hill, E. J., Ferris, M., and Martinson, V. (2003). Does it matter where you work? A comparison of how three work venues (traditional office, virtual office, and home office) influence aspects of work and personal/family life. *J. Vocat. Behav.* 63, 220–241. doi: 10.1016/S0001-8791(03)00042-3
- Hobbs, T. D., and Hawkins, L. (2020). The results are in for remote learning: it didn't work. *Wall Street J.*:5.
- Howard, G. S. (1994). Why do people say nasty things about self-reports? *J. Organ. Behav.* 15, 399–404. doi: 10.1002/job.4030150505
- Humphries, N., McDermott, A. M., Creese, J., Matthews, A., Conway, E., and Byrne, J. P. (2020). Hospital doctors in Ireland and the struggle for work–life balance. *Eur. J. Pub. Health* 30, iv32–iv35. doi: 10.1093/eurpub/ckaa130
- Hwang, H., Hur, W. M., and Shin, Y. (2020). Emotional exhaustion among the South Korean workforce before and after COVID-19. *Psycho. Psychoth.: Theory Res. Prac.* 94, 371–381.
- ILO Monitor (2020). *COVID-19 and the world of work. Updated estimates and analysis*. Geneva: International Labour Organization.
- International Federation of Red Cross and Red Crescent Societies (2020). *Mental health and psychosocial support for staff, volunteers and communities in an outbreak of novel coronavirus*. Geneva: International Federation of Red Cross and Red Crescent Societies.
- Irawanto, D. W., Novianti, K. R., and Roz, K. (2021). Work from home: measuring satisfaction between work–life balance and work stress during the COVID-19 pandemic in Indonesia. *Economies* 9:96. doi: 10.3390/economies9030096
- Javadi, S. M. H., Arian, M., and Qorbani-Vanajemi, M. (2020). The need for psychosocial interventions to manage the coronavirus crisis. *Iran. J. Psychiatry. Behav. Sci.* 14:e102546. doi: 10.5812/ijpbs.102546
- Kelloway, E. K., and Day, A. (2005). Building healthy workplaces: where we need to be. *Can. J. Behav. Sci.* 37, 309–312. doi: 10.1037/h0087265
- Khan, K. S., Mamun, M. A., Griffiths, M. D., and Ullah, I. (2020). The mental health impact of the COVID-19 pandemic across different cohorts. *Int. J. Ment. Heal. Addict.* 20, 380–386.
- Kirmeyer, C. (2000). “Work–life initiatives: greed or benevolence regarding workers' time” in *Trends in organisational behavior* (vol. 7). eds. C. Cooper and D. Rousseau (Chichester: John Wiley & Sons), 79–93.
- Kniffin, K. M., Narayanan, J., Anseel, F., Antonakis, J., Ashford, S. P., Bakker, A. B., et al. (2021). COVID-19 and the workplace: implications, issues, and insights for future research and action. *Am. Psychol.* 76, 63–77. doi: 10.1037/amp0000716
- Kossek, E. E., Lautsch, B. A., and Eaton, S. C. (2006). Telecommuting, control, and boundary management: Correlates of policy use and practice, job control, and work–family effectiveness. *J. Vocat. Behav.* 68, 347–367.
- Kost, D., Kopperud, K., Buch, R., Kuvaas, B., and Olsson, U. H. (2023). The competing influence of psychological job control on family-to-work conflict. *J. Occup. Organ. Psychol.* 96, 351–377. doi: 10.1111/joop.12426
- Kuhnle, C., Hofer, M., and Kilian, B. (2012). Self-control as predictor of school grades, life balance, and flow in adolescents. *Br. J. Educ. Psychol.* 82, 533–548. doi: 10.1111/j.2044-8279.2011.02042.x
- Kuo, C. C., and Tsai, Y. C. (2012). Organizational frustration and workplace withdrawal: the study of abusive supervision and work locus of control. *Chin. J. Psychol.* 54, 293–313.
- Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw. Open* 3:e203976. doi: 10.1001/jamanetworkopen.2020.3976
- Lazar, J., Jones, A., and Shneiderman, B. (2006). Workplace user frustration with computers: an exploratory investigation of the causes and severity. *Behav. Inform. Technol.* 25, 239–251. doi: 10.1080/01449290500196963
- Lazarus, R. S. (1990). Theory-based stress measurement. *Psychol. Inq.* 1, 3–13. doi: 10.1207/s15327965pli0101\_1
- Lewandowski, C. A. (2003). Organizational factors contributing to worker frustration: the precursor to burnout. *J. Soc. Soc. Welfare* 30:175. doi: 10.15453/0191-5096.2944
- Li, W., Yang, Y., Liu, Z. H., Zhao, Y. J., Zhang, Q., Zhang, L., et al. (2020). Progression of mental health services during the COVID-19 outbreak in China. *Int. J. Biol. Sci.* 16, 1732–1738. doi: 10.7150/ijbs.45120
- Lucas, R. E., and Donnellan, M. B. (2012). Estimating the reliability of single-item life satisfaction measures: results from four national panel studies. *Soc. Indic. Res.* 105, 323–331. doi: 10.1007/s11205-011-9783-z
- Maier, N. R. F. (1949). *Frustration: the study of behavior without a goal*. New York: McGraw-Hill.
- Maslach, C., Jackson, S. E., Leiter, M. P., Schaufeli, W. B., and Schwab, R. L. (1986). *Maslach burnout inventory* (vol. 21) pp. 3463–3464. Palo Alto, CA: Consulting Psychologists Press.
- Maslach, C., Schaufeli, W. B., and Leiter, M. P. (2001). Job burnout. *Annu. Rev. Psychol.* 52, 397–422. doi: 10.1146/annurev.psych.52.1.397
- Mazmanian, M., Orlikowski, W. J., and Yates, J. (2013). The autonomy paradox: the implications of mobile email devices for knowledge professionals. *Organ. Sci.* 24, 1337–1357. doi: 10.1287/orsc.1120.0806
- Mikkelsen, A., Øgaard, T., and Landsbergis, P. (2005). The effects of new dimensions of psychological job demands and job control on active learning and occupational health. *Work Stress* 19, 153–175. doi: 10.1080/02678370500167808
- Morbée, S., Vansteenkiste, M., Aelterman, N., and Haerens, L. (2020). Why do sport coaches adopt a controlling coaching style? The role of an evaluative context and psychological need frustration. *Sport Psychol.* 34, 89–98. doi: 10.1123/tsp.2018-0197
- Ojala, S. (2011). Supplemental work at home among Finnish wage earners: involuntary overtime or taking the advantage of flexibility? *Nord. J. Work. Life Stud.* 1, 77–97. doi: 10.19154/njwls.v1i2.2346
- Ongori, H., and Agolla, J. E. (2008). Occupational stress in organizations and its effects on organizational performance. *J. Manag. Res.* 8, 123–135.
- Pace, F., D'Urso, G., Zappulla, C., and Pace, U. (2021). The relation between workload and personal well-being among university professors. *Curr. Psychol.* 40, 3417–3424.
