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Workplace health promotion, volume II

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Workplace health promotion, volume II

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Editorial: Workplace Health Promotion, volume II

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Editorial on the Research Topic
Workplace health promotion, volume II

The purpose of this Research Topic, a continuation of Workplace Health promotion Volume 1, was to understand issues connected to population health from a workplace perspective such as factors mitigating against the health of workers, barriers to occupational health promotion, and other emerging problems (1–3). The aim was also to identify enabling factors, best practices, and other crucial aspects relevant for workplace health promotion and to explore the need for a strategic approach to WHP, described as a systematic and continuous process of needs analysis, priority setting, planning, implementation, and evaluation (4, 5).

A total of 88 researchers from across the globe contributed to 13 articles in this volume. The study participants were from sectors such as health and social welfare and include doctors, medical students, social workers, and the Police, to name a few. Several of the articles explored the impact of workplace issues on mental health and wellbeing; some examples include working conditions, gossip, feelings of exclusion at the workplace, and social media usage. One study investigated the outcome of an intervention to address depression among workers. Articles in this volume also highlight the role of social support, leadership, and supervision in addressing health-related workplace challenges. Other key features include, alcohol and sick leave, shift work and insomnia, performance, and work culture, fall accidents and supervision as well as burnout and the role of sleep quality, workplace violence and shift work. Each of the articles are summarized below.

According to Chang et al. WHP performance was significantly related to workplace health culture, especially health policies, healthy climate, and peer and supervisor support. In their study, the Workplace Health Scorecard was administered to WHP representatives at each workplace, while a personal questionnaire was used to measure workplace health culture, healthy lifestyles, and health statuses at the individual level. A total of 27 enterprises and 1,732 individuals participated in the cross-sectional study, and data analyzed using a hierarchical linear model.

Using the job demands and resources (JD-R) model, Huang et al. studied the relationship between work conditions and outcomes like psychological distress among social workers in Chengdu, China. The study also investigated the mediational effects of positive affect (PA) and negative affect (NA) among the 897 participants. Results suggest that JR has a greater effect on PA and NA relative to the effects of JD on PA and NA. The authors conclude by suggesting interventions to promote PA in order to buffer against the effects of JD among social workers.

Emsing et al. using the SCL-90-R survey, aimed to find if there are differences in the mental health of two cohorts of Swedish police recruits totaling 376 from 2009 and 2020. The mental health of both cohorts was also compared to that of the general population using data from 2002. Multivariate analysis of variance (MANOVA) and bivariate analyses were conducted. Results showed that recruits from 2020 fared better, and that while some recruits scored above the Swedish patient mean, the prevalence and intensity of mental health disorders among recruits were generally low. Findings also showed that gender, educational level and relationship status were important predictors of mental health.

What is the prevalence of insomnia caused by consecutive night shifts? What night shift duration worsens insomnia the most? These were the questions which Sim et al. attempted to answer by using e.g., multivariate logistic regression to analyze night shift profiles and baseline demographics data of three hospitals between January 2015 to December 2017 ($n = 13{,}025$). Findings showed that the prevalence of insomnia was 38.7%, and that there was a significant relationship between consecutive night shifts and insomnia. The authors conclude that findings from the study could be a basis for developing policies and guidelines to improve the health of night shift workers.

In the study by Yan et al. the aim was to investigate the prevalence of burnout among emergency physicians and its associated factors using a nationally representative cross-sectional survey of 15,243 emergency physicians between July and September 2019 in 31 provinces across China. The prevalence of burnout was 14.9%. Associated factors were depression, shift work, workplace violence, having poor self-perceived health status and sleep quality, working in developed regions and governmental hospitals, and having an intermediate professional title. Recommendations for prevention are discussed.

Given findings from a literature review and the characteristics of fall accidents in construction, Luo et al. propose a modification of the human factor classification analysis system (HFACS) framework. They also construct a Bayesian network (BN) topology based on the dependence between human factors and organizational factors, as well as determine the sensitivity of causal factors. Findings show that the most important reason for falling accidents is unsafe on-site supervision, the BN risk assessment model suggests that the most likely causes are loopholes in site management work, lack of safety culture, insufficient safety inspections and acceptance, amongst others.

According to Kanwal and Isha social media activities among office workers in the oil and gas industry significantly moderate the effect of effort-reward imbalance on health and wellbeing and impact job rewards. The conclusions are based on exploratory factor analysis and confirmatory factor analysis of data from 424 participants using an online questionnaire. Findings showed among others, that social media activities related to work-life decreased health and wellbeing by 11%, and social media activities related to personal life negatively affected job rewards by about 55%.

Cheng et al. studied the effect of workplace gossip on employees' mental health using data collected in three waves from 222 full-time employees of a Taiwanese tourism company. Results suggest that workplace gossip is associated with employees' mental health through psychological capital, and that the relationships among workplace gossip, psychological capital, and mental health are moderated by developmental job experience.

To understand the relationship between alcohol-related problems and drinking attitudes with sick leave, Hashemi et al. linked data from the WIRUS study (Workplace Interventions preventing Risky alcohol Use and Sick leave) to company-registered sick leave data. The study included a total of 2,560 employees from 95 different work units in 9 public companies and 5 private companies in Norway. Negative binomial regression models were used, adjusted for gender, age, cohabitation status, educational attainment, work position, and employment sector. Findings show that although there were variations of 1-day, short-term, and overall sick leave days between companies than between work units within companies, neither alcohol-related problems nor drinking attitudes were associated with sick leave.

Stassen et al. conducted a systematic review to investigate the attention to principles of resistance training (RT) progression and variables of RT exercise prescription in workplace-related RT interventions. The databases searched were LIVIVO, PubMed, SPORTDiscus, and Web of Science for publications between 2000 and 2020. Results from 21 articles (18 primary studies, three protocols) revealed that interventions showed different positive effects on strength- or performance-related and/or health- or complaint-related outcomes. However, several key RT principles and variables were reported inconsistently, thus reducing reproducibility, suggesting the need for standardized RT intervention reporting in workplace-related interventions.

The study by Xu et al. aimed to investigate medical residents' levels of social support, psychological resilience, and coping style, and explore the mediating role of psychological resilience. An online questionnaire was administered to a total of 577 medical residents from China recruited *via* convenience sampling, and the data were analyzed using Pearson correlation

analysis. Findings show positive correlations between social support, psychological resilience and coping style and a significant mediating effect of psychological resilience in the relationship between social support and coping styles. The importance of paying attention to the psychological status of medical residents, as well as the need for increasing enthusiasm for coping style and promoting their mental health using social support and psychological flexibility, are discussed.

Building on the stereotype content model and allostatic load theory, Frank et al. investigated whether employees with a mental illness become socially excluded at the workplace and if they have more days of sick leave. A total of 86 employees diagnosed with a mental disorder were interviewed and completed online-surveys, and Path analyses were conducted. Results show that the interview-rated severity of the mental disorder had an indirect effect on the days of sick leave, and that this was mediated by the symptomatic burden and social exclusion at the workplace. The need for organizations, especially supervisors, to be attentive for signs of exclusion and address same is discussed as important given the financial implications of employee absenteeism on organizations.

Gwain et al. conducted a pre-intervention and post-intervention study to assess an intervention which they developed to reduce depression among workers at the Outpatient Mental Health Clinic in Washington District of Columbia, United States. In order to determine the pre-intervention prevalence of depression, a survey was conducted on 43 employees using the Patient Health Questionnaire depression scale (PHQ-9). Thereafter, the WHO Healthy Workplace Model was adopted to design an instrument for determinants of depression at the workplace, followed by the development and implementation of a mHealth intervention. Finally, a post-intervention survey was conducted among the cohort, and the data was analyzed using descriptive and inferential statistics in STATA. Findings show that the prevalence of depression went from 30.2%, pre-intervention, to 12.6% post-intervention. The findings suggest that improving employee mental health can be achieved using cheap mhealth solutions.

The need for clear policys and routines, as well as increase in wellness packages offered and strategies to improve their uptake thus remains (6). In conclusion, more attention should continually be given to barriers, enabling factors and best practices for health promotion in the workplace given its strategic role for population health promotion.

Author contributions

LO-E was responsible for project idea, design, implementation, manuscript drafting, and final version of the manuscript. DG and SA contributed to project implementation and manuscript final version. 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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From Cognition to Behavior: Associations of Workplace Health Culture and Workplace Health Promotion Performance With Personal Healthy Lifestyles

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Introduction: The aim of this study was to explore associations of workplace health culture and workplace health promotion (WHP) performance with employees' healthy lifestyles and health statuses.

Methods: In total, 27 enterprises and 1,732 participants were recruited for a cross-sectional designed survey. At the group level, Workplace Health Scorecard was used to measure WHP performance, and it was filled out by the WHP representative at each workplace. At the personal level, a personal questionnaire was used to measure workplace health culture, healthy lifestyles, and health statuses. A hierarchical linear model analysis was used to assess correlations between these variables.

Results: Workplace health culture was significantly related to WHP performance, healthy lifestyles, and health statuses. In particular, the peer support domain was greatly related to healthy behaviors like physical activity ($\beta = 0.596$, $p < 0.001$), vegetable consumption ($\beta = 0.291$, $p < 0.001$) and fruit consumption ($\beta = 0.285$, $p < 0.05$), and it may illustrate the importance of establishing peer support to promote healthy behaviors.

Conclusions: WHP performance was significantly related to workplace health culture especially health policies, health climate, and peer and supervisor support. Hence, building a good workplace health culture should be taken seriously, and more studies exploring associations of health culture and WHP performance with employees' health are needed.

Keywords: workplace health culture, workplace health promotion, healthy lifestyle, workplace health culture scale, health promotion performance

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INTRODUCTION

It has been over 30 years since the World Health Organization (WHO) promoted workplace health promotion (WHP) (1, 2). During the past three decades, thousands of studies on WHP have been published worldwide, targeting workplace safety, employee healthy lifestyles, reducing health and medical costs, improving health productivity, etc. and trying to make health promotion become a

part of daily life. However, although most researchers reported that WHP programs have positive economic effectiveness (3–5), almost all WHP promoters stuck to a core issue: How to improve the participation rate of WHP. Regardless of how comprehensive and accessible a program is, a lack of employee involvement brings about no or insufficient benefits. Therefore, finding ways to increase participation rates, reduce barriers to participation, and increase the willingness to participate has finally become a hot research topic in recent years.

Taiwan has been promoting WHP for more than 20 years. The WHP certification program promoted by the government has provided free workplace health promotion counseling and a certification system since 2007 (6). Up to the present, over 24,000 workplaces have obtained certifications (7). The government referred to the models and tools of the WHO and the US Centers for Disease Control (CDC) (8–11) and appropriately modified and localized that information to make it suitable for implementation in Taiwan while adhering to the issue of improving the participation rate of WHP programs at the same time. Hence, we realized the potential to research on workplace health culture.

Culture is a concept related to employees' attitudes, behaviors, and norms, and it affects specific behaviors (12, 13). The culture of WHP, or "workplace health culture", is defined by considering norms, shared values, the health climate/morale, leadership support, peer support, and touch points (14). A culture of health reflects the attitudes and perceptions of the health of a company's employees, and these attitudes and cognition affect healthy behaviors. Regardless of which theory of healthy behavior one considers, behavior is driven by attitudes and cognition (15–17). Therefore, before trying to improve participation rates of WHP programs, it is more important to explore the workplace health culture. Although workplace health culture is not a novel topic, it seems that there have been few publications in the past two decades.

Since we previously developed a Workplace Health Culture Scale (WHCS) for Taiwan (18), it is time to explore deeper into the health culture. This study aimed to explore associations of workplace health culture and WHP performance with employees' healthy lifestyles and health statuses. Based on this study, we wanted to learn more about the factors that could increase participation rates in WHP programs.

MATERIALS AND METHODS

This study was a cross-sectional study approved by the Institutional Review Board (IRB) of Taipei Medical University (no. N201903113). In this study, we recruited enterprises of different sizes and from different industry categories to ensure sufficient generalizability.

Study Population and Features

We recruited participating companies from Taiwan's WHP certification program database to ensure that the recruited companies have sufficient knowledge of WHP to fill in the checklists and questionnaires in this survey. Since the certification has three different tiers according to different levels of WHP, there is a clear difference in the effectiveness of WHP between each level. We recruited companies that participated in the certification program in 2018 and collected date between May 2019 and June 2021. In 2018, a total of 885 companies in northern Taiwan renewed or received the certification, and among them data were collected from 27 enterprises, including 11 manufacturing establishments, four professional scientific enterprises, three publishing firms, three financial and insurance organizations, two utility companies, one wholesale and retail trade enterprise, one transportation and storage firm, one human health company, and one public administration and defense contractor. A health promotion representative from each company was assigned to recruit volunteers to fill out the questionnaire and be responsible for answering the Taiwan workplace health scorecard. Most of the representatives were nurses, occupational safety and hygiene officers, or human resources personnel who were familiar with issues relating to health promotion and employees' health conditions. Since the work style and workplace characteristics of each company are different, the health promotion representative distributed and collected questionnaires in the most suitable way for the company, such as recruiting respondents through internal company letters, health promotion activities, health seminars, etc. All full-time and part-time adult company employees were eligible to participate.

Sample Size

The sample size of each enterprise was decided by the company size. According to the sampling standards suggested by Glenn (19), the sample size for ±10% precision levels where confidence level is 95% and $p = 0.05$ for companies with 100–150 people, it is recommended that the number of samples should be about 50 people. For companies with more than 1,000 people, it is recommended that the number of samples should be about 100 people. If it is a small business with fewer than 100 people, it is encouraged to use the census as much as possible to increase its representativeness. In addition, according to the recommendations of Comrey and Lee (20), since this study would adopt a multi-level analysis, there should be more than 1,000 samples. Hence, in this study, we suggested that small-size companies (fewer than 150 employees) complete as many as 50 forms and medium- and large-size companies complete 100 forms.

Measures

Workplace health culture was measured by the WHCS (18), which contained 25 items in six domains of health policy, health climate, peer support, supervisor support and role modeling, personal values, and common values. We developed this Traditional Chinese questionnaire in 2019. WHCS has good construct validity and can explain about 69% of the variation, and the Cronbach's α of each domain is between 0.804 and 0.919. Every item began with "I think…" or "My colleagues and I feel that…" to reflect employees' attitudes and feelings,

Abbreviations: WHP, Workplace Health Promotion; WHCS, Workplace Health Culture Scale; IRB, Institutional Review Board; SD, Standard deviation.

and items were rated on a five-point Likert scale, ranging from "strongly agree" (5 points) to "strongly disagree" (1 point). We calculated scores for each domain and a total score. The items and total scores of the six domains were: Health policy: 3 items, 3–15 points; health climate:7 items, 7–35 points; peer support: 3 items, 3–15 points; supervisor support: 4 items, 4–20 points; personal value: 3 items, 3–15 points; and common value: 5 items, 5–25 points.

WHP performance was measured by the "Taiwan Workplace Health Scorecard" (21), and it was filled out by the person responsible for promoting WHP in each workplace. This tool was designed by referring to the US CDC's worksite health scorecard for a tool suitable to Taiwan's current environment and regulations of the WHP system, and it contained 46 items in five domains of health policy and planning (seven items, 15 points), workplace health needs assessments (four items, 10 points), health promotion activities (23 items, 50 points), healthy work environment (nine items, 20 points), and enterprise community involvement (three items, 5 points). All items were in a Yes/No format. Each item had a weighted point value (1–3 points) according to its importance. Overall and domain scores were summed on the items that received a "Yes" response, and "No" responses were given 0 points.

Healthy lifestyle variables were comprised of physical activity, vegetable consumption, fruit consumption, and regular weight measurement. Physical activity was measured with the Godin leisure-time physical activity scale (22, 23), which marks the number of days in a week a subject does vigorous (9 points), medium (5 points), and light (3 points) physical activities. After weighting and summing up each level of physical activity, it defines an active person as one with a total of $\geq$24 points, a moderately active person as one with 14–23 points, and an insufficiently active person as one with $\leq$13 points. Both vegetable and fruit consumption levels were measured by a single item, which evaluated the number of servings per day consumed in the past week. According to WHO's recommendations (24), we set the sufficient vegetables and fruits intake to at least three servings of vegetables and two servings of fruits a day. Regular weight measurement behavior was also measured by a single item to evaluate the frequency of weighing oneself.

Health status variables consisted of self-rated health, mental health, and the number of chronic diseases. Self-rated health was measured by a six-point item, ranging from "very good" (6 point) to "very bad" (1 point). Mental health was measured by the Brief Symptom Rating Scale Short Version (BSRS-5), which has good reliability and validity (25). It is a five-item, self-rated questionnaire, with each item ranging from 4 ("extremely") to 0 ("not at all"). Total scores of <5 points are considered "normal mental health", 6–9 points with a "mild mood disorder", 10–14 points as a "moderate mood disorder", and >14 might as a "severe mood disorder". Chronic diseases were measured by a multiple-choice question, and the total number was calculated.

Sociodemographic variables included group- and personal-level items. Group-level items included the enterprise size and industry category. Personal-level items included gender, age, educational level, and position. We classified managers above the first-line supervisor as supervisors, and other employees, including general staff, researchers, professional services, etc., were classified as general staff.

Statistical Analysis

An analysis of variance (ANOVA) test and Chi-squared test were employed to assess differences in sociodemographic factors, healthy lifestyles, health statuses, workplace health culture, and WHP performances among different-sized enterprises at the baseline (**Tables 1**, **2**). Pearson correlations were used to assess correlations between workplace health culture at the personal level and WHP performance (**Table 3**). Before the model analysis, we assessed simple correlations among sociodemographic factors, healthy lifestyles, health statuses, and personal-level workplace health culture to explore potential confounding variables. Finally, a hierarchical linear model analysis was used to assess correlations of personal-level workplace health culture (dependent variables) with healthy lifestyles and health statuses (independent variables), setting the company as the group-level adjusted variable and adjusting for gender, age, educational level, position, and enterprise size. The reference group set in the hierarchical linear model included those with insufficient physical activity, insufficient vegetable and fruit consumption, weight measurement less than weekly, and with a normal weight and normal mental health. All analyses were performed according to the intention-to-treat principle, and all tests were analyzed at a 95% significance level ($p < 0.05$). Analyses were conducted using PASW 22.0 software for Windows (SPSS, Chicago, IL, USA).

RESULTS

Between May 2019 and June 2021, 27 enterprises and eventually a total of 1,732 subjects were enrolled in the study, including three small enterprises, 18 medium enterprises, and six large enterprises. The demographic characteristics of the study group are listed in **Table 1**. Of the 27 enterprises, small enterprises had significantly more female employees, medium enterprises had significantly more general staff, and large enterprises had the most employees with a master's degree or above. Most health behaviors exhibited no significant differences among enterprise sizes except for physical activity and regular weight measurement. Large enterprises had the lowest percentage of employees who were insufficiently active and the highest percentage of employee who were active. Of 1,732 participants, 52.0% were female, the mean age was 39.3 (standard deviation (SD) = 9.55) years, 90.3% had a bachelor's degree or higher, 88.1% were general staff, the mean body-mass index (BMI) was 24.0 (SD = 4.09) kg/m^2, and 42.7% were overweight or obese. As to healthy lifestyles, 49.6% of participants were insufficiently active, 66.3% consumed insufficient fruit, 65.3% consumed insufficient vegetables every day, and 17.2% were smokers. As to the health statuses, 84.1% had good mental health, while 50.3% rated their health status as normal and 38.2% as good.

All indicators of the workplace health culture and WHP performance were significant among different enterprise sizes (**Table 2**). Large enterprises had the best health culture, but

TABLE 1 | Basic demographic characteristics, healthy lifestyles, and health status information.

	Enterprise size[a]			*p*-value
	Small (*N* = 3, *n* = 131)	**Medium (*N* = 18, *n* = 1,046)**	**Large (*N* = 6, *n* = 555)**	
Demographic characteristic, *n* (%)				
Gender				0.025*
Male	48 (36.6)	514 (49.2)	266 (48.0)	
Female	83 (63.4)	530 (50.8)	288 (52.0)	
Age (years)				0.074
18–29	13 (10.2)	168 (16.2)	93 (16.8)	
30–39	46 (35.9)	423 (40.7)	231 (41.8)	
40–49	51 (39.8)	289 (27.8)	142 (25.7)	
≥50	18 (14.1)	160 (15.4)	86 (15.6)	
Educational level				< 0.001**
Senior high school or below	3 (2.3)	123 (11.9)	34 (6.1)	
University	91 (70.5)	553 (53.5)	257 (46.6)	
Master's degree or above	35 (27.1)	358 (34.6)	261 (47.3)	
Job position				0.001**
Supervisor	23 (18.3)	100 (9.7)	80 (14.8)	
General staff	103 (81.7)	935 (90.3)	460 (85.2)	
Healthy lifestyle and health status				
Physical activity				<0.001**
Insufficiently active	75 (57.7)	542 (52.2)	235 (42.8)	
Moderately active	31 (23.8)	205 (19.7)	114 (20.8)	
Active	24 (18.5)	291 (28.0)	200 (36.4)	
Vegetable consumption				0.136
Insufficiently	44 (33.8)	344 (33.0)	211 (38.0)	
Sufficient	86 (66.2)	697 (67.0)	344 (62.0)	
Fruit consumption				0.228
Insufficiently	50 (38.5)	337 (32.3)	196 (35.4)	
Sufficient	80 (61.5)	707 (67.7)	358 (64.6)	
Regular weight measurement				0.020*
Almost everyday	7 (5.3)	57 (5.5)	50 (9.1)	
Weekly	58 (44.3)	373 (35.8)	192 (34.8)	
Monthly or less	66 (50.4)	612 (58.7)	310 (56.2)	
Mental health				0.600
Normal	113 (86.3)	875 (83.7)	469 (84.5)	
Light pressure	16 (12.2)	115 (11.0)	63 (11.4)	
Medium pressure	2 (1.5)	47 (4.5)	19 (3.4)	
High pressure	0 (0.0)	9 (0.9)	4 (0.7)	
Body-mass index				0.137
Underweight	4 (3.1)	42 (4.1)	11 (2.0)	
Normal weight	72 (55.4)	538 (53.1)	297 (55.2)	
Overweight	50 (38.5)	350 (34.6)	192 (35.7)	
Obese	4 (3.1)	83 (8.2)	38 (7.1)	
Self-rated health (mean ± SD)	3.35 ± 0.84	3.38 ± 0.91	3.46 ± 0.94	0.166

[a]*Small size: <150 employees, medium size: 150–999 employees, large size: ≥1,000 employees. n, number of participants; N, number of enterprises.*
$^{*}0.01 < p < 0.05$, $^{**}p < 0.01$.
SD, standard deviation.

WHP performances did not significantly differ among different enterprise sizes.

Correlations of personal level workplace health culture and WHP performance are listed in **Table 3**. A healthy work environment was not significantly correlated with any of the workplace health culture domains, and community involvement was significantly related to all health culture domains. In addition, personal values and common values were

TABLE 2 | Characteristic of workplace health culture and workplace health promotion (WHP) performance.

	Enterprise size (Mean ± SD)			*p*-value
	Small (*N* = 3, *n* = 131)	**Medium (*N* = 18, *n* = 1,046)**	**Large (*N* = 6, *n* = 555)**	
Workplace health culture[a]				
Health policy	10.48 ± 3.61	10.87 ± 3.56	11.46 ± 3.04	0.001**
Health climate	23.55 ± 5.48	24.66 ± 5.39	25.63 ± 4.79	<0.001**
Peer support	11.21 ± 2.20	11.20 ± 2.16	11.58 ± 2.12	0.004**
Supervisor support	13.84 ± 2.82	14.40 ± 2.95	14.63 ± 2.94	0.018*
Personal values	11.24 ± 1.86	11.00 ± 2.10	11.30 ± 1.98	0.015*
Common values	21.03 ± 2.72	20.35 ± 2.95	21.10 ± 2.79	<0.001**
WHP performance				
Health policies and plans	11.33 ± 6.35	14.17 ± 1.54	13.33 ± 1.86	0.187
Health needs assessments	8.33 ± 2.89	9.78 ± 0.73	10.00 ± 0.00	0.076
Health promotion activities	39.33 ± 12.90	42.56 ± 7.21	40.50 ± 3.27	0.616
Healthy work environment	20.00 ± 0.00	19.61 ± 0.92	18.00 ± 1.67	0.100
Community involvements	3.33 ± 2.31	3.50 ± 1.79	3.33 ± 1.97	0.189

[a]*The total scores of each domains are: Health policy: 3 items, 3–15 points; health climate: 7 items, 7–35 points; peer support: 3 items, 3–15 points; supervisor support: 4 items, 4–20 points; personal value: 3 items, 3–15 points; and common value: 5 items, 5–25 points.*

$^{*}0.01 < p < 0.05$, $^{**}p < 0.01$.

SD, standard deviation.

TABLE 3 | Correlations of personal health culture cognition with company workplace health promotion (WHP) performance.

WHP performance	**Workplace health culture**					
	Health policies	**Health climate**	**Peer support**	**Supervisor support**	**Personal values**	**Common values**
Health policies and plans	0.118**	0.158**	0.093**	0.083**	0.016	0.022
Health needs assessments	0.111**	0.182**	0.080**	0.080**	0.033	0.014
Health promotion activities	0.107**	0.128**	0.047	0.055*	0.016	−0.015
Healthy work environment	0.023	0.004	−0.020	0.029	−0.004	−0.022
Community involvement	0.151**	0.161**	0.146**	0.132**	0.108**	0.089**

$^{*}p<0.05$, $^{**}p<0.01$.

not significantly related with almost any WHP performance domains except community involvement.

Results of the hierarchical linear model analysis of workplace health culture with healthy lifestyles and health statuses are listed in **Table 4**. People who had better physical activity, vegetable consumption, and fruit consumption and measured their weight daily or weekly felt that they had significantly better peer support. With better physical activity habits, the participants had better personal values and common values of health. If they measured their weight every day or at least once per week, they felt that they had better peer support, supervisor support, and common values of health. People who had better self-rated health believed that they had a significantly better workplace health culture. In addition, the participants with fewer chronic diseases felt that they had significantly better health policies and health climate support. Also, people who had better mental health thought that they had a significantly better workplace health culture except for peer support. However, it seems that the BMI had no significant correlation with the workplace health culture.

DISCUSSION

In this study, we found that WHP performance was significantly related with workplace health culture especially health policies, health climate, and peer and supervisor support, but was less related to personal and common values of health. In addition, self-rated health and mental health were significantly related to the health culture, and people who had better physical activity habits felt that they had a better workplace health culture.

The significant correlation between health culture and WHP performance means that the more a company invests in WHP, especially in the domains of health policies, health needs assessments, and health behavior promotion, the better their employees will feel about health culture. Employees can really feel and agree with the company's efforts to promote WHP though there is not much research on health culture as seen in the research on safety culture (26, 27). In addition, those enterprises with better community involvement also had significantly better health cultures, e.g., providing health promotion to

TABLE 4 | Hierarchical linear model analysis: associations of workplace health culture with healthy lifestyles and health statuses, after adjusting for gender, age, educational level, position, and business size.

Variable	Workplace health culture β value					
	Health policies	Health climate	Peer support	Supervisor support	Personal values	Common values
Healthy lifestyle						
Physical activity	0.293#	0.321	0.596**	0.078	0.306**	0.416**
Vegetable consumption	−0.224	0.015	0.291**	0.074	−0.103	0.035
Fruit consumption	0.221	0.231	0.285*	0.209	0.138	0.171
Frequent weight measurement	0.312#	0.538*	0.409**	0.433**	0.158	0.334*
Health status						
Self-rated health	0.346**	0.873**	0.456**	0.479**	0.286**	0.424**
Number of chronic diseases	−0.280**	−0.415**	−0.042	−0.123	−0.065	−0.029
Body-mass index (kg/m^2)						
<18	−0.180	−1.304#	−0.090	−0.469	0.226	−0.441
≥24	0.208	0.216	−0.017	0.190	0.003	0.272#
Mental health	−0.658**	−2.086**	−0.230	−0.875**	−0.277*	−0.280

#$0.05 < p < 0.10$, *$0.01 < p < 0.05$, **$p < 0.01$.

employees' family members, affiliated companies, and people in the community.

The reason why there were no significant correlations between a healthy work environment and any of the workplace health culture domains may have been because this sub-scale focused on the safety environment rather than healthy lifestyles, and these items were related to the basic safety environment which most workplaces can meet. Some studies also found that it is not easy to change the health behaviors of employees by merely improving the health environment without promoting healthy lifestyles (28, 29). This does not mean that improving the health environment is not important, but designing and promoting workplace health policies, promoting health needs assessments, and actual health promotion actions can allow employees to experience the health culture more directly. After all, creating a supportive environment and making more-convenient, accessible, and healthier choices will also benefit healthy lifestyle building (30).

An interesting point is that in this study we found that there is almost no significant correlation between the scores of personal value and common value and WHP performance. This may indicate that basic workplace health promotion is not easy to change employees' health values related to WHP. In past studies, health values were mainly discussed on issues related to health beliefs, and health beliefs are the mediator of health culture and health behaviors (31). Although personal health beliefs are indeed related to personal health behaviors, there have been few discussions on beliefs related to participation in workplace health promotion in the past. This may mean that most studies did not regard participation in workplace health promotion as a "behavior". Although in recent years there have been more and more health coaching studies in the workplace region to improve the employees' healthy lifestyle and the WHP participation (32, 33), whether health coaching can improve employees' personal and common values of WHP still needs more studies.

It is not surprising that large-sized companies had significantly better health cultures in this study. Many studies found that smaller companies are less likely to fund WHP implementation due to fewer resources and experience than larger companies (34, 35), and the rate of implementing WHP in small companies was indeed lower than that in large companies. However, the enterprise size might not be the main factor in the WHP performance, since smaller companies can more easily achieve higher participant rates than large companies (36), and smaller companies also have relatively simple company structures which might make it easier for them to promote comprehensive WHP. This might explain why the WHP performance was not significant among enterprise sizes in our study.

In this study, we found those people who rated having a higher peer support score had significantly healthier lifestyles, and those with higher self-rated health also felt that they had a better health culture. In addition, people with better health e.g., fewer chronic diseases and better mental health, felt that they had better health policies and a healthy climate. Interestingly, it seemed that most health culture domains did not affect a healthy diet except for peer support, but one study indeed indicated that peer support and role models can help promote healthy eating (37). It also might mean that peer support is the most important cultural factor in improving personal healthy lifestyles. However, physical activity was also related to personal values and common values. One of the reasons why there were different results from a healthy diet may be because Taiwan has worked hard to promote physical activity in the workplace in recent years, providing a considerable number of resources to promote it in the workplace, or perhaps a healthy diet is more irrelevant to personal and common values. As to the correlation between chronic diseases and health culture, a possible explanation for only health policies and a healthy

climate being significantly related to it is that interpersonal health support and values might have more direct correlations with a healthy lifestyle and an indirect linkage to the health status, but this needs to be verified by future studies.

Finally, the assumption and some findings from other studies that health promotion cognitive/attitudes/values affect motivations for healthy behaviors and actual healthy behaviors, and thus affect the health status may be correct (31, 38). In the past, there were many studies which found that supervisor support could increase employees' participation in WHP (39, 40), and the participation rate greatly determines the effectiveness of WHP implementation (41). In fact, "participation in health promotion" is a kind of behavior, and it is inevitably affected by motivation. Many studies have explored ways to increase participants' motivation and participation rates in WHP programs or found out the reason why employees do not participate in such programs (30, 42, 43). For example, employers can provide participation rewards, shape a health-promoting environment, and provide healthy working conditions, which will be reflected in the domain of health policies and supervisor support of culture. Peer pressure and support are also important motivations for participation (44, 45), which will be reflected in the domain of peer support and common values of culture.

The main strength of this paper is that it is the first study conducted to examine correlations of workplace health culture and WHP performance with healthy lifestyles and health statuses. In addition, even though WHP has been promoted for quite a long time, so far, there have been few studies with large-scale investigations attempting to explore the correlation between WHP in the work environment, personal health behavior, and personal cognition. This study has a large sample size involving 27 enterprises, making it possible to use multi-level analysis to explore these relationships more comprehensively. Moreover, the scarcity of research related to workplace health culture also makes this research more important. However, there remain some limitations. First, the cross-sectional design did not allow us to draw causal relationships among these variables. Considering the assumptions that we can improve employees' motivation to engage in healthier behaviors by implementing WHP programs, this should involve a large, long-term, rigorous longitudinal test. Second, the workplaces which participated in this experiment may have had better WHP performances and a greater willingness to implement it. This might explain why the most WHP performance indicators had no significant difference among enterprise sizes in our study. Those workplaces that were willing to participate in this research may have had a higher willingness to promote WHP in the first place. At the same time, some samples in this study were collected during the COVID-19 pandemic, and pandemic prevention policies and workplace restrictions may affect the willingness to participate in the investigation. In addition, although some studies have pointed out that strict prevention policies during the COVID-19 pandemic may affect work efficiency and quality of life (46, 47), it caused little impact on the validity of this study due to the fact that Taiwan is only slightly affected by the COVID-19 pandemic. Hence, to heighten generalizability and representativeness of similar research in the future, diversified industries or companies should be incorporated.

Here are some suggestions for future work on WHP and studies according to our study results. First, actual health policy making and communication with employees, regular health needs assessments, and health promotion activities are worth implementing because these actions can improve the health culture except values. Considering that peer support is the most influential factor in a healthy lifestyle, implementing WHP should indeed help improve employee health through promoting healthy lifestyles. Second, building stronger peer support such as encouraging the building of healthy communities, organizing team competitions, and providing group workshops or group coaching to provide social support may improve healthy lifestyles more efficiently. And finally, it is important to provide resources to increase the willingness of small enterprises to invest in WHP. Our study results showed that small enterprises can also implement comprehensive and effective WHP, but the number of small enterprises that can do this is indeed far fewer than that of medium and large companies. Of course, it is also necessary to conduct more-comprehensive research on health culture, WHP performance, and employee 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

The studies involving human participants were reviewed and approved by Institutional Review Board of Taipei Medical University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

Y-TC and R-YC oversaw all aspects of the study. Y-TC contributed to study design, data collection, data analysis, interpretation of results, and wrote the first draft of the manuscript. F-JT contributed to study design, data collection, and data analysis. C-YY contributed to study design and data analysis. R-YC contributed to study design, data collection, interpretation of results, manuscript writing, and compiled edits from other authors. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

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Challenges Faced by Emergency Physicians in China: An Observation From the Perspective of Burnout

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Background: Burnout is considered a global problem, particularly in the emergency health sector; however, no large-sample cross-sectional study has assessed the prevalence of burnout among emergency physicians and its associated factors.

Methods: A nationally representative cross-sectional survey of 15,243 emergency physicians was conducted in 31 provinces across China between July and September 2019. Multiple linear regression analysis was performed to identify correlates of burnout.

Results: The participants' mean scores were 25.8 (SD = 15.9) on the emotional exhaustion (EE) subscale, 8.1 (SD = 7.9) on the depersonalization (DP) subscale, and 26.80 (SD = 12.5) on the personal accomplishment (PA) subscale, indicating a pattern of moderate EE, moderate DP, and high PA. The results of the large-sample survey found that 14.9% of emergency physicians had a high level of burnout in China, with 46.8% scoring high for EE, 24.1% scoring high for DP, and 60.5% having a high risk of low PA. Having poor self-perceived health status and sleep quality, working in developed regions and governmental hospitals, having an intermediate professional title, experiencing depression, performing shift work and experiencing workplace violence made emergency physicians more likely to experience occupational burnout.

Conclusion: Positive measures should be taken to reduce the burnout of emergency physicians and improve their work enthusiasm to maintain the quality of emergency medical services.

Keywords: burnout, emergency medicine, emergency physicians, organizational psychology, prevalence

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BACKGROUND

Burnout is a psychological syndrome that is a reaction to the long-term, accumulated negative effect of chronic work-related stress (1). It is a syndrome characterized by feelings of overextension and the depletion of resources (emotional exhaustion, EE), negative or callous responses to job responsibilities (depersonalization, DP), and feelings of incompetence and a lack of achievement (decreased personal accomplishment, PA) (2). DP is often referred to a coping strategy, while PA could be a way of burnout addressing. Burnout has been shown to exert adverse effects on organizations (e.g., turnover, higher absenteeism, lack of job commitment, and job dissatisfaction), the mental and physical health of healthcare practitioners, and the quality of healthcare delivery (2–5). In the United States alone, physician burnout has an estimated economic burden of $4.6 billion a year (6). Therefore, a growing number of researchers have studied physician burnout and found that emergency physicians have the highest burnout rate of any physician group (7–10).

Emergency physicians, who often need to provide urgent care and make important decisions that can affect whether a patient recovers or dies (11, 12), face high levels of stress and are more prone to burnout (13, 14). Emergency physicians often need to deal with numerous patients and various diseases during providing medical services; while they also faced staff shortages and the chaotic work environment characterized by unpredictability in the medical setting. Although many studies on burnout among emergency physicians have been conducted in recent years (15, 16), according to a recent systematic review, the samples of these studies are often small and underrepresentative (N = 23–315) (17). Specific data in low-income and middle-income countries are particularly scarce (18). In addition, systematic exploration of the potential factors associated with physicians' burnout is not available (17). Therefore, it is urgent to carry out large-sample studies and clarify the influencing factors on the occupational burnout of emergency physicians.

China has the largest number of emergency patients every year around the world, with more than 166.5 million (19), and China is also the country with the most emergency physicians, with nearly 60 thousand, accounting for more than 2% of all doctors in the country (19). Emergency treatment plays an important role in China's medical system, and it has received ample attention from the government (20). However, according to previous studies, emergency physicians in China still face many underlying dilemmas, including the following:

(1) Emergency physicians in China are often under great work pressure. Work pressure may have an impact on their daily lives (21), such as reducing their sleep quality (22, 23), and may also have an impact on their mental health (24, 25), such as triggering psychological problems such as depression (26).
(2) An excessive work burden can easily cause health damage (22). Many emergency physicians still need to keep working even when they are ill, which further aggravates the decline in emergency physicians' physical health (27), as well as their mental health.
(3) There are regional and sociodemographic differences in China's demand for health resources (28, 29). Hospitals in developed areas or government in China are often faced with an excessive demand for health services and need to provide adequate medical services (30), while hospitals in underdeveloped areas and non-governmental hospitals have an insufficient number of patients (31–33). The imbalance between health resources and needs exacerbates the work burden of emergency physicians in hospitals in developed areas and government-run hospitals.
(4) Many hospitals in China have not yet established reasonable management systems, and the management of health human resources is not based on scientific evidence (27, 34). For example, many emergency physicians have to engage in shift work, which greatly increases their work burden (35, 36).
(5) In recent years, physician-patient conflicts in China have become more frequent (37, 38). As emergency physicians often deal with patients in the acute stage of illness, they are more vulnerable to verbal or physical violence from patients or their relatives (39). Estrangement between physicians and patients reduces physicians' enthusiasm and sense of achievement.

The difficulties faced by emergency physicians in China reflect the contradictions faced by physicians in China and the deficiencies in health and healthy development. However, the potential impact of these challenges on emergency physicians and the mechanism by which these factors may lead to emergency physicians' burnout are unclear. This study aim to investigate these issues to further develop emergency care, maintain the stability of the population of emergency physicians and determine the influencing factors that have not previously been examined. As China is the largest developing country, understanding the prevalence of burnout among emergency physicians in China and its influencing factors can provide a reference for policy makers and researchers in global health care.

METHODS

Ethics Statement

The study protocol was approved by the Institutional Ethics Board of the Second Affiliated Hospital of Hainan Medical University, Haikou, China (HYLL-2018-035). All individuals provided written informed consent.

Study Participants and Survey Design

A cross-sectional study was carried out in China from July 2019 to September 2019. A multistage stratified random sampling design was used in this study. First, a total of 31 Chinese provinces were classified as developed, developing, or less-developed regions according to per capital household income in 2018. Second, we selected 10 hospitals randomly from each province. Third, based on the number and scale of the hospitals, 40% of the emergency physicians who had practiced in the emergency department for at least 6 months were randomly

Abbreviations: EE, Emotional Exhaustion; DP, Depersonalization; PA, Personal Accomplishment; BMI, Body Mass Index; CES-D, Center for Epidemiological Studies-Depression Scale.

selected from each hospital to complete a self-administered questionnaire. The inclusion criteria for study participants were: (1) emergency physicians performing emergency medicine services; (2) Have been working for at least 6 months. Exclusion criteria for the study were: (1) nurses or other medical technical service personnel; (2) Have worked for <6 months. In total, 15,455 emergency physicians were asked to participate in this survey, and 182 physicians did not respond. Additionally, 30 questionnaires were discarded due to missing information. Ultimately, 15,243 eligible questionnaires were used in this analysis, and response rate was 98.6%.

Instrument and Measurement

The questionnaire was designed based on literature reviews, group discussions, and preliminary interviews. Independent variables were selected based on previous studies and findings, including demographic characteristics, workplace violence, shift work, and depression. Furthermore, a pilot study was conducted in one Wuhan community to improve the quality of the questionnaire. A total of 50 physicians filled out the questionnaire and made sure the questions were understood. The questionnaire consisted of questions on sociodemographic information (e.g., region, age, gender, education level, marital status, and professional title), burnout, depression status and workplace violence.

Burnout was measured with the Maslach Burnout Inventory (MBI-HSS) that consisted of three subscales and 22 items on a six-point Likert scale ranging from 0 (never) to 6 (every day) (40). The three dimensions of EE, DP, and PA were measured in 9, 5, and 8 items, respectively. Higher scores on the EE and DP subscales were positively associated with higher levels of burnout, while the PA subscale score was inversely associated with burnout. In the analysis of the prevalence of burnout, we analyzed the subscales as categorical variables. The cutoff points for different categories (low, moderate, and high) for each subscale were defined in the study according to the MBI-HSS scoring guidelines (41). Emergency physicians were categorized as having a high level of burnout if they scored high on EE and DP and low on PA. In this study, the Cronbach's alpha coefficients for the MBI-HSS total scale and the EE, DP, and PA subscales were 0.86, 0.92, 0.88, and 0.89, respectively, suggesting that the overall measurement was reliable.

The Center for Epidemiological Studies Depression scale (CES-D) was used to assess depression. The scale includes includes 20 items; each item is scored on a four-point scale ranging from 0 ("little or none of the time") to 3 ("most or almost all of the time"). The items are declarative expressions such as "I feel I can't get out of my gloomy mood even with the help of my family and friends." "I can't concentrate." The total score ranges from 0 to 60 points, and the higher the score is, the more severe the depressive symptoms. On the original CES-D scale, a total score of 16 was used to detect the presence of depressive symptoms (42). However, a large number of studies have assessed the diagnostic accuracy of CES-D in detecting depression in the general population and have proposed multiple cutoff points, such as a cutoff point of 18 for elderly people living in residential homes (43) and a cutoff score of 22 for older Chinese individuals (44). A meta-analysis systematically reviewed 28 CES-D studies, including several Chinese studies, and obtained an optimal cutoff point of 20 points (45). As a result, an overall score of 20 or higher was considered an indicator of depressive symptoms in this study, consistent with previous research (46). The CES-D has good reliability and validity, and it has been widely used in the Chinese population. In this study, the Cronbach's alpha coefficient of the scale was 0.90.

Workplace violence was measures by Workplace violence Scale (WVS) was developed by Wang et al. (47), has a good reliability and validity for measuring the incidence of workplace violence when applied to medical staff in China. It includes 5 items measured with a four-point ordinal scale ranging from 0 (never) to 3 (more than 3 times/year). In this study, the Cronbach's alpha for WPV was 0.81.

Data Collection and Quality Control

Our research includes the following steps: (1) determining research objectives; (2) Define the research type; (3) Determine the research object; (4) Determine sample content and sampling method; (5) Data collection and statistical analysis. A web link to the online questionnaire, which was designed using Questionnaire Star, was disseminated to the participants through WeChat (similar to WhatsApp in Western countries, WeChat is the largest communication platform in China, with over one billion users). To prevent the same participants from repeatedly answering the questionnaire, each device (e.g., smartphone or computer) was eligible to complete the questionnaire only once, and logical checks were concurrently run on the WeChat platform to identify invalid questionnaires. The data were entered into a web-based database by trained investigators to ensure accuracy.

Statistical Methods

In the descriptive analysis, the mean and standard deviation were calculated for continuous variables, and the quantity and percentage were calculated for categorical data. The dependent variables (EE, DP, PA, and overall burnout) were treated as continuous variables. The ANOVA were used to compare differential factors for burnout. No clustering was observed among the respondents (correlation $= 0.03$, $P < 0.001$). A multiple linear regression model was performed to identify the correlates of three distinct dimensions of burnout, as identified by EE, DP, and PA subscales. Predictive variables such as age (continuous), gender, marital status, education level, work tenure, average monthly income, contract status, professional level, managerial responsibility, practice setting, and workplace violence were included in the multiple linear regression analysis. All statistical analyses were performed with Statistical Analysis System (SAS) version 9.2 (SAS Institute Inc., Cary, NC, USA). Statistical significance was accepted at the 5% level ($P < 0.05$).