- Penado Abilleira, M., Rodicio-García, M. L., Ríos-de Deus, M. P., and Mosquera-González, M. J. (2021). Technostress in Spanish university teachers during the COVID-19 pandemic. *Front. Psychol.* 12:617650. doi: 10.3389/fpsyg.2021.617650
- Peters, L. H., and O'Connor, E. J. (1980). Situational constraints and work outcomes: the influences of a frequently overlooked construct. *Acad. Manag. Rev.* 5, 391–397. doi: 10.2307/257114
- Peters, L. H., O'Connor, E. J., and Rudolf, C. J. (1980). The behavioral and affective consequences of performance-relevant situational variables. *Organ. Behav. Hum. Perform.* 25, 79–96. doi: 10.1016/0030-5073(80)90026-4
- Petterson, I. L., and Arnetz, B. B. (1998). Psychosocial stressors and well-being in health care workers. The impact of an intervention program. *Soc. Sci. Med.* 47, 1763–1772. doi: 10.1016/S0277-9536(98)00245-7
- Piszczek, M. M. (2017). Boundary control and controlled boundaries: organizational expectations for technology use at the work–family interface. *J. Organ. Behav.* 38, 592–611. doi: 10.1002/job.2153

- Putrevu, S., and Ratchford, B. T. (1997). A model of search behavior with an application to grocery shopping. *J. Retail.* 73, 463–486. doi: 10.1016/S0022-4359(97)90030-0
- Raghuram, S., Hill, N. S., Gibbs, J. L., and Maruping, L. M. (2019). Virtual work: bridging research clusters. *Acad. Manag. Ann.* 13, 308–341. doi: 10.5465/annals.2017.0020
- Reio, T. G. Jr. (2011). Supervisor and coworker incivility: testing the work frustration-aggression model. *Adv. Dev. Hum. Resour.* 13, 54–68. doi: 10.1177/1523422311410648
- Rockwood, N. J., and Hayes, A. F. (in press). “Multilevel mediation analysis” in *Multilevel modeling methods with introductory and advanced applications*. eds. A. O’Connell, D. McCoach and B. Bell (Charlotte, NC: Information Age Publishing)
- Ruiz, M., Devonport, T., Chen-Wilson, C. H., Nicholls, W., Cagas, J., Fernandez-Montalvo, J., et al. (2021). A cross-cultural exploratory study of health behaviors and wellbeing during COVID-19. *Front. Psychol.* 11:608216. doi: 10.3389/fpsyg.2020.608216
- Sabagh, Z., Hall, N. C., Saroyan, A., and Trépanier, S. G. (2022). Occupational factors and faculty well-being: investigating the mediating role of need frustration. *J. High. Educ.* 93, 559–584. doi: 10.1080/00221546.2021.2004810
- Sakib, N., Bhuiyan, A. I., Hossain, S., Al Mamun, F., Hosen, I., Abdullah, A. H., et al. (2020). Psychometric validation of the Bangla fear of COVID-19 scale: confirmatory factor analysis and Rasch analysis. *Int. J. Ment. Heal. Addict.*, 1–12.
- Salanova, M., Llorens, S., Cifre, E., and Nogareda, C. (2007). *El tecnostres: Concepto, medida y prevención [Technostress: Concept, measurement and prevention]*. *Nota Técnica de Prevención*, 730. Madrid, Spain: INSHT.
- Schaufeli, W. B., and Greenglass, E. R. (2001). Introduction to special issue on burnout and health. *Psychol. Health* 16, 501–510. doi: 10.1080/08870440108405523
- Schaufeli, W. B., Maslach, C., and Marek, T. (1993). “The future of burnout” in *Professional burnout: recent developments in theory and research*. eds. W. B. Schaufeli, C. Maslach and T. Marek (Washington DC: Taylor and Francis), 253–259.