RESULTS

Table 1 presents the main characteristics of the survey respondents. Among the 15,243 respondents, most were married (83.3%), were men (69.9%) and had a bachelor's degree

TABLE 1 | Statistical description of study samples.

Variables	*N* (%)	EE scores [M (SD)]	*P*-value	DP scores [M (SD)]	*P*-value	PA scores [M (SD)]	*P*-value
Total	15,243 (100.00)	25.78 (15.94)	NA	8.13 (7.85)	NA	26.80 (12.53)	NA
Gender							
Male	10,650 (69.87)	25.36 (16.05)	<0.001	8.46 (8.08)	<0.001	26.46 (12.77)	<0.001
Female	4,593 (30.13)	26.76 (15.64)		7.38 (7.23)		27.61 (11.91)	
Age group, y							
≤31	4,089 (26.83)	24.96 (15.76)	<0.001	8.31 (7.72)	<0.001	25.45 (12.37)	<0.001
>31 and ≤37	4,117 (27.01)	28.04 (15.69)		9.20 (8.22)		26.05 (11.86)	
>37 and ≤43	3,291 (21.59)	27.00 (15.85)		8.46 (7.92)		27.05 (12.23)	
>43	3,746 (24.59)	23.13 (16.04)		6.48 (7.21)		28.90 (13.37)	
Region							
Developed	6,000 (39.36)	25.65 (15.80)	0.431	8.13 (7.74)	0.991	27.03 (12.28)	<0.001
Middle-developed	4,097 (26.88)	26.05 (15.83)		8.14 (7.88)		27.20 (12.37)	
Less-developed	5,146 (33.76)	25.72 (16.19)		8.12 (7.95)		26.23 (12.91)	
Education level							
Associate's degree or vocational diploma*	894 (5.86)	20.66 (15.76)	<0.001	5.93 (6.86)	<0.001	26.58 (13.91)	0.507
Bachelor degree	10,293 (67.53)	25.92 (15.94)		8.17 (7.92)		26.88 (12.57)	
Master degree or higher	4,056 (26.61)	26.56 (15.80)		8.52 (7.79)		26.65 (12.10)	
Marital status							
Married/widow/divorced	12,691 (83.26)	25.88 (15.94)	0.099	8.06 (7.85)	0.012	26.99 (12.56)	<0.001
Unmarried	2,552 (16.74)	25.31 (15.93)		8.49 (7.84)		25.87 (12.34)	
Income level							
High	1,672 (10.97)	21.64 (15.47)	<0.001	6.87 (7.25)	<0.001	28.31 (13.40)	<0.001
Middle	6,746 (44.26)	25.04 (15.37)		7.73 (7.45)		27.17 (12.26)	
Low	6,825 (44.77)	27.53 (16.36)		8.84 (8.30)		26.07 (12.52)	
Work tenure, y							
≤3	4,921 (32.28)	24.41 (15.75)	<0.001	7.87 (7.52)	<0.001	26.03 (12.45)	<0.001
>3 and ≤6	3,114 (20.43)	26.76 (15.94)		8.67 (8.16)		26.20 (12.46)	
>6 and ≤11	3,424 (22.46)	27.79 (15.80)		8.77 (8.18)		27.01 (12.19)	
>11	3,784 (24.82)	24.94 (16.09)		7.44 (7.62)		28.12 (12.86)	
Contract status							
Permanent	9,715 (63.75)	25.55 (15.91)	0.186	8.07 (7.83)	0.214	27.11 (12.55)	<0.001
Temporary	5,528 (36.27)	25.91 (15.96)		8.24 (7.89)		26.26 (12.47)	
Professional title							
Elementary or below	5,349 (35.09)	25.25 (16.08)	<0.001	8.31 (7.92)	<0.001	25.56 (12.57)	<0.001
Intermediate	5,861 (38.45)	27.71 (15.72)		8.78 (8.06)		26.90 (11.91)	
Senior	4,033 (26.46)	23.68 (15.77)		6.95 (7.29)		28.32 (13.15)	
Ownership							
Governmental	14,599 (95.78)	25.97 (15.96)	<0.001	8.20 (7.88)	<0.001	26.78 (12.50)	0.242
Non-governmental	644 (4.22)	21.51 (14.98)		6.51 (6.79)		27.37 (13.08)	
Level of hospital							
Three-grade level	10,152 (66.60)	26.14 (15.83)	<0.001	8.29 (7.87)	<0.001	26.86 (12.35)	0.513
Two-grade level	4,841 (31.76)	25.38 (16.14)		7.94 (7.84)		26.72 (12.81)	
Other	250 (1.64)	18.78 (14.95)		5.53 (6.53)		26.04 (14.07)	
Shift work							
Yes	13,288 (87.17)	26.76 (15.87)	<0.001	8.55 (7.98)	<0.001	26.50 (12.29)	<0.001
No	1,955 (12.83)	19.14 (14.81)		5.31 (6.19)		28.87 (13.87)	
Workplace violence							
Yes	13,699 (89.87)	27.13 (15.65)	<0.001	8.65 (7.92)	<0.001	26.95 (12.07)	<0.001
No	1,544 (10.13)	13.79 (13.27)		3.54 (5.27)		25.50 (15.97)	

(Continued)

TABLE 1 | Continued

Variables	*N* (%)	EE scores [M (SD)]	*P*-value	DP scores [M (SD)]	*P*-value	PA scores [M (SD)]	*P*-value
Self-perceived health status							
Good	4,707 (30.88)	17.60 (14.04)	<0.001	5.54 (6.40)	<0.001	27.70 (14.25)	<0.001
Fair	7,729 (50.71)	26.85 (14.90)		8.31 (7.53)		26.53 (11.88)	
Poor	2,807 (18.42)	36.55 (14.38)		11.99 (9.14)		26.05 (11.01)	
BMI (kg/m^2)							
<25	9,588 (62.90)	25.53 (15.86)	0.013	7.89 (7.67)	<0.001	26.64 (12.50)	0.032
≥25	5,655 (37.10)	26.20 (16.08)		8.54 (8.12)		27.09 (12.57)	
History of hypertension							
Yes	2,317 (15.20)	28.72 (16.21)	<0.001	9.38 (8.56)	<0.001	27.57 (12.16)	0.001
No	12,926 (84.80)	25.25 (15.84)		7.91 (7.69)		26.67 (12.59)	
History of diabetes							
Yes	598 (3.92)	28.19 (17.22)	<0.001	9.29 (9.01)	<0.001	27.15 (12.94)	0.496
No	14,645 (96.08)	25.68 (15.88)		8.08 (7.79)		26.79 (12.51)	
History of coronary heart disease							
Yes	471 (3.09)	34.17 (16.10)	<0.001	11.10 (9.29)	<0.001	28.33 (12.00)	0.007
No	14,772 (96.91)	25.51 (15.87)		8.04 (7.78)		26.75 (12.54)	
Smoking status							
Non-smokers	12,287 (80.61)	25.56 (15.88)	0.001	8.01 (7.73)	<0.001	26.64 (12.47)	0.001
Smokers	2,956 (19.39)	26.68 (16.16)		8.63 (8.32)		27.49 (12.73)	
Alcohol drinking							
Non-drinkers	1,1451 (75.12)	25.86 (15.90)	0.270	7.93 (7.71)	<0.001	26.78 (12.44)	0.753
Drinkers	3,792 (24.88)	25.53 (16.07)		8.74 (8.22)		26.86 (12.79)	
Physical inactivity							
Yes	11,098 (72.81)	27.29 (15.76)	<0.001	8.56 (7.94)	<0.001	26.49 (12.05)	<0.001
No	4,145 (27.19)	21.75 (15.73)		6.98 (7.49)		27.64 (13.69)	
Sleeping quality							
Good	2,295 (15.06)	15.39 (13.15)	<0.001	4.66 (5.74)	<0.001	28.55 (14.62)	<0.001
Fair	7,347 (48.20)	23.46 (14.91)		7.58 (7.31)		26.48 (12.63)	
Poor	5,601 (36.74)	33.09 (14.99)		10.28 (8.61)		26.51 (11.36)	
CES-D scores							
<20	9,818 (64.41)	18.54 (12.86)	<0.001	5.02 (5.36)	<0.001	27.40 (13.64)	<0.001
≥20	5,425 (35.59)	38.88 (12.18)		13.76 (8.47)		25.72 (10.12)	

P-value is the result of ANOVA analysis.

**Associate's degree or vocational Diploma: Mainly cultivate vocational and technical students. Education level below bachelor's degree.*

EE, Emotional Exhaustion; DP, Depersonalization; PA, Personal Accomplishment; BMI, Body Mass Index; CES-D, Center for EpidemiologicalStudies-Depression Scale.

or above (94.2%). The mean age (SD) was 37.66 (8.1) years. Approximately 65% of the participants had intermediate or senior professional titles. In total, 55.23% of the respondents were in the middle- and lower-income groups, more than half estimated their own health to be at the general level, and ∼40% were from developing regions. A minority of the participants (27.2%) participated in regular physical activity (**Table 1**).

The participants' mean scores were 25.8 (SD = 15.9; range = 0–54) on the EE subscale, 8.1 (SD = 7.9; range = 0–30) on the DP subscale, and 26.8 (SD = 12.5; range = 0–48) on the PA subscale, indicating a pattern of moderate EE, moderate DP, and high PA. The distribution of the sample is normally distributed. The plots of the mean domain score and thresholds can be seen in **Figure 1**. **Table 2** shows the prevalence of burnout and its dimensions among emergency physicians. Among the participants, 46.8% reported high levels of EE burnout, 24.1% reported high levels on DP burnout, and 60.5% exhibited reduced feelings of PA. In total, 15.0% scored high for all three dimensions.

The factors associated with the emergency physicians' burnout and three dimensions of burnout are presented in **Table 3**, including gender, age, region, education level, marital status, work tenure, professional title, ownership, shift work, workplace violence, self-perceived health status, BMI, history of hypertension and coronary heart disease, smoking and alcohol drinking status, physical inactivity, sleeping quality and depression.

For emotional exhaustion, respondents who are female (β = 1.8) and smokers (β = 0.8), worked in developed country (β = 0.6) and governmental ownership (β = 2.1), had higher education level [bachelor degree (β = 2.4) or master degree or higher (β = 2.4)] and higher CES-D scores (β = 16.1),

longer work tenure [>6 and ≤11 (β = 0.9) or >11 (β = 0.6)], intermediate professional title (β = 0.5), poorer self-perceived health status [fair (β = 3.6) or poor (β = 6.7)] and better sleeping quality [fair (β = 2.9) or poor (β = 5.8)], had history of hypertension (β = 0.7) and coronary heart disease (β = 2.1), participate in physical inactivity (β = 1.2), experienced shift work (β = 2.2), and workplace violence (β = 5.8) have higher EE scores.

For depersonalization, respondents who are unmarried (β = 0.4) and drinker (β = 0.7), worked in developed country (β = 0.3), had higher education level [bachelor degree (β = 1.1) or master degree or higher (β = 1.4)], poorer self-perceived health status [fair (β = 0.8) or poor (β = 2.0)] and poorer sleeping quality [fair (β = 0.9) or poor (β = 0.8)], had history of hypertension (β = 0.5), coronary heart disease (β = 0.8) and higher CES-D scores (β = 16.1) have higher DP scores; while those who are female (β = −0.8) and older [>37 and ≤43 (β = −0.4) or >43 (β = −1.1)] have lower DP scores.

For personal accomplishment, respondents who are female (β = 2.0), smoker (β = 1.4) and older [>37 and ≤43 (β = 1.0) or >43 (β = 2.6)], worked in middle-developed (β = 0.8) or developed country (β = 0.7), had intermediate professional title (β = 0.6), the BMI of over 25 (β = 0.6) and coronary heart disease (β = 1.3), experienced workplace violence (β = 2.4) have higher PA scores; while those who had poorer self-perceived health status [fair (β = −0.9) or poor (β = −1.2)], poorer sleeping quality [fair (β = −1.4) or poor (β = −0.8)] and higher CES-D scores (β = −1.4), experienced shift work (β = −1.0).

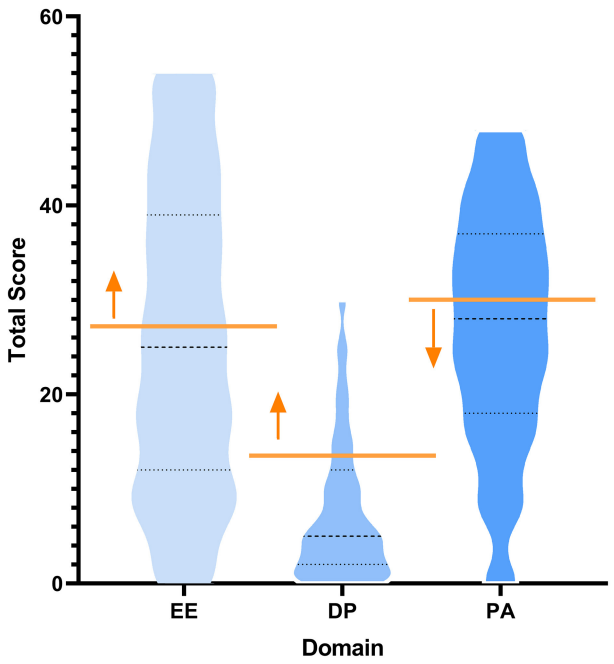

FIGURE 1 | Violin plot showing threshold and distribution for burnout. Yellow lines indicate high burnout threshold with respect to each domain. Arrows indicate all participants who met or exceeded the high threshold for burnout. EE, emotional exhaustion; DP, depersonalization; PA, personal achievement.

DISCUSSION

According to the findings of a previous meta-study (N = 4–7,830) (48), this study is the largest cross-sectional study of physician burnout in the world (7, 8). We found that 15.0% of the emergency physicians had a high level of burnout in China, with 46.9% scoring high for emotional exhaustion, 24.1% scoring high for depersonalization, and 60.5% having a high risk of low PA. Compared with a previous meta-analysis (17) on the level of burnout among emergency physicians (high EE = 40%, high DP = 41%, low PA = 35%), this study showed that more emergency physicians had high DP and low PA and fewer physicians had high DP. In addition, we identified a number of representative factors that clearly correlate with the development of occupational burnout among emergency physicians and reflect potential challenges in the practice of emergency physicians.

Sleep Quality and Depression Were Significantly Associated With Burnout Among Emergency Physicians

Previous research has shown that job stress can have a variety of consequences, including damage to health (49), reduced quality of life (22), and psychological problems (24, 25). Another study reported that long-term work stress will lead to the potential for negative effects on the quality of patient care (50).

TABLE 2 | The prevalence of burnout in emergency physicians according to three distinct dimensions of burnout.

Variables	Burnout in all three dimensions		EE[a]		DP[b]		PA[c]	
	N	% (95%CI)	*N*	%	*N*	%	*N*	%
Low[d]	1,301	8.5	5,098	33.4	8,601	56.4	3,112	20.4
Moderate	11,662	76.5	3,015	19.8	2,970	19.5	2,908	19.1
High[e]	2,280	15.0	7,130	46.8	3,672	24.1	9,223	60.5

DP, Depersonalization; EE, Emotion exhaustion; PA, Personal accomplishment.

[a] *Score ≤ 16 indicated low level; 17–26 indicated moderate level; ≥27 indicated high level.*

[b] *Score ≤ 6 indicated low level; 7–12 indicated moderate level; ≥13 indicated high level.*

[c] *Score ≥ 39 indicated low level; 32–38 indicated moderate level; ≤31 indicated high level.*

[d] *Low degree of burnout was defined by a low score on the subscales for EE and DP, and a high score on the PA subscale.*

[e] *High degree of burnout was defined by a high score on the subscales for EE and DP, and a low score on the PA subscale.*

TABLE 3 | Correlates of burnout in emergency physicians: results of stepwise regression.

Variables	EE		DP		PA	
	β	95%CI	β	95%CI	β	95%CI
Gender (Ref: male)						
Female	1.776	1.334 to 2.217	−0.779	−1.023 to −0.535	1.995	1.527 to 2.462
Age group, y (Ref: ≤31)						
>31 and ≤37	—	—	—	—	—	—
>37 and ≤43	—	—	−0.401	−0.675 to −0.127	1.033	0.520 to 1.547
>43	—	—	−1.117	−1.411 to −0.823	2.551	2.025 to 3.077
Region (Ref: less-developed)						
Developed	0.598	0.206 to 0.990	0.332	0.117 to 0.548	0.709	0.243 to 1.175
Middle-developed	—	—	—	—	0.826	0.315 to 1.336
Education level (Ref: associate's degree or vocational diploma)						
Bachelor degree	2.411	1.601 to 3.221	1.089	0.640 to 1.539	—	—
Master degree or higher	2.827	1.954 to 3.701	1.446	0.960 to 1.932	—	—
Marital status (Ref: married/widow/divorced)						
Unmarried	—	—	0.361	0.069 to 0.654	—	—
Income level (Ref: low)						
High	—	—	—	—	—	—
Middle	—	—	—	—	—	—
Work tenure, y (Ref: ≤3)						
>3 and ≤6	—	—	—	—	—	—
>6 and ≤11	0.861	0.369 to 1.352	—	—	—	—
>11	0.600	0.120 to 1.080	—	—	—	—
Contract status (Ref: temporary)						
Permanent	—	—	—	—	—	—
Professional title (Ref: elementary or below)						
Intermediate	0.501	0.095 to 0.906	—	—	0.590	0.168 to 1.012
Senior	—	—	—	—	—	—
Ownership (Ref: non-governmental)						
Governmental	2.088	1.153 to 3.024	0.846	0.330 to 1.362	—	—
Level of hospital (Ref: other)						
Three-grade level	—	—	—	—	—	—
Two-grade level	—	—	—	—	—	—
Shift work (Ref: no)						
Yes	2.164	1.566 to 2.762	0.815	0.475 to 1.155	−0.965	−1.618 to −0.312
Workplace violence (Ref: no)						
Yes	5.802	5.160 to 6.444	2.152	1.798 to 2.506	2.406	1.730 to 3.082
Self-perceived health status (Ref: good)						
Fair	3.633	3.172 to 4.094	0.803	0.550 to 1.056	−0.933	−1.414 to −0.451
Poor	6.732	6.086 to 7.379	1.907	1.553 to 2.261	−1.185	−1.856 to −0.513
BMI (kg/m^2) (Ref: <25)						
≥25	—	—	—	—	0.619	0.196 to 1.043
History of hypertension (Ref: no)						
Yes	0.748	0.196 to 1.299	0.478	0.169 to 0.788	—	—
History of diabetes (Ref: no)						
Yes	—	—	—	—	—	—
History of coronary heart disease (Ref: no)						
Yes	2.062	0.950 to 3.173	0.798	0.184 to 1.412	1.251	0.089 to 2.414
Smoking status (Ref: non-smokers)						
Smokers	0.761	0.259 to 1.264	—	—	1.397	0.869 to 1.925
Alcohol drinking (Ref: non-drinkers)						
Drinkers	—	—	0.742	0.485 to 0.999	—	—

(Continued)

TABLE 3 | Continued

Variables	EE		DP		PA	
	β	95%CI	β	95%CI	β	95%CI
Physical inactivity (Ref: no)						
Yes	1.168	0.727 to 1.609	—	—	—	—
Sleeping quality (Ref: good)						
Fair	2.898	2.321 to 3.475	0.905	0.588 to 1.222	−1.400	−2.005 to −0.794
Poor	5.757	5.103 to 6.410	0.819	0.460 to 1.178	−0.825	−1.509 to −0.141
CES-D scores (Ref: <20)						
≥20	16.137	15.707 to 16.568	7.663	7.426 to 7.901	−1.433	−1.886 to −0.980

R^2: EE: 0.457; DP: 0.318; PA: 0.025.

EE, Emotional Exhaustion; DP, Depersonalization; PA, Personal Accomplishment; BMI, Body Mass Index; CES-D, Center for Epidemiological Studies-Depression Scale.

This study demonstrates that these adverse effects ultimately lead to occupational burnout among emergency physicians. Because emergency physicians need to deal with patients in the acute stage, they are one of the groups experiencing the most stress among all types of physicians (27) and should be given full attention.

Studies have shown that chronic work stress can affect sleep quality, especially among physicians (22, 51). Emergency physicians are under great work pressure, and burnout occurs along with a decline in sleep quality. Similarly, the participants in this study with a previous history of hypertension and coronary heart disease showed higher emotional exhaustion and depersonalization. The results of a previous meta-study suggest that job stress has a significant impact on burnout (52). Therefore, emergency physicians must be alert to their high work burden and take corresponding measures to improve their quality of life.

Work stress can not only cause quality of life and health to decline but also take a toll on mental health (24, 53). Previous studies have suggested that a high workload can affect mental health (27, 54). This phenomenon is particularly common for emergency physicians and may lead to psychological problems such as depression, and depression is significantly correlated increased emotional exhaustion and depersonalization as well as a deficiency in personal accomplishment. Therefore, it is necessary to pay full attention to the mental health of emergency physicians and take targeted measures to improve their well-being, which is of great significance for maintaining the stability of emergency physician groups (24, 53).

Emergency Physicians in Governmental Hospitals and Developed Areas Showed a High Level of Burnout

China's public hospitals, especially emergency departments, must receive a large number of patients (55). This is because Chinese residents generally trust governmental hospitals to maintain a high quality of medical care (especially in emergency situations); in addition, the Chinese government implements a universal health care policy, and the average cost of treatment in governmental hospitals is lower than that in non-governmental hospitals (56). Residents prefer to select governmental hospitals for medical treatment, and governmental hospitals face far more emergency demands than non-governmental hospitals, which leads to emergency physicians in governmental hospitals needing to treat a large number of emergency patients (55). In this study, as the workload increased, the emergency physicians' EE and DP increased. In recent years, the Chinese government has been working hard to develop the diagnosis and treatment capacity of non-governmental hospitals and reduce the cost of diagnosis and treatment to support non-governmental hospitals in sharing the excess demand of governmental hospitals (57).

In addition, emergency physicians in China also show different levels of burnout in different regions, with emergency physicians in developed regions having higher EE and DP.

This phenomenon may be the result of regional differences in the demand for medical services (29). Due to regional economic differences (32), the population of developed regions is much larger than that of less developed regions, so hospitals in developed regions face a greater burden, and the physicians in these hospitals are more prone to occupational burnout. In addition, highly skilled physicians are more likely to practice in developed regions, which further exacerbates the imbalance in the supply of health resources and induces more patients to seek medical treatment in developed regions (27). At present, the Chinese government has taken a series of measures to try to balance the supply of medical services in different regions, including through the development of remote diagnosis and treatment (58) and the construction of medical confederations to improve the level of diagnosis and treatment in underdeveloped areas and to reduce the workload of physicians in developed areas in the future.

Physicians With Intermediate Titles and Those Who Worked Shift Work and Experienced Workplace Violence Were More Likely to Suffer From Burnout

One group that needs to be considered is physicians with intermediate titles. In previous studies, this group has not been given sufficient attention. However, this study found that physicians with intermediate professional titles had the highest

EE and the highest PA, indicating that on the one hand, they had a higher sense of job achievement, but on the other hand, they had a higher sense of burnout. This finding is very interesting, and it is very likely that this phenomenon reflects the current state of physician practice in China. Compared with young physicians, physicians with intermediate titles are given more important tasks, and compared with physicians with senior professional titles, they need to work harder to gain promotion opportunities (59). Therefore, physicians with intermediate professional titles in China are the backbone of medical services and the hardest working physician group. However, due to the heavy work and family burdens that these physicians may face, they need to take care of their parents as well as their children and manage complex social relations, so they are more prone to burnout. More attention should be given to the physical and mental health statuses of middle-aged physicians, which should be the focus of health researchers and policy makers.

Another group that needs to be considered is emergency physicians who engage in shift work, who have higher EE and DP as well as significantly lower PA than those who do not. Previous studies have documented the physical effects of shift work, which can lead to decreased energy levels and physical and mental health problems (36, 60). Emergency physicians are required to provide emergency medical services around the clock, so most emergency physicians have to perform shift work, which is especially common in China, where a large amount of medical services must be provided. Therefore, the managers of medical institutions should further improve the scientific basis of management (61) and avoid emergency physicians having to perform shift work.

Physician-patient conflict also affects the occupational burnout of emergency physicians. In recent years, conflict between physicians and patients has become increasingly prominent in China (37). This conflict mainly refers to the imbalance between the supply and demand of medical services but also reflects the tension in interpersonal relations, the frequent occurrence of violent incidents and the instability of the social environment (38). In the face of workplace violence, physicians may become suspicious of medical services, which in turn reduces the quality of medical services provided and ultimately damages patients' health (39). Physicians are also more prone to burnout and occupational rejection after being exposed to violence. This study proves that workplace violence has a strong impact on occupational burnout, which leads to an increase in EE and DP and a decrease in PA. In recent years, China has taken an increasing number of measures to improve the relationship between physicians and patients and maintain the professional image of physicians, which will help to maintain the stability of the emergency physician group (27).

Organizational psychology research has explored ways to ameliorate physician burnout. Gagné and Deci suggested that financial incentives may not directly prevent or reduce burnout (60), and our results support the hypothesis that income level may not be a factor in burnout among emergency physicians. In reality, Gagné and Deci posited three pillars that support professionals' intrinsic motivation and psychological well-being: competence, autonomy, and relatedness (60). However, in China, emergency physicians with only intermediate professional titles have to take on a large amount of work, which is not in line with the principle of competence. Management systems that are not based on scientific evidence rob emergency physicians of the right to take volitional action and force them to perform shift work and comply with other unreasonable institutional arrangements. In addition, the high incidence of workplace violence undermines the intimacy of the doctor-patient relationship. Our results support previous suggestions that stripping away these three competencies may be a deeper cause of physician burnout. Therefore, an important direction for future research is to explore strategies to reduce physicians' burnout from the perspective of organizational psychology.

Finally, this study found that several demographic characteristics also influenced the burnout of emergency physicians to varying degrees. Studies have shown that female physicians have higher EE and PA, while male physicians have higher DP, and that burnout declines as physicians age. In addition, the physicians in this study who had higher education levels, who were unmarried, and who had been in the emergency department for longer were more likely to report burnout. In conclusion, this study systematically demonstrated the potential sources of occupational burnout among emergency physicians by analyzing various factors. Together with previous evidence that burnout can effectively be reduced with moderate levels of investment, these findings suggest substantial economic value of policy and organizational expenditures for burnout reduction programs for physicians (6). Therefore, appropriate measures should be taken to reduce the job burnout of emergency physicians according to the findings of this study.

Strengths and Limitations

Conducted in China, the largest developing country in the world, our study used a large-sample cross-sectional survey to explore the influencing factors of occupational burnout among emergency physicians. First, the large sample size significantly increased the statistical power to detect burnout. We surveyed nearly a quarter (19) of the nation's emergency physicians, so the study was representative. Second, this study presented a broad view of the challenges faced by emergency physicians and reflects the practice status of physicians in China. This study closely examined the challenges faced by emergency physicians, such as decreased sleep quality, poor physical condition, depression, and workplace violence, and demonstrated the impact of these factors on burnout. Through quantitative analysis, it was found that working in public hospitals, working in developed areas and performing shift work were important reasons for increased occupational burnout in emergency physicians. In particular, the study innovatively proposed that emergency physicians with intermediate titles have the highest sense of achievement and burnout, which provides a reference for future research. Third, the survey was anonymous and self-administered, which likely made the respondents provide more valid responses and eliminated interviewer bias.

This study had several limitations. First, the study used a cross-sectional study design, which precluded the evaluation of the temporality of the observed relationships. Second, the data were collected from the participants' self-reports; thus, recall bias was unavoidable. Finally, the study was performed before the COVID-19 pandemic, which may have led to changes in the burnout of emergency physicians after the pandemic.

Suggestions for Future Research

The findings of our study can serve as a reference for further research in the future. Based on our findings, we suggest that, first, prospective studies are needed to investigate the association between the identified factors and burnout. Second, this study highlights the need for the investigation or implementation of interventions to improve emergency physicians' well-being or promote strategies to reduce work burnout on emergency physicians in China's emergency healthcare settings, include more rest time, more flexible schedules, and adequate salary. Finally, investigating the potential impact of burnout on emergency physicians' work performance, the quality of patient care delivery, and family life would provide important insights.

CONCLUSION

The results of the large-sample survey showed that 14.9% of emergency physicians had a high level of burnout in China, with 46.78% scoring high for EE, 24.1% scoring high for DP, and 60.5% having a high risk of low PA. Self-perceived health status, sleep quality, depression, region, ownership, professional title, workplace violence, shift work and other factors were the main factors associated with the prevalence of burnout. Positive measures should be taken to reduce the burnout of emergency physicians and improve their work enthusiasm to maintain the quality of emergency medical services.

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 Institutional Ethics Board of the Second Affiliated Hospital of Hainan Medical University, Haikou, China, in accordance with the Chinese Statistical Law. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SY, XS, YG, and CL conceived and designed the study. RW and ZL participated in the acquisition of data. XS analyzed the data. SY gave advice on methodology. SY and XS drafted the manuscript. XH, YG, and CL revised the manuscript. CL is the guarantors of this work and had full access to all the data in the study and takes responsibility for its integrity and the accuracy of the data analysis. All authors read and approved the final manuscript.

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The Association Between the Number of Consecutive Night Shifts and Insomnia Among Shift Workers: A Multi-Center Study

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Sim J, Yun B-Y, Lee J, Kim SK, Lee S, Cho A, Kim S, Kim C-y, Oh Y and Yoon J-H (2021) The Association Between the Number of Consecutive Night Shifts and Insomnia Among Shift Workers: A Multi-Center Study. Front. Public Health 9:761279. doi: 10.3389/fpubh.2021.761279

Objectives: There is a need to determine the optimal limit of consecutive night shift work to reduce insomnia caused by the accumulation of sleep problems among night shift workers. This study aimed to investigate the prevalence of insomnia caused by consecutive night shifts and evaluate the night shift duration that worsens insomnia the most, using a large amount of medical examination data.

Methods: Night shift profiles and baseline demographics data of three hospitals were collected from January 2015 to December 2017. For subjects who had been examined more than once at the same institution, information corresponding to the most recent date was used. Multivariate logistic regression was performed to estimate odds ratios (ORs) and 95% confidence intervals (CIs). Pooled ORs were calculated by using the results of the three institutions.

Results: Of the 33,669 participants, 31.3% were female. The average age was 41.1 ± 11.1 years and the prevalence of insomnia was 38.7% (n = 13,025). After adjusting for potential confounders and compared to workers who reported not working in consecutive night shifts, odds of insomnia were greatest among workers reporting working three consecutive nights (OR 2.65, 95% CI 1.97–3.56) followed by those working two nights (OR 1.81, 95% CI 1.45–2.26), five nights (OR 1.78, 95% CI 1.56–2.03), and four nights (OR 1.68, 95% CI 1.55–1.82).

Conclusion: Our study demonstrates a significant relationship between consecutive night shift and insomnia with multicenter examination data, using common data model. This study could be a basis for establishing policies and guidelines that improve night shift workers' health.

Keywords: insomnia, consecutive night shifts, shift workers, common data model (CDM), medical examination data

INTRODUCTION

Shift work is a working system used by 15–20% of employers worldwide as a way to provide continuous production or service every day (1). The change in working hours due to shift work was a social change related to the expansion in service industries (2). According to a survey conducted in 2015, 19% of workers worked at night in Europe (3), and approximately 40% of workers in the healthcare field of the European Union had shift work (4). In Republic of Korea, ∼15.5% of all 89,582 companies worked shifts including night shifts (5).

Many studies have shown that shift work, including night shifts, was associated with the occurrence of various diseases. Shift work showed a significant correlation with cardiovascular disease, breast cancer, digestive disorders, arthritis, attention deficit, and fatigue as a consequence of mental and sleep problems (6–13). Working night shifts is associated with short sleep time, and causes sleep disorders such as insomnia and drowsiness (14, 15). Furthermore, insomnia, which is related to night shifts, has been shown to cause hypertension (16). According to a study of electronic manufacturers' employees in Republic of Korea, shift work was associated with insomnia, depression, and suicidal thoughts, respectively (17).

Various factors could be considered when studying the relationship between night shift work and sleep disorders, including insomnia. One study implied that nurses having <11 h between shifts showed significant positive association with insomnia, excessive sleepiness, and excessive fatigue (18). Another study revealed that fixed night shifts were more related to sleep and mental health problems than fixed day, rotating day, and rotating night shifts (19). Studies like these, which should be continuously performed, could help improve the health of night shift workers by providing basic data to be used as a management guideline for those workers.

Consecutive night shift can be a risk factor for various health problems. A quasi-experimental crossover study of police officers, showed that continuous night work shortened sleep time and caused deterioration of sleep quality, and there was an increase in sleep debt with longer consecutive night shifts (20). Therefore, there is a need for a study on the optimal limit of consecutive night shift work to reduce the fatigue caused by the accumulation of sleep problems among night shift workers.

Thus, this study aimed to investigate the prevalence of insomnia according to consecutive night shifts and to provide basic data for finding the safest consecutive night shift duration, using a large medical examination data.

METHODS

Study Population

Korean Workers Health Examination-Common Data Model (KWHE-CDM) was applied for five medical institutions that conduct special health checkups, two of which participated in this study. Data of the KWHE-CDM consists of general measurement, common questionnaires, special questionnaires, and night shift questionnaires. Data on night shift and baseline demographics were collected from January 2015 to December 2017. For subjects who had been examined more than once at the same institution, information corresponding to the most recent date was used.

In total, 13,311 workers from Sinchon Severance Hospital, 6,429 workers from Wonju Severance Hospital, and 13,929 workers from Ulsan University Hospital (33,669 workers) were recruited. The same analysis was conducted at each medical institution with the same statistic syntax so that equivalent results were calculated using the CDM method.

Procedure

The primary outcome of this study was the presence of insomnia. Insomnia was measured using the Insomnia Severity Index (ISI) questionnaire, which has been broadly used as a reliable scale of insomnia. ISI is a survey tool used to quantify insomnia severity (21) and has been proven to be valid in Republic of Korea (22). Each question of the ISI is rated by a 5-point Likert scale, yielding a total score ranging from 0 to 28. Based on the score, the participants were categorized into four groups as follows: 0–7 (absence of insomnia), 8–14 (sub-threshold insomnia), 15–21 (moderate insomnia), and 22–28 (severe insomnia) (23). Those with scores ranging from 0–7 were classified into the non-insomnia group, and those in the other score categories (sub-threshold, moderate, and severe insomnia) were classified into the insomnia group.

Data on night shift work were collected from the participants, using the night shift questionnaires in the CDM. The number of consecutive night shifts was collected through a question "How many consecutive night shifts did you usually work in the past year?" using a 5-point Likert scale with the following answers: none, 2 nights, 3 nights, 4 nights, and ≥5 nights, respectively.

Covariates used in the multivariate analysis were obtained from baseline demographics (age and sex) and night shift profiles including shift type, shift interval, and working hours. Shift type at current workplace was assessed, and the answers were categorized as follows: 3 shifts, 2 shifts, every other day, fixed, and irregular. Workers whose rest time between shifts was <11 h were classified into the "quick return" group; others were classified into "slow return" group. Whether workers worked 52 or more hours per week on average or not was used as a working-hour covariate.

Statistical Analysis

For continuous and categorical data, differences between participants with and without insomnia were evaluated using the independent *t*-test and the chi-square test, respectively. Odds ratios (ORs) of insomnia with 95% confidence intervals (CIs) were estimated using a multiple logistic regression model. The association between shift work and insomnia was explored using multivariable logistic regression, and OR and 95%CI were reported. Model 1 was adjusted for sex and age, Model 2 was adjusted for sex, age, working hours, and rest time between shifts. The data of each hospital were analyzed with equivalent statistical methods. Based on the logistic regression results of each organization, meta-analysis was implemented to confirm the integrated results, and a random effect model was applied to

TABLE 1 | Baseline characteristics of the entire participants stratified by insomnia.

	Total (*N* = 33,669)	Insomnia (*N* = 13,025)	Non-insomnia (*N* = 20,644)	*P*-value
Sex				
Male	23,140 (68.7%)	8,391 (64.4%)	14,749 (71.4%)	<0.001
Female	10,529 (31.3%)	4,634 (35.6%)	5,895 (28.6%)	
Age				
Mean ± SD	41.1 ± 11.1	40.4 ± 10.8	42.2 ± 11.2	<0.001
Working hours				
Under 52 h	24,595 (73.0%)	9,389 (72.1%)	15,206 (73.7%)	0.002
Over 52 h	9,074 (27.0%)	3,636 (27.9%)	5,438 (26.3%)	
Rest time between shifts				
Slow return (11 h or more)	26,094 (77.5%)	9,817 (75.4%)	16,277 (78.8%)	<0.001
Quick return (<11 h)	7,575 (22.5%)	3,208 (24.6%)	4,367 (21.2%)	
Consecutive night shifts				
None	7,238 (21.5%)	1,955 (15.0%)	5,283 (25.6%)	<0.001
2 nights	3,274 (9.7%)	1,331 (10.2%)	1,943 (9.4%)	
3 nights	4,041 (12.0%)	2,095 (16.1%)	1,946 (9.4%)	
4 nights	5,066 (15.0%)	1,983 (15.2%)	3,083 (14.9%)	
5 or more nights	14,050 (41.7%)	5,661 (43.5%)	8,389 (40.6%)	

"consecutive night shift" to further implement subgroup meta-analysis. The weight acquired through the standard error was used to generate pooled ORs and 95% CIs for insomnia.

All statistical tests were two-sided, and statistical significance was defined as a $p < 0.05$. The R software version 4.0.3 (R Foundation for Statistical Computing, Vienna, Austria) was used for all statistical analyses.

Ethics Statement

The study protocol was approved by Severance Hospital's Institutional Review Board and followed the ethical requirements of the 1975 Declaration of Helsinki (IRB: Y-2020-0011). Because of the retrospective nature of this study, informed permission from the participants was waived.

RESULTS

The baseline characteristics of the entire participants are summarized in **Table 1**. In total, 33,669 participants were recruited in this study, with an average age of 41.1 ± 11.1 years. The proportion of females was 31.3%, and the prevalence of insomnia was 38.7% ($n = 13,025$).

The workers with and without insomnia were 13,025 and 20,644, respectively. The proportion of women in insomnia group was 35.6% and that in the non-insomnia group was 28.6%, statistically significant differences ($p < 0.001$). The average age in insomnia group was 40.4 ± 10.8 years, 1.8 years younger than 42.2 ± 11.2 years in non-insomnia group, with a statistically significant difference ($p < 0.001$). Compared to workers with non-insomnia, those with insomnia were more likely to be female, having rest time between shifts of <11 h ("quick return"), and having five or more consecutive night shifts ($p < 0.01$ for all).

TABLE 2 | Pooled odds ratios of insomnia in multivariable logistic regression models.

	Model 1	Model 2
Consecutive night shifts		
None	(Reference)	(Reference)
2 nights	1.69 (1.29–2.21)	1.81 (1.45–2.26)
3 nights	2.32 (1.59–3.39)	2.65 (1.97–3.56)
4 nights	1.78 (1.64–1.93)	1.68 (1.55–1.82)
5 or more nights	1.78 (1.54–2.06)	1.78 (1.56–2.03)

Adjusted for Model 1: sex, age.
Adjusted for Model 2: sex, age, working hours, Rest time between shifts.

Pooled ORs were calculated by using the results of the three institutions in **Table 2**. The factors affecting insomnia were sex, age, quick return, and consecutive night shift in all institutions. Model 1 was adjusted using age and sex as covariates. The final adjusted model used age, sex, working hour and quick return as covariates. In Model 2, all the answers regarding consecutive night shifts were significantly associated with insomnia compared with the "none." Additionally, "3 nights" had the highest OR of 2.65 (95% CI 1.97–3.56), followed by 2 nights, 5 nights, and 4 nights [2 nights: OR 1.81 (95% CI 1.45–2.26); 5 or more nights: OR 1.78 (95% CI 1.56–2.03); 4 nights: OR 1.68 (95% CI 1.55–1.82)].

The ORs of insomnia by consecutive night shifts in each institution are shown in **Figure 1**. Regardless of the number of consecutive night work days, all institutions showed higher OR values compared to those who did not. Moreover, all three institutions showed the highest OR in workers with 3 nights. The completed version of the baseline characteristics and the

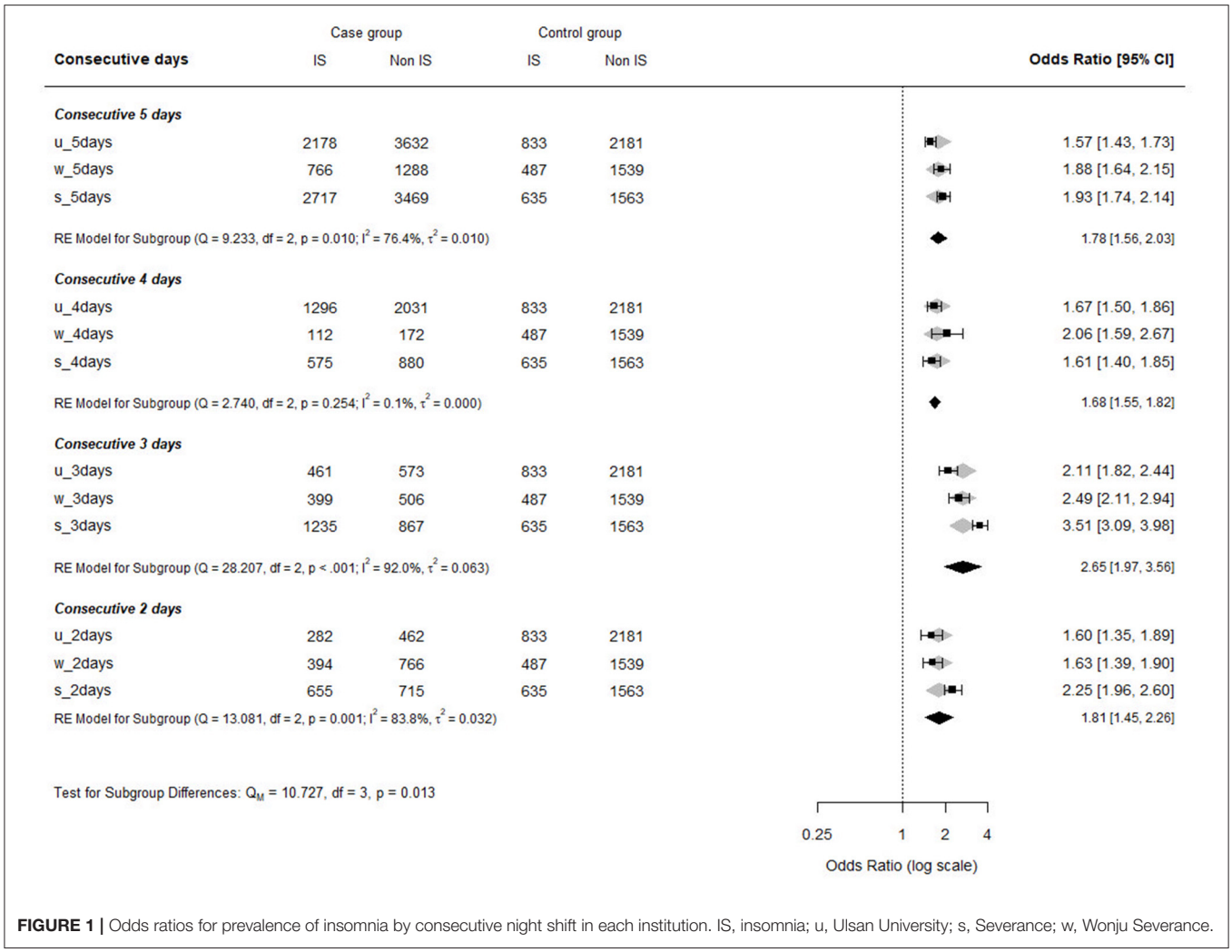

FIGURE 1 | Odds ratios for prevalence of insomnia by consecutive night shift in each institution. IS, insomnia; u, Ulsan University; s, Severance; w, Wonju Severance.

multivariable logistic regression model of the institutions is summarized in **Supplementary Table 1**.

DISCUSSION

According to the results of this study, consecutive night shift was significantly associated with the presence of insomnia. This relationship was significant even after adjusting for covariates including age, sex, working hours, and quick return. Although a few studies have elucidated the relationship between consecutive night shift and insomnia, many people still worked night shifts for five consecutive nights or more on average in this study.

In a study of Korean nurses, the incidence of insomnia increased as the number of consecutive night shifts increased (24); however, in this study, the OR for insomnia was highest at "3 nights" compared to "none." When consecutive night shift was implemented, although the quality of sleep and the duration of sleep were shortened, the difference was not significant on days other than the last day, even with an increase in the number of consecutive night shifts and the presence of accumulated lack of sleep on the last day (25). Although consecutive night shift is an important factor in insomnia, insomnia does not seem to increase as the number of consecutive night shifts increases. Since it is well-known that insomnia is associated with the development of various diseases including hypertension, diabetes, cardiovascular diseases and mortality, consecutive night shifts should be adjusted, considering the health effects on workers (6, 7, 16).