- Schmitt, N. (1994). Method bias: the importance of theory and measurement. *J. Organ. Behav.* 15, 393–398. doi: 10.1002/job.4030150504
- Segerstrom, S. C., and Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychol. Bull.* 130, 601–630. doi: 10.1037/0033-2909.130.4.601
- Serafini, G., Parmigiani, B., Amerio, A., Aguglia, A., Sher, L., and Amore, M. (2020). The psychological impact of COVID-19 on the mental health in the general population. *QJM* 113, 531–537. doi: 10.1093/qjmed/hcaa201
- Shanafelt, T., Ripp, J., and Trockel, M. (2020). Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA* 323, 2133–2134. doi: 10.1001/jama.2020.5893
- Shaukat, N., Ali, D. M., and Razzak, J. (2020). Physical and mental health impacts of COVID-19 on healthcare workers: a scoping review. *Int. J. Emerg. Med.* 13, 1–8. doi: 10.1186/s12245-020-00299-5
- Sinclair, R. R., Allen, T., Barber, L., Bergman, M., Britt, T., Butler, A., et al. (2020). Occupational health science in the time of COVID-19: now more than ever. *Occup. Health Sci.* 4, 1–22. doi: 10.1007/s41542-020-00064-3
- Slaski, M., and Cartwright, S. (2002). Health, performance and emotional intelligence: an exploratory study of retail managers. *Stress. Health* 18, 63–68. doi: 10.1002/smi.926
- Spector, P. E. (1978). Organizational frustration: a model and review of the literature. *Pers. Psychol.* 31, 815–829. doi: 10.1111/j.1744-6570.1978.tb02125.x
- Spector, P. E. (1994). Using self-report questionnaires in OB research: a comment on the use of a controversial method. *J. Organ. Behav.* 15, 385–392. doi: 10.1002/job.4030150503
- Spector, P. E., Dwyer, D. J., and Jex, S. M. (1988). Relation of job stressors to affective, health, and performance outcomes: a comparison of multiple data sources. *J. Appl. Psychol.* 73, 11–19. doi: 10.1037/0021-9010.73.1.11
- Stankovska, G., Memedi, I., and Dimitrovski, D. (2020). Coronavirus COVID-19 disease, mental health and psychosocial support. *Society Reg.* 4, 33–48. doi: 10.14746/sr.2020.4.2.03
- Su, L., Swanson, S. R., and Chen, X. (2016). The effects of perceived service quality on repurchase intentions and subjective well-being of Chinese tourists: the mediating role of relationship quality. *Tour. Manag.* 52, 82–95. doi: 10.1016/j.tourman.2015.06.012
- Ten Have, M., Van Dorsselaer, S., and de Graaf, R. (2015). The association between type and number of adverse working conditions and mental health during a time of economic crisis (2010–2012). *Soc. Psychiatry Psychiatr. Epidemiol.* 50, 899–907. doi: 10.1007/s00127-015-1009-2
- Valcour, M. (2007). Work-based resources as moderators of the relationship between work hours and satisfaction with work-family balance. *J. Appl. Psychol.* 92, 1512–1523. doi: 10.1037/0021-9010.92.6.1512
- Vander Elst, T., Van den Broeck, A., De Witte, H., and De Cuyper, N. (2012). The mediating role of frustration of psychological needs in the relationship between job insecurity and work-related well-being. *Work Stress* 26, 252–271. doi: 10.1080/02678373.2012.703900
- Volini, E., Denny, B., Schwartz, J., Mallon, D., Van Durme, Y., Hauptmann, M., et al. (2020). *Returning to work in the future of work: embracing purpose, potential, perspective, and possibility during COVID-19*. Deloitte Insights.
- Wanberg, C. R., Csillag, B., Douglass, R. P., Zhou, L., and Pollard, M. S. (2020). Socioeconomic status and well-being during COVID-19: a resource-based examination. *J. Appl. Psychol.* 105, 1382–1396. doi: 10.1037/apl0000831
- Wang, P. H., Ku, Y. C., Chen, C. C., Jeang, S. R., and Chou, F. H. C. (2016). Work-related frustration among senior nurses at a medical centre. *J. Clin. Nurs.* 25, 2040–2051. doi: 10.1111/jocn.13241
- Weinberg, A., and Cooper, C. (2012). The nature of stress in turbulent times. *Stress in turbulent times*. 39–61.
- Whinghter, L. J., Cunningham, C. J., Wang, M., and Burnfield, J. L. (2008). The moderating role of goal orientation in the workload-frustration relationship. *J. Occup. Health Psychol.* 13, 283–291. doi: 10.1037/1076-8998.13.3.283
- WHO. 5 keys to healthy workplaces. WHO global model for action [internet]. (2011) Available at: [https://www.who.int/occupational\\_health/5\\_keys\\_EN\\_web.pdf?ua=1](https://www.who.int/occupational_health/5_keys_EN_web.pdf?ua=1) (Accessed December 12, 2020)
- Yu, Y., Lau, J. T., and Lau, M. (2023). Development and validation of the conservation of resources scale for COVID-19 in the Chinese adult general population. *Curr. Psychol.* 42, 6447–6456.

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