In our study, working three consecutive night shifts had the highest OR for insomnia compared to others. Bjorn et al. conducted a study of adaptation and readaptation of night work on oil Rig night workers. The study implies that more consecutive night shifts induce circadian rhythm adaptation, resulting in better and longer sleep throughout the day (26). On the other hand, according to a study of police officers, sleep length adaptation did not occur even after six consecutive night shifts, and last day fatigue is the most difficult to recover from regardless of the number of consecutive shifts (20). This implies that workers with 3 consecutive shifts

were more repetitively exposed that situation, which could result in higher OR of insomnia. Considering that short-term consecutive night shifts result in frequent fatigue and the effect of long-term continuous night shift on sleep is unclear, it is necessary to establish accurate standards for consecutive night shifts, considering sleep health. Another explanation is linked with a healthy worker effect. Healthy worker effect indicates that healthier workers could selectively survive in harsh working environment (27). In our study, it is plausible that healthy workers who have already adapted to the harsh environment, which indicates 4 or 5 consecutive night shifts, might remain in the workplace, thus OR of insomnia could be underestimated.

Danish police officers preferred four consecutive night shifts to seven or two (28). The preferred number of consecutive night shifts in Republic of Korea has not been investigated, but it is expected that this number should depend on an individual's ability to recover. Shift work schedules varies according to economic incentives and family/individual life (29), and it was discovered that shift work schedules were established with family life as the primary consideration (30). Therefore, when adjusting the schedule for health, it will be impossible to do only the schedule that the individual wants. Further studies should be implemented to elucidate the appropriate number of consecutive night shifts with respect to workers' health.

This study has several strengths. First, using the CDM method for multiple institutions, many multicenter participants were enrolled. The same night shift questionnaires were used at each hospital and the data were standardized into an identical structure. Second, analysis was performed with verified variables, and validated survey of insomnia was used as an outcome. Through ISI, a valid assessment of insomnia could be made. Working year, working hours, short return, and consecutive night shift were all validated with several studies, as most workers in Republic of Korea answered the same questions (31, 32). Third, because we enrolled participants from various occupational field, the health effects of consecutive night shift on shift workers makes this study generalizable to various workers in other fields.

There are also some limitations in this study. First, lifestyle factors including drinking history, smoking history were not adjusted, which could affect the quality of sleep. Second, history of sleep disorders or related diseases including thyroid disease, psychiatric disease were not clarified in this study due to lack of data. It might be better to exclude or adjust for diseases related to insomnia if possible. Third, the exact profile of night shift was not provided. The number of consecutive shifts or shift intervals were not provided and the average trend in the questionnaire were used. Finally, this is a cross-sectional study and a causal relationship could not be established. However, insomnia symptoms were reported in the health examination data based on the symptoms in the last 2 weeks, whereas the questionnaires on night shift intensity reported data obtained 6-month prior to the survey date. Since exposure occurred before health consequence, some degree of temporal relationship could be achieved from this study. Therefore, causal relationship between consecutive night shifts and insomnia should be surely further studied in the future.

In conclusion, our study elucidates a significant relationship between consecutive night shift and insomnia using the CDM method with multicenter examination data. This study could be a basis for establishing policies and guidelines that improve night shift workers' health. Further studies should be performed to identify the causal relationship of consecutive night work and insomnia based on this study.

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 Severance Hospital's Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JS has written the manuscript and responsible for the conception and data analyses in cooperation with B-YY, JL, C-yK, YO, SKK, and J-HY has collected data each institution. SL, AC, and SK have contributed with literature review. J-HY has contributed with insight, scientific discussion, and editing of the manuscript. All authors contributed to the article and approved the submitted version.

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The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.761279/full#supplementary-material

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The Influence of Human-Organizational Factors on Falling Accidents From Historical Text Data

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This paper firstly proposes a modified human factor classification analysis system (HFACS) framework based on literature analysis and the characteristics of falling accidents in construction. Second, a Bayesian network (BN) topology is constructed based on the dependence between human factors and organizational factors, and the probability distribution of the human-organizational factors in a BN risk assessment model is calculated based on falling accident reports and fuzzy set theory. Finally, the sensitivity of the causal factors is determined. The results show that 1) the most important reason for falling accidents is unsafe on-site supervision. 2) There are significant factors that influence falling accidents at different levels in the proposed model, including operation violations in the unsafe acts layer, factors related to an adverse technological environment for the unsafe acts layer, loopholes in site management in the unsafe on-site supervision layer, lack of safety culture in the adverse organizational influence layer, and lax government regulation in the adverse external environment layer. 3) According to the results of the BN risk assessment model, the most likely causes are loopholes in site management work, lack of safety culture, insufficient safety inspections and acceptance, vulnerable process management and operation violations.

Keywords: falling accidents, human-organizational factors, human factor analysis and classification system (HFACS), Bayesian network, fuzzy set theory

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INTRODUCTION

To improve the legal system for emergency management, standardize the investigation and handling of production safety accidents, and protect people's lives and property, China issued the "Regulations on Reporting and Investigation and Handling of Production Safety Accidents," which clearly proposes measures to improve accident investigation mechanisms and the preparation of accident investigation reports. These measures can be applied to assess responsibility and learn from accidents over time, which is conducive to promoting the implementation of safe production measures (1). In recent years, the accident rate in the construction industry has been the highest among all industrial production sectors, and the safety of construction workers has become a global problem (2, 3). According to statistics from the Ministry of Housing and Urban-Rural Development in China, 7,878 construction safety accidents occurred across the country between 2007 and 2019, resulting in 9,548 deaths (4); these accidents not only generated vast economic losses but also seriously affected societal stability. Among the reported construction accidents, falling from heights

was most common for 54.57% of all accidents. Thus, the occurrence of safety accidents can be potentially limited by studying falling accidents in construction and implementing corresponding measures. In terms of the causes of falling accidents, Martín et al. (5) suggested that many factors can cause falls in the construction process, but a maximum of 90% of accidents are caused by human-related factors. It is important to reduce the occurrence of falling accidents, identify the human factors that contribute to falling accidents and propose corresponding improvement measures according to the key influential factors.

An increasing number of high-risk industries have gradually realized that human factors and organizational factors are the main causes of accidents (6), and many scholars have conducted research on the definition of human-organizational factors, the mechanisms of accidents and influencing factors, the methods of analyzing human error and other related topics. For example, Leveson (7) proposed the system-theoretic accident modeling and processes (STAMP) method, which emphasizes not only the identification of accident causes from the perspective of complex social technology systems but also includes coupled and interactive factors, such as human factors and organizational factors. Daramola (8) utilized the human factor analysis and classification system (HFACS), which is a human factor research tool based on system theory, to analyse human error factors related to safety accidents. Hollnagel (9) proposed the cognitive reliability and error analysis method (CREAM), emphasizing the important influence of the situational environment on human behavior; the unique cognitive model provides root cause traceability and human error probability prediction. There are many methods and tools for human factor analysis in different fields, among which HFACS is currently one of the most widely applied tools. Comprehensive and effective accident analysis results have sparked significant research attention on HFACs in various industrial fields (10, 11). Although the HFACS framework provides a reliable tool for the identification and analysis of human-organizational factors related to safety accidents, there are limitations in specific research applications due to the lack of quantitative analysis and the unclear causal relationships among research factors. To enhance the ability of the HFACS to assess human factors in detail during the process of accident investigation, many studies have combined quantitative analysis with the HFACS framework. For example, the HFACS framework has been combined with the analytical network process (ANP) method (12), fuzzy Bayesian network (FBN) method (13), structural equation model (SEM) method (14) and other quantitative research theories. Notably, BNs are considered the most effective for analyzing the dependence among factors in an uncertain research environment and are widely employed in the field of security.

There have been many studies of the causative factors of construction accidents, but few studies have conducted human factor analysis based on actual historical accident reports. The non-reproducibility of construction accidents determines that the investigation of accident causes mainly depends on interviews and sensing information. Therefore, the investigation of accident causes has strong uncertainty and subjectivity. How to improve the accuracy of accident cause investigations through relevant information after the occurrence of accidents has become a very important research topic. Therefore, this paper, first, revises the original HFACS framework according to the characteristics of falling accidents and establishes a risk assessment model for falling accidents based on interfactor dependence. Second, the collected falling accident reports and fuzzy set theory were combined to infer a BN. Finally, the probability distribution and human-organizational sensitivity factors in falling accidents are calculated to identify the potential causes of falling accidents in construction and to provide theoretical guidance for impact mechanism analysis, safety risk prevention, and accident report rectification related to falling accidents.

MATERIALS AND METHODS

Research Methods

Human Factors Analysis and Classification System (HFACS)

The HFACS was proposed by Shappell and Wiegmann (15); its development was inspired by the "Swiss cheese" model of Reason (16). The HFACS is currently widely employed in human factor analyses of safety accidents based on system theory. The "Swiss cheese" model proposed by Reason divides the causes of accidents into four levels and visually compares errors to "holes" in the systems corresponding to different levels. When errors at all levels yield risks that break through the defence line, a safety accident occurs. Based on the "Swiss cheese" model, the HFACS method can be utilized to determine the causes of accidents at different levels, and the human-organizational factors of safety accidents can be comprehensively and systematically analyzed. Notably, the causes of accidents can be traced, and targeted safety precautions can be established at all levels.

The research related to the HFACS has mainly supplemented the framework content and expanded HFACS applications. Specifically, the original HFACS framework has four levels of human error: adverse organizational influences, unsafe on-site supervision, preconditions for unsafe acts, and unsafe acts from top to bottom. With the development of accident cause theory, research on human factors at the government and environmental levels has gradually received attention. Reinach and Viale (17) added "outside factors" to the HFACS framework for the railway field, which classified causes into "regulatory oversight" and "other" categories. When Chen et al. (18) investigated the human-organizational causes of maritime accidents, a fifth layer that included external factors and "legislation gap," "administrative oversight," and "design flaw" categories in combination with the International Maritime Organization (IMO) guidelines, was added. In view of the increasing emphasis on external factors such as the economy and environment, the identification of potential influential factors with the HFACS model must be supplemented and improved according to actual cases. In the expansion of the HFACS research scope, Shappell and Wiegmann (19) initially developed an HFACS model for safety analyses of military aviation accidents. Similar models have been applied in shipping (20), coal mine (21), chemical industry (22), railway (23), and construction (24)

research, as shown in **Table 1**. Although it has been widely applied in different fields, the HFACS model has rarely been applied in studies of the construction industry, potentially due to the insufficient attention given to the human- and organization-based causative factors associated with safety accidents in the construction industry.

Bayesian Networks

A BN is a tool that combines probability theory with graph theory to perform uncertainty reasoning and data analysis in complex fields; specifically, a visual network graph is used to visualize the probability relationships among variables. The composition of a BN is divided into qualitative parts and quantitative parts. At the qualitative level, a directed acyclic graph (DAG) is used to represent the dependent and independent relationships between two variable sets, and at the quantitative level, a conditional probability table (CPT) is utilized to describe the dependent relationships among variables and their parent nodes (25). A BN can be defined as $N =< G, P >$, where G is the structure diagram of the BN, $G =< V, E >$, V represents the set of nodes $V_1, V_2, \cdots, V_n$, and each node represents different random events. There are three types of nodes in BNs: target node (leaf node), evidence node (parent node) and intermediate node (child node). E represents the set of directed edges with dependencies between two nodes, usually from the parent node to the child node. P represents the parameter set of the BN, including the prior probability table and CPT of nodes, which are utilized to represent the dependency strength between two nodes. The prior probability can be learned from prior knowledge or data, and the conditional probability distribution of each variable (X_i) is based on its parent node. The parameter is expressed as $p(X_i \left| \pi(X_i) \right.)$, where $\pi(X_i)$ is the parent set of the variable X_i. Semantically, a BN represents the union of the CPTs of all nodes. By decomposing the joint probability distribution, the complexity of the probability calculation process is reduced. *Via* the independent and dependent relationships among variables, a BN provides predictions and solutions for uncertain problems. The essence of BN calculations is to optimize the relevant parameters by determining the prior and posterior probabilities for a specific network structure.

Fuzzy Bayesian Networks

Existing construction accident reports focus on identifying the responsible parties of an accident. The in-depth, human factor investigation of an accident has a strong uncertainty, and available historical data are limited, so it is difficult to express the probability of an event with a definite numerical value. However, BN analysis that is based on fuzzy theory is suitable for modeling research in the new field of uncertainty. Therefore, BNs and fuzzy set theory can be combined to construct FBNs, which can be employed for the quantitative treatment of boundary uncertainty and uncertainty problems at nodes (26, 27). The steps involved in applying a BN for safety accident risk assessment can be divided into network topology establishment, probability determination of node parameters, network learning and reasoning, risk assessment and sensitivity analysis.

1) The establishment of a network topology refers to the formation of a network association structure based on real accident scenes and the relationships among security risks and accidents. The following factors need to be considered in this process: ① factor identification and status determination, ② logic structure combination, and ③ BN transformation.

2) Probability determination for node parameters refers to measuring the prior probability and conditional probability of each node in the BN based on statistics or expert consultation. Many data samples need to be collected when node parameters are calculated based on statistical methods these samples are obtained according to probability theory and a Bayesian formula. If the data sample size is insufficient, the expert consultation method combined with fuzzy set theory is generally adopted to obtain the prior probability distribution table for evidence nodes (without parent nodes) and conditional probability distribution table for intermediate nodes.

① Bayesian parameter estimation with complete data

After construction of the BN topology, the maximum likelihood estimation (MLE), maximum a posteriori (MAP) estimation, Bayesian estimation and empirical Bayesian (EB) can be applied for parameter learning to determine the conditional probability distribution among the relevant variables (28). MLE is generally applicable to the parameter estimation of large sample sizes, and the estimated value shows agreement with the actual value. In this paper, a large number of construction falling accident report texts can be collected, so MLE can be utilized for parameter learning. Conceptually, MLE uses parameter θ to calculate the value with the highest fitting degree for data set D (29). The calculation process is expressed as follows:

Step 1: Construct the likelihood function for θ:$L(\theta) = \prod_{i=1}^{n} P(X_i|\theta)$

Step 2: Take the logarithm of $L(\theta)$, and obtain the derivative: $\frac{d \ln L}{d\theta} = 0$

Step 3: Solve the likelihood function and obtain the MLE value θ^* for parameter θ .

where X_i is the state value of the dataset D, θ is the parameter to be estimated, and $P(X_i \left| \theta \right.)$ is the conditional probability of variable X_i based on parameter θ .

②Bayesian parameter estimation in the case of missing data

To overcome issues related to uncertainty and a lack of sufficient data support, the concept of "linguistic variables" can be considered in semantic and probability conversion (30). Based on a fuzzy semantic probability table, experts give fuzzy scores for different risk states; then, by processing the obtained data, the BN parameter values for the target nodes are obtained. In this study, seven language terms are used to estimate the probability of occurrence of basic events, and each fuzzy number is processed according to a triangular fuzzy function. The results are shown in **Table 2**.

The probabilities of the parameters can be obtained by averaging, defuzzifying and normalizing the fuzzy probabilities. Firstly, the fuzzy probabilities obtained from different experts are arithmetically averaged, and the formula is expressed

TABLE 1 | List of HFACSs in continuous improvement in different industries.

Literature sources	Industry	HFACS version	Key modifications	Main findings
Daramola (8)	Aviation industry	Modified-HFACS	The improved framework was more suitable for the analysis of human factors related to civil aviation accidents, and the technical environment was added to the second layer.	Findings from the research highlight the need to address personnel skills, physical environment issues (mostly weather-related) and supervisory competence.
Wrobel et al. (43)	Shipping industry	HFACS-MA	The addition of a fifth level called external influence includes administration oversights, design flaws and legislation gaps. In the second level, the impact of software and hardware on the safety performance has been added.	Implementation of unmanned ships might reduce the number of navigation-related accidents like collisions or groundings.
Kaptan et al. (44)	Shipping industry	HFACS-PV	The addition of a fifth level called operational conditions includes internal conditions and external conditions.	Unqualified crew assignment and lack of training and familiarization were found to be the most critical factors.
Verma and Chaudhari (45)	Coal mine industry	Modified-HFACS	The addition of a fifth level called outside factors with the factors of regulatory factors and other.	Skill-based errors are most critical and require immediate attention for mitigation.
Liu et al. (14)	Coal mine industry	HFACS-CM	The addition of a fifth level called external environment includes management factors, political factors, economic factors and historical factors.	From the most impactful factor to the least impactful factor are external environment, unsafe leadership, preconditions for unsafe acts, and organizational influences.
Xia et al. (33)	Chemical industry	Modified-HFACS	The addition of a fifth level called emergency failure includes emergency resource errors; not timely emergency; inappropriate emergency.	The individual level human factors should be managed from the perspectives of safety skills, work attitude and personal health status.
Wang et al. (46)	Chemical industry	HFACS-CSME	The definition of each cause factor in the original model was retained and supplemented with corresponding specific manifestations.	Based on the further revision of manifestations and causes classification, a new model consisting of 15 cause factors and 56 manifestation forms was obtained.
Zhan et al. (47)	Railway industry	HFACS-RAs	The accident casual factors in the second level are further changed to Substandard Conditions of Operators, Substandard Conditions of Team, Adverse Conditions of Mission and Adverse Physical Environment.	The critical problem existing in organization level indirectly such as insufficient training quality and management.
Hale et al. (48)	Construction industry	Modified-HFACS	Combine the content of the third and fourth levels and increase a fifth level called environmental influences, including political, regulatory, market and social influences.	The underlying factors associated with inadequacies in planning and risk assessment, competence assurance, hardware design, purchase and installation, and contracting strategy.
Ye et al. (49)	Construction industry	I-HFACS	The addition of a fifth level with the two categories called regulatory factors and economic/political/social/legal environment. In level 4, the factors of organizational climate were replaced with safety culture.	Seven key factors were regulatory factors, organizational process, supervisory violations, adverse spiritual state, skill underutilization, skill-based errors, and violations.

as follows:

$$P_{ij} = \frac{P_{ij}^{1} + P_{ij}^{2} + \cdots + P_{ij}^{m}}{m} = \left(a_{ij}, n_{ij}, b_{ij}\right) \quad (1)$$

where P_{ij} is the fuzzy probability that the state of the i-th node is j; P_{ij}^{m} is the fuzzy probability given by the m-th expert for the i-th node status of j; and (a_{ij}, n_{ij}, b_{ij}) are the parameters of the triangular fuzzy function.

Then, the probability of occurrence for different events is converted into a precise value through the process of defuzzifying. In this paper, the "mean area method" is utilized in the defuzzifying process, and the formula is expressed as follows:

$$P_{ij}^{'} = \frac{a_{ij} + 2n_{ij} + b_{ij}}{4} \quad (2)$$

Finally, the accurate probability values of the nodes in different risk states are normalized, and the sum of the probabilities for the same node in different states is 1. The corresponding process can be expressed as follows:

$$\overline{P_{ij}} = P_{ij}^{'} / \sum_{j=0}^{k} P_{ij}^{'} \quad (3)$$

3) Network learning and reasoning

Network learning and reasoning involve calculating the probability of a target node based on the prior probability table and CPT associated with a known node. According to the different directions of reasoning and the roles of node variables, the Bayesian reasoning process can be divided into two

TABLE 2 | Semantic terms and corresponding triangular fuzzy numbers.

Number	Semantic term	Triangular fuzzy numbers
1	Certain	(0.85,1,1)
2	Probable	(0.75,0.85,1)
3	Expected	(0.5,0.75,0.85)
4	Fifty-fifty	(0.25,0.5,0.75)
5	Uncertain	(0.15,0.25,0.5)
6	Improbable	(0,0.15,0.25)
7	Impossible	(0,0,0.15)

modes. The first mode is 1) positive causal reasoning, that is, the reasoning process from cause to effect. Given the probability values of all root nodes at different risk levels, the BN topology and parameter values are combined to obtain the probability results. The second mode is 2) reverse diagnostic reasoning, that is, the reasoning process from result to cause. Given the probability values of the target node at different risk levels, the probability of each cause can be determined for a given event.

4) Risk assessment and sensitivity analysis

Risk assessment refers to the identification of accident risk levels and key causal factors under different conditions based on the reasoning process. In a positive causal reasoning network, the grade corresponding to the maximum probability value in the target probability distribution is selected as the risk probability grade, and the key causative factors of accidents can be determined by combining this approach with a reverse diagnostic reasoning network. Sensitivity analysis involves identifying the factors that have the greatest impact on the occurrence of accidents and quantifying them considering the degree of influence and the parameters of the target node (31). The sensitivity factor is denoted as α and expressed as follows for the i-th basic event:

$$\alpha_i = \frac{(P^T - P^T{}_i)/P^T}{\max\left\{(P^T - P^T{}_i)/P^T\right\}} \tag{4}$$

where P^T is the probability of a risk event; $P^T{}_i$ is the probability of a risk event when the i-th basic event does not occur; and $i = 1, 2, \cdots, m$.

Data Sources

This paper mainly collects safety accident reports through network screening to obtain original data related to the human-organizational causative factors of falling accidents in construction. Safety accident reports were mainly collected from the Ministry of Housing and Urban-Rural Development, State Administration of Production Safety Supervision and Management, websites of various administrative departments, safety management network, municipal governments and various safety supervision bureaus. A total of 432 reports of construction falling accidents in China from 29 to 29 were collected (32), focusing on the major production safety accident reports and general production safety accident reports. The cases judged as non-liability accident or near misses were excluded from the analysis. In addition, the text of the accident report mainly included the following four aspects: general situation of the accident unit, process of the accident, casualties and direct economic losses caused by the accident, causes and nature of the accident, and identification of the accident responsibility.

Research Framework

To clearly describe the overall research process of the human-organizational factor analysis of falling accidents by integrating the HFACS and BN methods, the research framework is shown in **Figure 1**.

REVISED DESIGN OF THE HFACS FRAMEWORK FOR FALLING ACCIDENTS IN CONSTRUCTION

Constructing the Corrected HFACS Framework for Falling Accidents

The original HFACS framework was proposed for human factor analyses of aviation accidents without considering the influence of external factors. As the application of HFACS has gradually expanded, it has become necessary to modify the general model accordingly. Garrett and Teizer applied the HFACS in the construction industry for the first time in conjunction with the human error awareness training (HEAT) model to investigate the causes of human errors in construction. Xia et al. (33) adjusted the HFACS framework according to the specific characteristics of the construction industry to effectively analyse construction safety performance. In addition to adding to and deleting some of the original components, external environmental impact layers, including stakeholders, social and industrial environments, legislation and enforcement, were added. In this paper, the HFACS framework is applied to falling accidents in building construction. Based on the collected accident cases and an analysis of the existing literature, the original HFACS framework is modified, and an HFACS framework suitable for falling accidents in building construction is proposed, as shown in **Figure 2**.

L1: Unsafe Acts

Reason proposed that in analyses of safety accidents, human factors can be divided into errors and violations. Errors indicate that a person's ability or psychological level did not achieve the expected results. Zhang and Fang (34) proposed that errors can be divided into cognitive, decision-making and skill errors. According to the different forms of deviation, decision-making errors will occur when the available information and knowledge is insufficient; cognitive errors will occur when the concept of personal safety is not prioritized or does not conform to realistic requirements; and skill errors will occur when individuals who engage in the work do not understand or remember the skills required. A violation is a deliberate deviation from the defined safety rules and operating procedures, and violations can be habitual or accidental (35). For example, individuals working at high altitudes need to wear protective equipment correctly, but

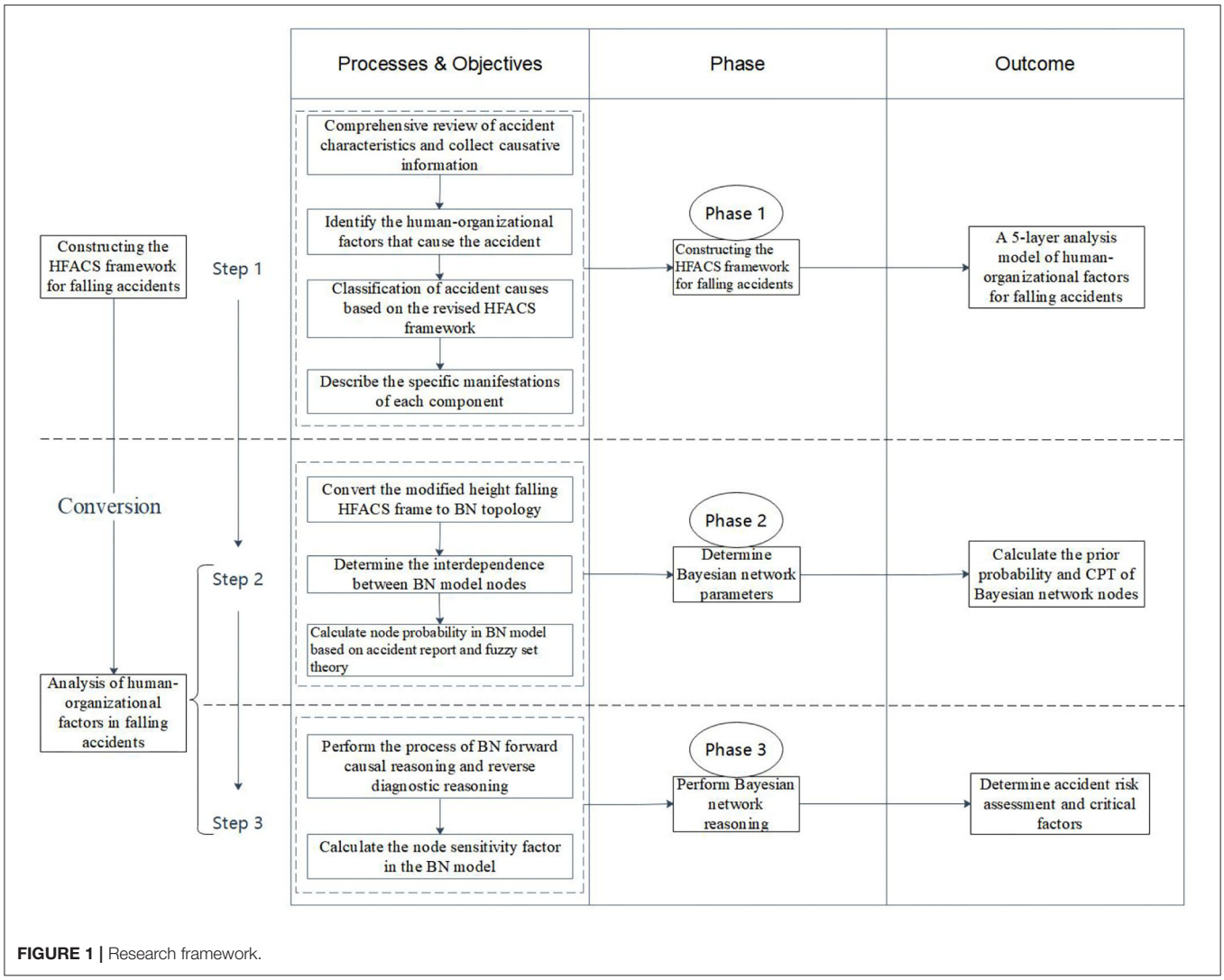

FIGURE 1 | Research framework.

some personnel deliberately do not wear or improperly wear protective equipment during climbing, thus creating a potential safety hazard.

In summary, the unsafe acts of construction workers are influenced by three factors: perception and decision-making errors (L1R1), skill errors (L1R2), and operational violations (L1R3).

L2: Preconditions for Unsafe Acts

Liang (36) noted that unsafe acts are usually the result of a combination of individual status, operating machinery and the operating environment. Individual status issues are mainly related to a poor physical state, poor mental state, or physical intelligence deficiency. Based on the characteristics of construction industry personnel, it is proposed that individual state problems are mainly manifested through poor physical and mental states and insufficient skill levels. There are many situations in which mechanical equipment is employed in construction at high altitudes, and there are potential unsafe factors related to the specification, configuration and proper operation of mechanical equipment. Therefore, the factors that influence machinery are mainly considered from the aspects of mechanical model configuration and operation standardization. According to the traditional HFACS framework, the factors that influence the working environment are related to the technical environment and the physical environment. In the technical environment, protection during work and personnel safety are emphasized. In the physical environment, surface cleanliness, good lighting and suitable weather will affect employee risk.

In summary, the preconditions for unsafe acts include the employee mental state (L2R1), physiological state (L2R2), and skill level (L2R3); mechanical equipment (L2R4); equipment operation and maintenance (L2R5); physical environment (L2R6); and technical environment (L2R7).

L3: Unsafe On-Site Supervision

Aksorn and Hadikusumo (37) verified the 16 key success factors identified in the safety literature and existing studies. The

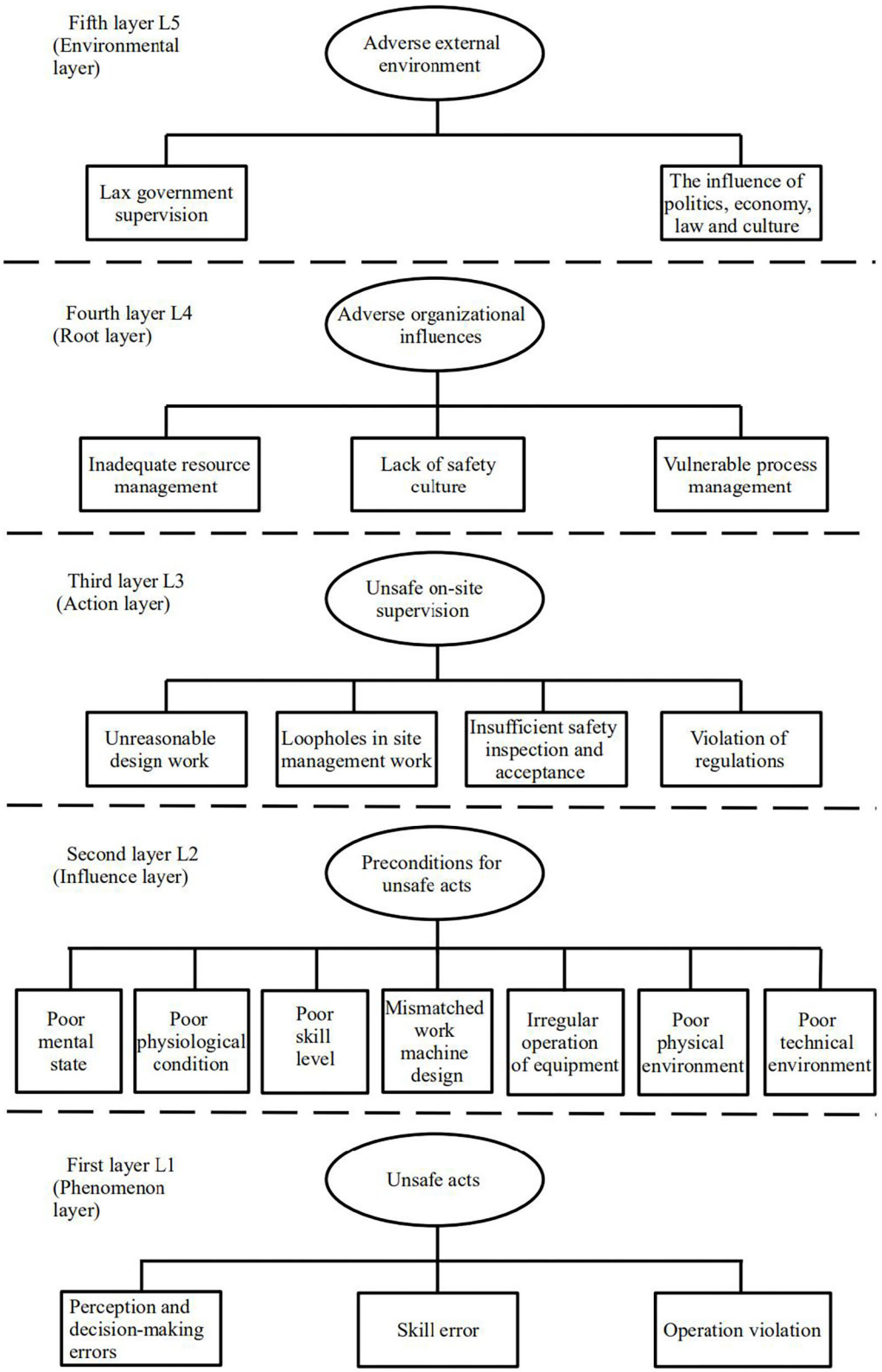

FIGURE 2 | HFACS framework for falling accidents in construction.

survey results showed that the factor that had the greatest impact on the safe production of construction projects was on-site safety management behavior. A construction site requires not only strict management but also timely inspection and acceptance, real-time assessments of the on-site conditions and employee behavior, and timely correction of unsafe phenomena (38). Supervisors of construction projects face severe penalties if regulations are violated, such as authorizing unqualified personnel to perform special operations and deliberately directing operators to perform dangerous work (39).

In summary, unsafe on-site supervision includes design work (L3R1), on-site management work (L3R2), safety inspection and acceptance (L3R3), and violations of regulations (L3R4).

L4: Adverse Organizational Influences

In the construction industry, it is necessary to rationally allocate relevant personnel, funds and supplies, and resource allocation has an important influence on organizational safety management (40). Yang and Fu (41) proposed that the internal safety culture of an enterprise will influence the behavior and attitude of employees through different channels and ultimately reduce the occurrence of safety accidents. Based on analyses of the factors that influence organizational success, strengthening process management at the enterprise level can ensure the smooth development of safe production activities. Additionally, decision-making and daily supervision at the organizational level can guide the scientific approach and standardized behavior at a project site.

In summary, the main adverse organizational influences include resource management (L4R1), safety culture (L4R2), and process management (L4R3).

L5: Adverse External Environment

Compared with the levels in the original HFACS framework, this level is new; it focuses on the influential factors outside an enterprise organization. Yang and Li (42) suggested that improving government supervision capabilities can effectively reduce the occurrence of construction safety accidents. Through expert consultation, it was found that external factors such as policy support, legal improvement, economic stability, and cultural penetration have a positive effect on construction safety.

In summary, the adverse external environment includes government supervision (L5R1) and the effects of politics, the economy, law and culture (L5R2).

Manifestations of the Components of the Revised HFACS Framework

Based on a literature analysis and the opinions of 5 experts, the preliminary manifestations of the various components of the HFACS framework for construction falling accidents were sorted and revised. A total of 432 accident cases were utilized to assess the specific influence of each human-organizational factor. The open-loop analysis method was utilized to test the consistency of the description accuracy of the extracted factors, and expressions were obtained, as shown in **Table 3**.

ANALYSIS OF THE INFLUENCE OF HUMAN-ORGANIZATIONAL FACTORS ON FALLING ACCIDENTS IN CONSTRUCTION

Bayesian Network Model Construction and Parameter Calculations

Based on the revised HFACS model, the initial topological structure of the BN is constructed according to the dependence and independent relationships among factors. The model is adjusted in combination with the opinions of field experts to establish the human-organizational factor-BN risk assessment model for falling accidents in construction, as shown in **Figure 3**. According to the sample data obtained from the accident reports and fuzzy set theory, combined with Netica software and a Bayesian formula, the prior probabilities of root nodes and conditional probabilities of intermediate nodes in the network graph are calculated. Notably, there are two main methods for parameter estimation. For the nodes that have been fully reflected in the accident report, MLE is performed to obtain the BN parameter values. For the nodes that are not fully reflected in the accident report, fuzzy set theory is used to estimate the corresponding values. After sorting and coding the human-organizational factors involved in the falling accident reports, the parameter values for nodes L1R1, L1R2, L1R3, L2R3, L2R4, L2R5, L2R6, L2R7, L3R1, L3R2, L3R3, L4R1, L4R2, and L4R3 were calculated from accident reports, and the parameter values for nodes L2R1, L2R2, L5R1, and L5R2 were estimated with fuzzy set theory. The probability table of all nodes in the BN structure was obtained. Due to the limitation of content length, certain calculation details of the node parameters in BN are given in **Appendix A**.

Bayesian Network Reasoning

Inference Analysis Process of the Bayesian Network

Under the condition that the BN topology and parameter values are determined, it is necessary to perform subsequent inference analysis on human-organizational factors of falling accidents of construction. The relevant data based on historical accident reports and expert consultations are collated and input into Netica for inference calculations, and the risk probability values at the nodes when a falling accident occurs are calculated. The calculation results are shown in **Figure 3**.

As shown in **Figure 3**, the following conclusions can be drawn when a falling accident occurs during construction.

1) As a five-layer defensive barrier for accident risks, unsafe on-site safety supervision (L3) has the greatest influence on the occurrence of falling accidents, followed by adverse organizational influence (L4), unsafe acts (L1), adverse external environment (L5), and preconditions for unsafe acts (L2). This result suggests that the on-site supervision of projects and the influence of the organization have a substantial roles in the occurrence of accidents. In addition, unsafe personal behavior has an important influence on risk prevention.

2) In the unsafe acts layer (L1), the number of falling accidents related to operation violations (L1R3) is the highest, accounting

TABLE 3 | Components and manifestations of the HFACS framework for falling accidents.

Level serial number	Level contents	Human factor	Manifestation
First layer L1 (Phenomenon layer)	Unsafe acts	Perception and decision-making errors (L1R1)	A: The risk perception is inconsistent with the actual situation; B: Encountering problems beyond the scope of ability; C: The measures implemented to address the problem are incorrect; D: Employee safety awareness is limited
		Skill error (L1R2)	A: Insufficient safety skills and literacy; B: The method used in the implementation process is incorrect
		Operation violation (L1R3)	A: Habitual violations; B: Accidental violations
Second layer L2 (Influence layer)	Preconditions for unsafe acts	Poor mental state (L2R1)	A: There are random, habitual, and exploitative psychological behaviors, as well as the effects of being tired, in high office work; B: Inner pressure in daily work; C: Negative emotions in the process of getting along with co-workers
		Poor physiological condition (L2R2)	A: Overtired; B: Work with illness; C: Work after alcohol abuse; D: Physical impairment of hearing or vision
		Poor skill level (L2R3)	A: Insufficient construction experience; B: Lack of safety knowledge and safety training
		Mismatched work machine design (L2R4)	A: Safety warning label design for mechanical equipment is not obvious; B: Specifications and models of the equipment are inconsistent with the plan
		Irregular operation of equipment (L2R5)	A: The equipment is not used in strict accordance with the operation instructions; B: When the equipment fails, it is still used; C: The equipment is not regularly maintained
		Poor physical environment (L2R6)	A: Dirty, chaotic, and poor working environment; B: Inadequate lighting in the workplace; C: Limited working surface space
		Poor technical environment (L2R7)	A: Safety protection equipment is not utilized; B: No safety warning signs
Third layer L3 (Action layer)	Unsafe on-site supervision	Unreasonable design work (L3R1)	A: There is a lack of safety consideration in the design of the operation process; B: Too many tasks must be performed; C: Mismatched team members
		Loopholes in site management work (L3R2)	A: Safety rules and regulations are not implemented; B: Failure to quickly correct workers' incorrect behaviors; C: Failure to perform production safety management; D: Lack of timely and adequate technical disclosure
		Insufficient safety inspection and acceptance (L3R3)	A: Daily safety inspections are not performed; B: Insufficient investigations of hidden dangers; C: Lack of phased acceptance of a project
		Violation of regulations (L3R4)	A: Safety management personnel are not qualified to practice; B: Supervisors violate safety rules and regulations; C: False reporting and concealment of safety incidents
Fourth layer L4 (Root layer)	Adverse organizational influences	Inadequate resource management (L4R1)	A: Insufficient number of safety management personnel; B: Insufficient investment in safety production; C: Poor quality of purchased machinery and equipment
		Lack of safety culture (L4R2)	A: Management personnel do not pay attention to safety procedures; B: Lack of safety production regulations; C: Inadequate safety training
		Vulnerable process management (L4R3)	A: Lack of emergency plans; B: Unsound production safety responsibility system; C: Untimely work feedback; D: Inadequate safety precautions
Fifth layer L5 (Environmental layer)	Adverse external environment	Lax government supervision (L5R1)	A: Few on-site inspections by competent authorities; B: Insufficient punishment for illegal acts; C: Overlap of regulatory responsibilities and mutual prevarication in certain cases
		Influence of politics, economy, law and culture (L5R2)	A: Nonoptimal building safety laws and regulations; B: Unsound building safety policies and systems; C: Inadequate safety policy publicity; D: Overly formalized public supervision, public opinion supervision and social group supervision

for 67.4% of all accidents, followed by perception and decision-making errors (L1R1), accounting for 47.5%. The number of accidents related to skill level errors (L1R2) is the lowest, accounting for 19.4% of all accidents. The results are consistent with those of Fogarty and Shaw in their study of unsafe behaviors: although the frequency of operational violations in daily work is much lower than the frequency of errors, the accident risk caused by violations is higher, and the potential harm is more serious.

3) In the preconditions of the unsafe acts layer (L2), the number of falling accidents related to the technical environment (L2R7) is the highest, accounting for 44.4% of all accidents, followed by poor physiological conditions (L2R2), which

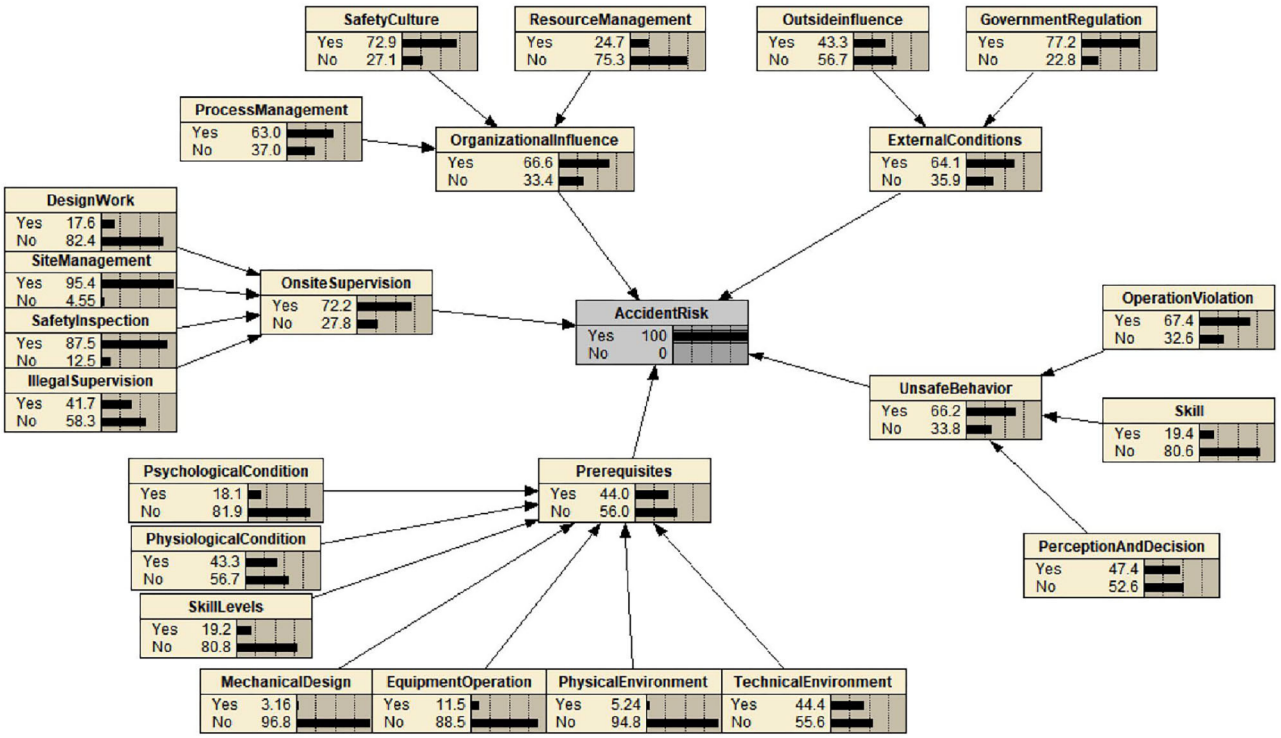

FIGURE 3 | Reverse diagnosis and reasoning results of the BN for falling accidents.

accounted for 43.3% of accidents. Poor skill level (L2R3), poor mental state (L2R1), irregular operation of equipment (L2R5), poor physical environment (L2R6), and mismatched work machine design (L2R4) had comparatively small impacts on the occurrence of accidents, accounting for 19.2, 18.1, 11.5, 5.24, and 3.16% of accidents, respectively. The results indicate that the occurrence of falling accidents in construction is closely related to construction safety protection measures and employee physiological factors; therefore, high-altitude operation requires rigorous and meticulous management of employees with appropriate climbing qualifications and the use of mechanical equipment.

4) In the unsafe on-site supervision layer (L3), the number of falling accidents related to loopholes in site management work (L3R2) is the highest, accounting for 95.4% of all accidents, followed by insufficient safety inspection and acceptance (L3R3), accounting for 87.5%. Violations of regulations (L3R4) and unreasonable design work (L3R1) factors were noted in only 41.7% and 17.6% of accidents, respectively. The results indicate that management and supervision factors at the field level have a decisive role in the occurrence of falling accidents, and the prevention of falling accidents should focus on these two factors.

5) In the adverse organizational influences layer (L4), the number of falling accidents related to the lack of safety culture (L4R2) is the highest, accounting for 72.9% of all accidents, followed by the vulnerable process management (L4R3) factor, accounting for 63% of all accidents. Inadequate resource management (L4R1) accounts for the smallest proportion of accidents at 24.7%. The results suggest that falling accidents are greatly affected by the safety culture of the enterprise, and cultural penetration and process management at the organizational level need to be considered by the internal management personnel of enterprises.

6) In the adverse external environment layer (L5), the number of falling accidents related to lax government supervision (L5R1) is the highest, accounting for 77.2% of all accidents, while the politics, the economy, law and culture (L5R2) factor accounts for a relatively small proportion of accidents at 43.3%. Government supervision problems occur not only in the preliminary bidding stage of a project but also in the acceptance stage, and the relevant law enforcement agencies must strictly comply with the management requirements throughout the project life cycle.

Sensitivity Analysis

With Netica software and relevant calculation formulas, the changes in target node probabilities caused by changes in parent node factors were quantified, and the key factors in the Bayesian risk assessment model were identified based on the measured sensitivity of human-organizational factors, as shown in **Figure 4**. Based on the calculation results in the figure, the sensitivity factors corresponding to loopholes in site management work, lack of safety culture, insufficient safety inspection and acceptance, vulnerable process management, and operation violations are relatively large, that is, these factors are

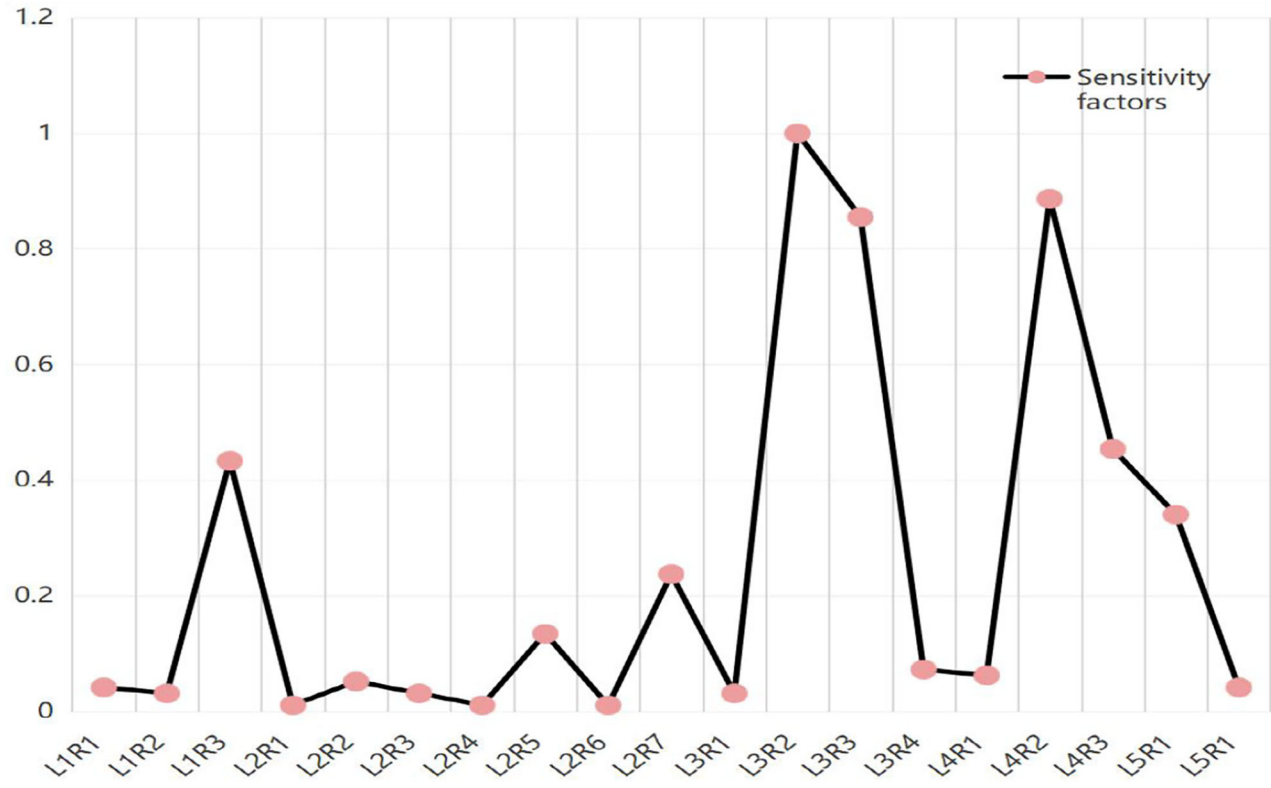

FIGURE 4 | Sensitivity of human-organizational factors related to falling accidents.

the key causal factors of falling accidents in construction. It is necessary to focus on the management of these factors during risk identification and control at the human-organizational level to reduce the occurrence of falling accidents in construction.

CONCLUSION

As the accident type accounting for the largest proportion of construction safety accidents, reducing the number of falling accidents by assessing the key causes and proposing control and defensive measures can effectively decrease financial and personnel losses. Due to the lack of adequate description of certain human factors, it is difficult to obtain an exact estimation of their occurrence possibility. Therefore, a BN risk analysis based on fuzzy theory under uncertainty is proposed to calculate the system reliability and identify the most sensitive factors of an accident. The final conclusions are presented as follows:

1) Based on the HFACS framework, characteristics of falling accidents in construction and existing literature, a revised HFACS framework for falling accidents was established. This framework encompasses the human-organizational factors that can cause falling accidents. A systematic structural framework including 5 layers (L1 phenomenon layer, L2 influence layer, L3 action layer, L4 root layer, and L5 environment layer) and 19 detailed causal factors was obtained to assess the causes of falling accidents.

2) With the BN inference analysis method, the revised HFACS framework was converted to a BN topology, and the probability value of each node in the network diagram was calculated based on the collected accident reports and fuzzy set theory. Through BN reasoning, the following results were obtained. In the five-layer falling accident prevention system, on-site safety supervision, organizational factors and unsafe acts of employees have vital roles in the occurrence of accidents. At the level of on-site safety supervision, lack of on-site management and insufficient safety inspection have the largest impacts on the occurrence of accidents. A lack of safety culture and vulnerable process management at the organizational factor level highly influence the organization and management of enterprises. At the level of unsafe acts, operation violations and perception and decision-making errors directly cause the occurrence of major falling accidents.

3) By combining BN reasoning with relevant formulas, a sensitivity factor analysis of the nodes in the BN risk assessment model was performed. The results indicate that when falling accidents occur, the most likely human-organizational factors are loopholes in site management work, lack of safety culture, insufficient safety inspection and acceptance, vulnerable process management, and operational violations. The calculated values of the corresponding sensitivity factors were relatively large, indicating that these factors are the key human-organizational factors of falling accidents.

4) Through sorting and coding of the collected accident reports, it was determined that management, inspection and education should be prioritized. Moreover, employee skill level, physiological state, psychological state, external politics, economy, law, and other factors had relatively minimal influence on falling accidents. Thus, in-depth investigations of specific scenarios are necessary. In addition, during the analysis of causal factors, illegal supervision behavior and a poor technical environment account for small proportions of the total number of falling accidents, but they have a considerable impact on project safety risks. Additionally, a single factor may create considerable safety hazards for a project, and influential factors should be fully considered by construction safety and risk management personnel.

In this paper, the combination of HFACS and BN is applied to the analysis of the impact of human-organizational factors of falling accidents in construction, which not only expands the application of BN in the field of safety but also helps to realize the quantitative analysis of accident human factors based on accident investigation data. However, this paper has limitations. BN reasoning based on historical accident texts is helpful for accident investigators to more accurately and comprehensively investigate the human-organizational factors that cause accidents. However, the existing accident investigation reports focus more on the description of accident responsibility identification, and the in-depth human factor investigation of the accident is insufficient. Therefore, it is necessary to rely on field experts in the process of risk identification and BN model construction. Our subsequent research objectives will focus on the collection of multisource data for security performance prediction and the use of more intelligent knowledge analysis technology to realize automatic knowledge management.

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.

AUTHOR CONTRIBUTIONS

XL and QL contributed to conception and design of the study. ZQ organized the database. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Job Demands and Resources, Positive and Negative Affect, and Psychological Distress of Social Workers in China

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Globally, human service professionals, like social workers, experience significant job demands (JD) which can lead to outcomes like psychological distress, burnout, and high turnover rates. This is especially true in China, where the social work profession has grown substantially in recent decades. Because social workers play a crucial role in supporting vulnerable communities, there is a need to understand how their work conditions affect outcomes like psychological distress. This study applies the job demands and resources (JD-R) model to study this relation, along with the mediational effects of positive affect (PA) and negative affect (NA), in social workers from Chengdu, China (n = 897). The results of structural equation modeling indicate that JD-R differentially affect psychological distress. PA and NA partially mediate these relations. Job resources (JR) reduced psychological distress by reducing NA and increasing PA. JD did not have any effect on PA but significantly increased NA, which was associated with higher psychological distress. The magnitudes of each estimate suggest that JR has a greater effect on PA and NA, relative to the effects of JD on PA and NA. Interventions that seek to promote PA and reduce NA may be able to work with existing JR to buffer against the effects of JD in social workers.

Keywords: job demands, resources, positive affect, negative affect, psychological distress, social workers, China

INTRODUCTION

Industrialized economies have undergone a significant transformation in workforce structure in past decades, leading to greater job demands and work-related stress (1–4). Work-related stress is associated with a range of health-compromising behaviors which individuals may use to cope with or to manage stress (5–7). It is no surprise, then, that studies have also shown that work-related stress is a significant risk factor of poorer physical (6, 8) and psychological health and well-being (3, 4, 6). While work-related stress is not specific to any singular occupation, research has found that some occupational groups experience greater-than-average work-related stress (7, 9, 10). Social workers, for example, experience a high degree of work-related stress and, therefore, have a greater risk of burnout (7, 10, 11). This stress is often associated with the emotional labor demands required of many who work human service jobs (10, 11). Indeed, compassion fatigue has been found to be a positive predictor of psychological distress among social workers from several cross-cultural studies (12–14). Given this, mediational studies of how job demands like emotional workload or

labor—and other work conditions—affect psychological distress in social workers are needed to better understand possible points of intervention and to promote the psychological well-being of social workers, an occupational group which provides critical services to vulnerable populations. The goal of this study is to apply the job demands and resources (JD-R) model to examine how job demands (JD) and job resources (JR) differentially affect psychological distress and whether these relations are parallelly mediated by positive affect (PA) and negative affect (NA) in a sample of Chinese social workers.

LITERATURE REVIEW

In China, the social work profession has developed rapidly over the last two decades. In <10 years, the workforce increased from 0.2 million in 2010 to 1.2 million in 2018 (15, 16). This unprecedented rate of professionalization was brought upon by increasing social problems that followed the country's economic reform in 1978. While social workers in China provide essential services to vulnerable community members in schools, hospitals, community centers, and other social agencies, the future of the profession is threatened by high burnout and psychological distress rates, comparable to those found in international studies (17, 18).

The Job Demands and Resources (JD-R) Model

Work-related conditions, such as job demands (JD) and job resources (JR), and their effects on employee outcomes have been studied significantly. Studies often apply the job demands and resources (JD-R) model, which posits a conceptual framework to explain how work conditions affect the work and health outcomes of employees (7, 19, 20). This model divides working conditions into the categories of JD and JR, each with different effects on worker outcomes. JD are those aspects of a job that require sustained physical and/or mental effort from an individual. These aspects result in physiological and psychological costs, such as exhaustion. JD act as stressors that activate a performance-protection strategy which results in "strategy adjustments" such as reduced attention and "fatigue after-effects" (e.g., risky decision making; (21), p. 501). JR, on the other hand, are aspects of the job that can facilitate the achievement of work goals and reduce the physiological and psychological costs of JD (21). Demerouti et al. (21) posited that JD-R affect work and health through two processes. In the first, the demanding aspects of work lead to exhaustion and burnout. In the second, a lack of resources further exacerbates the challenges experienced in meeting JD, leading to withdrawal, disengagement, and burnout.

The JD-R model has been supported by a plethora of studies that examine samples of different occupational groups (19, 20, 22) and various health- and work-related outcome variables, including psychological distress and mental health (7, 23–27). Cross-cultural studies have also applied the JD-R model and found effects of JD and JR on workers, whereby, through an energy depletion process, JD causes fatigue, and, through a motivation process, JR can buffer JD's effects. Importantly, however, studies have also found that a lack of JR may compound the effects of JD (7, 25, 28–31).

High JD can have severe consequences for individuals, considering that JD, stress, and burnout are positively correlated with one another (7, 10, 32). It has been suggested that the emotional labor required of certain high stress jobs, including those in the social work profession, can cause greater occupational stress and, subsequently, several other negative outcomes (10). A study on 55 hospice social workers in the U.S. found that over half (56.4%) of the sample experienced moderate compassion fatigue, while just over one-fifth (21.8%) experienced high compassion fatigue (32). Among social workers across several cultures, compassion fatigue has been found to be a positive predictor of psychological distress (12–14).

Psychological Distress

Psychological distress is an emotional state that is typically characterized by symptoms of depression and anxiety and even somatic complaints (33). An individual may experience psychological distress when they encounter a stressor that is difficult to cope with or to overcome (33, 34). While stress itself is not inherently negative and can be associated with positive emotions and coping, when an individual fails to cope with stress and experiences psychological distress, they are at risk for a plethora of negative behavioral, health, and work outcomes (35–38). Further, psychological distress is a strong predictor of serious mental illnesses, including mood and anxiety disorders (35, 37), and suicidal behavior (39, 40). It follows, then, that understanding the antecedents of psychological distress among social workers, professionals who work, daily, with vulnerable populations, is of utmost importance to develop appropriate interventions that sustain their well-being and prevent the escalation of psychological distress.

JD and JR have been shown to be related to psychological distress, albeit in opposite directions (18, 24, 28). In a survey of 7,800 people from different occupations, Oshio et al. (24) found JD, such as workload, was positively corelated with psychological distress ($r = 0.26$, $p < 0.001$) and JR, such as coworker support, was negatively correlated with psychological distress ($r = -0.21$, $p < 0.001$). Notably, JD and psychological distress have been found to be positively correlated with one another ($r = 0.39$, $p < 0.001$) in a sample of over 600 social workers in Israel (28), indicating a need to further examine the underlying mechanism between JD-R and psychological distress in social workers.

Positive Affect and Negative Affect (PA and NA)

Over the years, scholars have come to understand subjective well-being as a multi-dimensional construct. In one conceptualization, subjective well-being is comprised of two independent dimensions (41): positive affect and negative affect (PA and NA). Broadly, affect can be described as the experience of any feeling or emotion (American Psychological Association, 2021). Characteristics related to PA include confidence, optimism, sociability, effective coping, and flexibility (42). Fredrickson's (43) broaden-and-build theory posits that PA may broaden

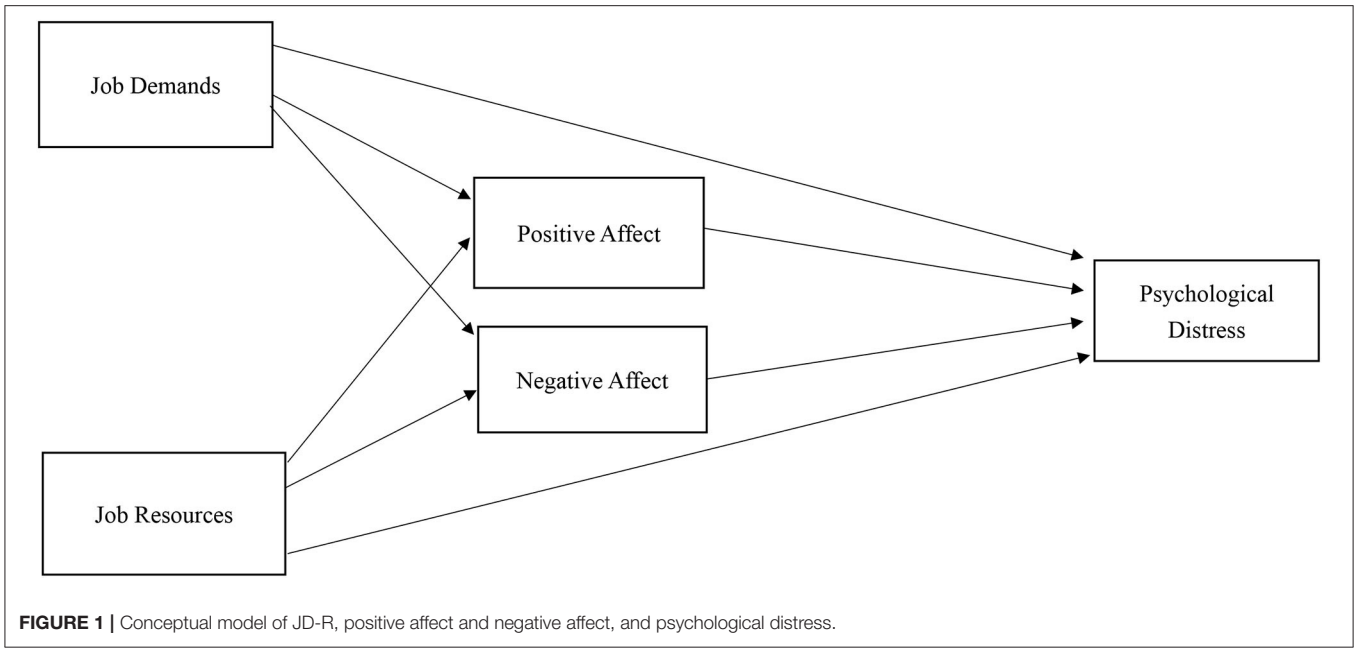

FIGURE 1 | Conceptual model of JD-R, positive affect and negative affect, and psychological distress.

momentary thought-action repertoire, allowing people to accrue enduring personal physical, psychological, and social resources that, in turn, facilitate success. Indeed, PA is associated with success across life domains such as work performance, income, and health, among many others (42). Studies that apply the broaden-and-build theory have indicated that PA significantly reduces emotions and stress symptoms, turnover intentions, maladaptive coping, and depression and anxiety (44, 45).

By contrast, NA is characterized by guilt, anxiety, and fear and is associated with physical and mental health outcomes such as emotion dysregulation and psychiatric symptoms (46–49). Weiss and Cropanzano's (50) affective events theory explains that employees' internal influences (e.g., emotions) and reactions to the work environment can affect job performance and satisfaction. Research has found evidence that is consistent with this theory (49, 51, 52). For example, NA is predictive of workplace deviance, including absenteeism, theft, and poor job performance, as well as low well-being (49, 51, 52). Notably, Chen et al. (49) found that PA and NA mediated the relations between work conditions and well-being. Taken together, these studies, along with others, reflect that PA and NA play a significant role in shaping cognition, behavior, and well-being (53, 54), especially in the workplace. Thus, PA and NA may play a role in the relation between JD-R and psychological distress.

Empirical studies which apply the JD-R model, the broaden-and-build theory, and affective events theory have primarily used Western samples. These studies have shown that JD-R has a significant consequence for psychological distress in individuals. Some evidence suggests that PA and NA may mediate this relation, but the current state of knowledge on PA and NA's mediating effects is still quite preliminary. Further, we currently lack scholarship on whether the relation between JD-R and psychological distress is mediated by PA and NA among human service workers, such as social workers. The present study thus examines the effects of JD-R on psychological distress—and whether PA and NA mediate this relation—in a sample of Chinese social workers. The findings of this paper may contribute to the understanding of how JD-R affect psychological distress through PA and NA in a rapidly developing occupational group with a high turnover rate in China.

CONCEPTUAL MODEL AND HYPOTHESES

Based on the JD-R framework (21), the broaden-and-build theory (43), and affective events theory (50), a conceptual model involving JD-R, PA, and NA, and psychological distress was proposed to examine the mediational pathways between JD-R and psychological distress *via* PA and NA, as shown in **Figure 1**. Specifically, we hypothesize that:

1) JD is negatively associated with PA.
2) JD is positively associated with NA.
3) JR is positively associated with PA.
4) JR is negatively associated with NA.
5) PA is negatively associated with psychological distress.
6) NA is positively associated with psychological distress.
7) JD has an indirect effect on psychological distress *via* PA and NA, indicating partial mediation pathways.
8) JR has an indirect effect on psychological distress *via* PA and NA, indicating partial mediation pathways.

METHODS

Data and Sample

The data for this study were collected from social workers in Chengdu, China, *via* an anonymous web-based survey. Chengdu

TABLE 1 | Profile of the sample.

	Mean (S.D.)
Gender [%]	
Female	78.3
Male	21.7
Age	31.8 (7.3)
Education achievement [%]	
Below college	45.4
College and above	54.6

N = 897.

is the capital city of Sichuan province and has seen rapid development in social work. Within the past decade, the number of employed social workers in Chengdu has multiplied 31.8 times, from 553 in 2010 to 17,622 in 2020 (55). At the same time, however, turnover rates in Chengdu and other big cities have been high, around 20–30% between 2015 and 2020 (56, 57). We randomly selected two districts out of the 22 city districts in Chengdu. We then contacted social work professional associations and agencies that employ social workers within the two districts in order to recruit participants. Each district has around 600 social workers. Members of these organizations were invited to participate in the survey starting May 5, 2021. One and two weeks after the initial invitation, we sent reminders to participate. 915 social workers responded to the survey between May 5, 2021, and May 29, 2021. We excluded 18 surveys from our final analysis due to incomplete data, leaving a final analytic sample of 897. The survey response rate was 75%. An informed consent process was implemented prior to the survey. Participants were compensated 5 RMB (1 USD) after finishing the survey. Further, participants were informed that their participation in the survey was voluntary and that they could choose to discontinue the survey at any point. This research protocol was approved by the institutional review board at one of the co-authors' university in China. About 78% of the sample were female. The average age of the sample was 31.8. A majority of the sample had a at least a college degree (54.6%) and a social work license (52.3%), as shown in **Table 1**.

Measures

The dependent variable, psychological distress, was assessed by the Kessler 6 Psychological Distress Scale (K6) (37, 58), a 6-item scale that measures psychological distress with high validity and reliability (24, 37, 59). The items in the scale ask respondents about past 30-day prevalence of psychological distress, such as feelings of nervousness, hopelessness, restlessness, worthlessness, and depression. An item in the scale asks about the frequency to which the respondent felt as though "everything was an effort" (37, 58). Items are rated on a 5-point scale which ranges from 0, indicating "none of the time," to 4, indicating "all of the time." Psychological distress is represented by the sum of responses to all items, which could range 0 to 24. The severity of psychological distress was according to the K6 has been identified through past calibration studies (35, 58, 60, 61). Scores of 7 and below indicate low psychological distress. Scores between 8 and 12 indicate moderate psychological distress. Scores 13 and above indicate high psychological distress. In this study, the K6 scale had a Cronbach's alpha value of 0.94.

PA and NA were measured *via* the short form version of the International Positive and Negative Affect Schedule (I-PANAS-SF) (62), a 10-item scale that has demonstrated cross-sample stability, internal reliability, temporal stability, cross-cultural factorial invariance, and convergent and criterion-related validity (62–64). The I-PANAS-SF asks respondents to report on the frequency at which they felt the emotions—such as hostile, upset, inspired, and determined—in the past 2 weeks. Possible responses ranged 1, "never," to 5, "always." We summed up the scores of the items that correspond to PA and to NA. Possible PA and NA scores ranged from 5 to 25. In this study, the PA subscale had Cronbach's alpha of 0.76, while the NA subscale had a Cronbach's alpha of 0.87.

Measures for JD-R came from the Questionnaire sur les Ressources et Contraintes Professionnelles (QRCP), a multidimensional scale developed by Lequeurre et al. (31). Given the work of social workers in China, we selected two dimensions of JD (workload and emotional workload) and two dimensions of JR (relationship with colleagues and information) as the measurements for JD and JR in this study. Workload is defined as the sense of having too much work to do in the time available, while emotional workload characterizes emotional job demands, such as needing to cope job-inherent emotions and/or maintaining organizationally desired emotions. Relationship with colleagues refers to team atmosphere and the potential to receive social support from co-workers. Information refers to the availability of information to employees, specifically feedback regarding job performance. Each dimension is measured with 4 items (31). Respondents answered each item on a 7-point Likert scale ranging from 1, "never," to 7, "always." Higher scores indicated higher levels of JD or JR. The possible range for each dimension's total score ranged 4 to 28. JD was calculated by summing up the scores of workload and emotional workload, while JR was calculated by calculating the sum of relationships with colleagues and information. In this study, the Cronbach's alpha value of the JD subscale was 0.82. The JR subscale had a Cronbach's alpha of 0.91.

Analytical Approach

We conducted descriptive and Pearson's correlation analyses to observe the sample characteristics and the correlations among all variables. Then, we conducted structural equation modeling (SEM) analysis to examine the relations among JD-R, PA, and NA, and psychological distress. We selected SEM over regression techniques because it allows for the simultaneous examination of direct and indirect effects through mediating variables (65). STATA software 16.0 was used for all analyses. Results of regression analyses (not shown) using extensive covariates (e.g., personal and family characteristics) indicated that the relations among JD-R, PA, and NA, and psychological distress were similar to those reported here. These results are available upon request.

TABLE 2 | Descriptive statistics and correlations of key variables.

	Cronbach's Alpha	Mean (S.D.)	1	2	3	4	5
1. Psychological distress [0–24]	0.94	7.2 (5.2)	–				
2. Positive affect [5–25]	0.76	15.7 (3.2)	−0.19***	–			
3. Negative affect [5–25]	0.87	12.1 (4.2)	0.44***	0.15***	–		
4. Job demands [8–56]	0.82	38.5 (6.6)	0.15***	0.08*	0.23***	–	
5. Job resources [18–56]	0.91	40.8 (6.9)	−0.24***	0.31***	−0.21***	0.30***	–

*N = 897. Numbers in parentheses show ranges of the variables.*p < 0.05,***p < 0.001.*

RESULTS

Table 2 presents the descriptive statistics of the variables. The sample had an average psychological distress score of 7.2 (SD = 5.2). The average PA and NA scores were 15.7 and 12.1, respectively. The sample reported relatively high JD (M = 38.5, SD = 6.5) and JR (M = 40.8, S.D. = 7.0).

The Pearson's correlation analysis indicated a positive association between JD and NA ($r = 0.23$, $p < 0.001$) and between JD and psychological distress ($r = 0.23$, $p < 0.001$). Meanwhile, JR was positively associated with PA (r = 0.31, $p < 0.001$) and negatively associated with NA ($r = -0.21$, $p < 0.001$) and psychological distress ($r = -0.24$, $p < 0.001$). PA and NA were significantly correlated with psychological distress ($r = -0.19$, $p < 0.001$; r = 0.44, $p < 0.001$). Surprisingly, JD was positively correlated with PA ($r = 0.08$, $p < 0.05$). Finally, JD and JR were highly positive correlated with each other ($r = 0.30$, $p < 0.001$). Further regression analysis suggests that the positive correlation between JD and PA was driven by JR.

The results of hypothesis testing are presented in **Table 3**. **Figure 2** presents the standardized coefficients of the SEM model. JD had no significant association with PA and was negatively associated with NA (β = −0.32, $p < 0.001$). These results do not support Hypothesis 1 but confirm Hypothesis 2. JR was positively associated with PA (β = 0.31, $p < 0.001$) and negatively associated with NA (β = −0.31, $p < 0.001$). These results support Hypotheses 3 and 4. In addition, both JR (β = −0.11, $p < 0.01$) and PA (β = −0.23, $p < 0.001$) significantly reduced psychological distress, while JD (β = 0.10, $p < 0.01$) and NA (β = 0.43, $p < 0.001$) significantly increased psychological distress. These results support Hypotheses 5 and 6.

The total effect of JD on psychological distress was 0.25 (p < 0.001) and the indirect effects of JD through PA and NA, together, was 0.14 (p < 0.001). Although JD did not have a direct effect on PA, JD had a significant effect on NA, which in turn had a significant effect on psychological distress. Thus, JD had a significant indirect effect on psychological distress through PA and NA. Proportionately, PA and NA mediated 0.56 (0.14/0.25) of JD's effect on psychological distress. This result provides support for Hypothesis 7. The total effect of JR on psychological distress was −0.32, and the indirect effect of JR on psychological distress through PA and NA (combined) was −0.20 (p < 0.001), or 0.63 of the total effect (−0.20/−0.32). These results support Hypothesis 8.

TABLE 3 | Results of hypothesis testing.

Hypothesis	Beta	P
H1: JD -> PA	−0.02	
H2: JD -> NA	0.32	***
H3: JR -> PA	0.31	***
H4: JR -> NA	−0.31	***
H5: PA -> PD	−0.23	***
H6: NA -> PD	0.43	***
H7: Indirect effect of JD on PD *via* PA and NA	0.14	***
H8: Indirect effect of JR on PD *via* PA and NA	−0.20	***

*N = 897.***p < 0.001.*

DISCUSSION

Given that much of the empirical evidence showing JD-R's effects on work and health outcomes has come from studies focused on Western samples (21, 31, 49, 66), this study extends the literature by investigating JD-R's effects on a sample of Chinese social workers. We applied the JD-R model to examine how JD-R affect psychological distress and whether these relations are mediated by PA and NA. Based on the results of descriptive statistics, the sample of social workers in this study experience high JD in their roles; at the same time, they have considerable JR at their disposal. The SEM results provided support for the hypothesized dual processes by which JD-R affect psychological distress in social workers in China. High JD was associated with high NA and, subsequently, high psychological distress, indicating an energy depletion process (Hypotheses 2 and 6; 21). However, we did not find that JD have effect on PA (Hypothesis 1). Together, the results of JD on PA and NA suggest that JD influence affect through energy depletion process rather than motivational one for this sample. Meanwhile, JR was positively associated with high PA and low NA (Hypotheses 3 and 4), which were both associated with psychological distress (Hypotheses 5 and 6). This indicated a motivational process (21) which protects against psychological distress. The significant indirect effects of JD and JR on psychological distress through PA and NA indicate that PA and NA partially mediated the association between JD-R and psychological distress (Hypotheses 7 and 8). The magnitude of the estimates from our results show that JR have greater effects on PA and NA and psychological distress than JD had on NA and psychological distress. Together, these findings are consistent with and expand upon previous findings with the JD–R model

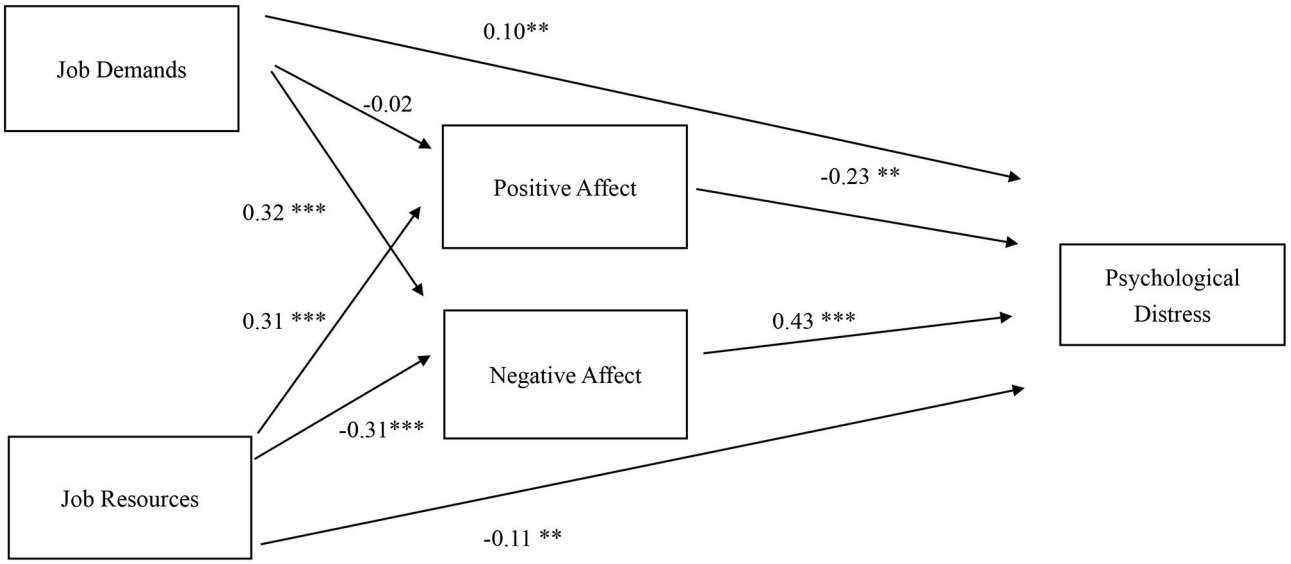

FIGURE 2 | Standardized estimates of JD-R, positive affect and negative affect, and psychological distress. $^{**}p < 0.01$; $^{***}p < 0.001$.

(19–21). Our results show that JD-R are significant predictors of PA and NA and psychological distress, and the underlying energy depletion and motivational processes do not appear to differ between social workers and other professionals.

Based on the findings of our study, we offer a few practice and research suggestions for organizations that employ social workers and researchers who seek to further investigate social workers' occupational well-being or who seek to examine the JD-R model's underlying processes. According to descriptive statistics, the study sample reported high JD. Given that JD significantly and positively predicts NA and psychological distress, employers of social workers in China may seek to focus on both reducing JD and increasing JR to mitigate NA and psychological distress. Descriptive statistics also showed that the sample had considerable JR at their disposal; this shows great promise, given JR's ability to increase PA, reduce NA, and reduce psychological distress. Social work agencies and other employers will need to maintain the availability of JR to their social workers.

Importantly, PA and NA were found to act as mediators of the relations between JD-R and psychological distress, pointing to PA and NA as key points of intervention. To apply this finding, employers may implement a number of interventions that seek to promote PA while reducing NA. For example, studies on mindfulness-based interventions have provided evidence of mindfulness's effectiveness in improving PA and reducing NA (67–69). Moreover, mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT), and mindfulness-based interventions (MBI) all can effectively reduce psychological distress and promote mental health and well-being (70–72).

While these findings offer a starting point for interventions that bolster the psychological well-being of social workers, they also can act as a guide for further study. Perhaps most notably, our variables of interest—JD-R, PA, and NA, and psychological distress—are all multidimensional constructs that have been measured and operationalized differently throughout the past decades of study. Due to resource constraints, we only used two dimensions to measure JD and JR. While these two dimensions have been found to be significant predictors of workers' outcomes (31), it is necessary that future studies examine the effects of other JD-R dimensions on PA and NA and psychological distress. For example, Demerouti's (21) framework conceptualizes JD with 5 underlying dimensions and JR with 6 underlying dimensions. In Lequeurre et al.'s (31) JD-R framework, JD and JR each consist of 7 dimensions. It is likely that the various dimensions of JD-R and PA and NA will differentially affect each of the psychological distress dimensions, warranting further research.

The results of this study should be considered within the context of several limitations. First, since we collected cross-sectional data from our sample, the results can only approximate associative relations among our variables. To address this limitation, researchers may use a longitudinal design to better examine the causal relations among JD-R, PA, and NA, and psychological distress. Second, our dataset relied on self-reporting from respondents, which leaves the data subject to unintended and intended reporting errors. Social desirability bias, for example, may lead the sample to underreport psychological distress, given the prevalence of stigma related to mental illness in Chinese society (73). Future studies might consider the use of data triangulation, using sources such as colleague reports, employers, and family members. Third, unobserved variables, which were not included in this study, could have influenced on the observed relationships among JD-R, PA, and NA, and psychological distress. For example, we collected data during the global COVID-19 pandemic. Although the COVID-19 cases were under control in China in May 2021,

to the extent of ongoing COVID-19 pandemic might have effects on above relationships in Chinese social workers is unknown. Finally, while the sample size and response rate in this study increase our confidence in the results, the generalizability of the findings to all social workers in China is unknown. Our sample was drawn from two districts in Chengdu, one of China's most populous cities [9.3 million in 2021; (74)]. Meanwhile, however, the development and professionalization of social work in China varies by region, due to differences in educational policies and resource allocation (75). Thus, future experimental design should emphasize recruiting a representative sample, as well as examining whether being employed in a rural or urban region may moderate the effects of JDR on PA and NA and psychological distress.

CONCLUSION

Applying the JD-R model, this study found that JD and JR affect Chinese social workers' psychological distress through PA and NA. These results add to the growing body of cross-cultural research that supports the dual process by which JD-R affects the well-being of various occupational groups. Social workers have been shown to be a vulnerable occupational group, particularly due to the significant emotional job demands that are characteristic of their work (10, 12–14). We provide evidence of a partial mediation pathway between JD-R and psychological distress through PA and NA, suggesting that PA and NA may be effective points of intervention. The implementation of interventions that reduce NA may serve to buffer against JD's effect on psychological distress as well as to strengthen JR's effect on psychological distress.

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 Review Committee, Research Institute of Social Development, Southwestern University of Finance and Economics. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

CH and XX: conceptualization and resources. CH, XX, SC, and YZ: methodology and software, validation, formal analysis, and writing—original draft preparation. CH, XX, and YZ: investigation and data curation. All authors contributed to the article and approved the submitted version.

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Trajectories of Mental Health Status Among Police Recruits in Sweden

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Background: The stressful and complex nature of police work and its adverse effects on mental health are well-documented in police research. The mental health of police students however, has not been given the same attention. To the best of our knowledge, studies on the mental health of Swedish police recruits have not been undertaken since 2010.

Objectives: The present study aims to examine whether there are differences in the mental health between two cohorts (2009 and 2020) of Swedish police recruits, as well as to compare the mental health of both cohorts with the general population data collected in 2002.

Methods: Data was collected using the SCL-90-R survey. Data was analyzed using multivariate analysis of variance (MANOVA) and independent sample *T*-tests. Bi-variate analyses including *t*-test and chi-square were used to examine differences in sociodemographic variables between the two cohorts.

Results: A total of 376 police recruits participated in the study. Results indicated no significant differences between the cohorts with regards to the three global indices of the SCL-90-R: Global Severity Index (GSI), Positive Symptom Total (PST), and Positive Symptom Distress Index (PSDI). Recruits with a college degree had lower scores on GSI and PSDI, similar to respondents that where in a relationship vs. singles. A total of 15 (four female) recruits had GSI scores above the Swedish patient mean. Compared with the general population, males and females from the 2009, as well as females from the 2020 cohorts had lower or insignificantly different mean scores on all global indices, with males from the 2020 cohort having a significantly lower PST score.

Conclusions: While the vast majority of recruits had results that where indicative of a low prevalence and intensity with regards to mental health disorders, some recruits did score above the Swedish patient mean. While mental preparedness is part of the curriculum for Swedish police recruits, interventions targeting the stigmas of poor mental health could be of value. The fact that educational attainment appears to have a positive impact on the mental health of police recruits, could be taken in to consideration when recruiting future police officers.

Keywords: police, education, mental health, law enforcement, police training

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INTRODUCTION

The stressful and complex nature of police work is well-established in police research (1–7). Police officers are confronted with not only organizational stressors, such as lack of support from leadership, time pressure, and staff shortages, but also task-related strains, such as potential violence, threats, and exposure to unknown situations and interpersonal conflicts, which have been established since the infancy of police-related research (8–11). To handle the situations police officers are not only faced with but are required to manage, officers are given far-reaching mandates, including the lawful right to use force when conducting their duties. Given the power vested in the police, the discretion with which officers use this power is of great importance not only to the individuals with which they interact but also to public perceptions of trust in the justice system (12). With these mandates and the importance of discretion as a point of departure, the factors of conflict management and behavior play an important role. Notably, this is an area where officers have a breadth of possible approaches or behaviors ranging from the misuse of power to withdrawing from engaging in conflicts, and where a range of factors appear to affect the propensity of officers to use force (9, 13, 14). Notwithstanding the several investigations on different aspects of police work, less attention has been paid to the context of police education and how police officers are prepared for challenges they will meet in the line of duty. The lack of knowledge about police education might depend on variations in police education structures with regards to length and content in many countries, as well as the fact that police research is a relatively novel area of research.

BACKGROUND

Basic Training for Police Officers

In Sweden, police officers go through 2 years (four terms) of formal training at one of the universities that have a basic training program for police officers. After graduation, future officers go through 6 months of probationary training, whereafter (if given a passing grade), they are hired as sworn officers.

Since 2006, and the inception of the *National Basic Tactics* [Nationell Bastaktik], all recruits and officers have received training in a mental preparedness program, which includes basic knowledge of stress and reactions to stress, coping, mental preparedness (short- and long-term), mental training through mental and muscular relaxation, and methods for improving sleep quality (15). The training to be a police officer is conducted at five universities and is regulated in broad terms by an education plan provided by the Swedish Police. Therefore, the material described above can be supplemented by other sources, as long as they are in line with the goals and contents of the plan (16) and the competency profile for police officers (17).

Declines in Mental Health Status—From Recruitment to Officer

Corollary to the aforementioned demands and strains, as well as the power vested in them, aspiring officers generally go through rigorous testing. Although recruitment processes and methods of testing differ, commonly used test batteries include personality tests, such as the MMPI-2 (3) and the NEO-PI (18), physical fitness tests (19), and medical screening. Therefore, it is perhaps not surprising that, compared to the general population, police recruits at a group level are in good health upon admission (20, 21). However, research on the overall health of police officers shows that despite strong baseline results (i.e., upon admission to the academies), there appears to be a marked decline in the mental and physical health of police officers (1, 19, 22). Evidence has suggested that among the negative effects of police work are anxiety, depression, post-traumatic stress disorder (PTSD) (1, 7, 23, 24), burnout (10, 25), and substance abuse (26). It is well-known that mental health conditions, such as those described above, can be severely debilitating, significantly increase the risk of premature morbidity, and account for a large proportion of the burden of disease globally (27, 28). Mental health conditions have also been shown to have significant comorbidity with other non-communicable diseases ranging from (but not limited to) cardiovascular disease to oral health (29, 30). As already mentioned there appears to be less known about the mental health status of police recruits than about police officers. In reviewing previous research on mental health among police recruits a literature search was conducted in PubMed using the search terms ((mental health) OR (mental status) OR (stress) OR (psych*)) AND (Police/education[MeSH]). A similar search was conducted in ERIC and ASE using the search terms: (police education OR police recruit* OR police trainee* OR police student*) AND (mental health OR mental status OR psych*) with Subject terms: police, police education and higher education.

The absolute majority of the articles that were found examined various forms of training interventions for officers, and in some cases recruits, aimed at handling people suffering from poor mental health, or psychiatric disorders and *Crisis Interventions Teams* (CIT). Research in to the mental health of police recruits were however scarce. One study examined the association of mental status of police recruits and periodontal health (29) with other ($N = 3$) examining the associations of personality and mental health (20, 21, 31). In other studies coping behaviors of police recruits during training have been examined, suggesting that the training is a potentially stressful environment (32, 33), with recruits reporting an increase in alcohol consumption in part to cope with stress (33). However, little remains known about the mental health and symptoms of distress among police recruits.

Mental Health and Police Officer Performance

The deleterious effects of mental health conditions mentioned above are however not limited to the individual, and in the case of police officers, these effects can be amplified by their work context. As already stated, conflicts and confrontations are omnipresent features of police work and need to be handled in a professional manner (34). Extant research on the mental health conditions described above shows that, for example, PTSD and burnout can have significant negative effects on conflict and conflict management behavior and performance (10, 35, 36).

Finally, the deleterious effects of poor mental health on police officers could further be amplified by limited leeway in terms of feasible alternatives for coping strategies and help-seeking, where officers are: (1) required to face conflicts and other stressors daily (thus limiting the possibility of situational coping); (2) the stigmas surrounding mental health issues among police officers appear to be strong (1, 37, 38); and (3) police cultures where the potential dangers facing police officers are emphasized, adding an impetus for the development of a view of the world as a dangerous place where a "warrior" or "combat mindset" is necessary (39, 40) and where fearlessness and stoicism is encouraged (41).

Thus, the poor mental health of police officers and declines that have been shown in terms of mental health (42) and the negative effects that are perhaps particularly salient among police officers compared to the general public make police officer mental health a public health issue that should be paid great attention, especially in the recruitment process and training of police officers. Physical fitness plays an important role in resilience to stressors and positive effects on mental health (43) and performance, already in training (44), as well as good baseline values in terms of mental health. Even small negative changes in mental health could have negative effects on job performance and resilience among police officers.

Relevance of the Study

The present study is part of an ongoing research project that started in 2018 with the aim of understanding the interplay between conflict management and mental health among Swedish police officers and recruits. To the best of our knowledge, the most recent research on the mental health of police recruits in Sweden (post-admission) was conducted in 2010. During this time, changes in society and recruitment have occurred that could affect the mental health of police recruits. For example, in Sweden, recent studies have shown that while overall rates of homicides in Sweden have decreased since the 1990s, gun-related homicides and attempts to kill have gone up among males, with indications that the increase in part is attributable to gang-related conflicts (45). According to official statistics, the rate of gun-related homicides has seen an approximately two-fold increase between 2011 and 2018, with Sweden having comparatively higher per capita rates of individuals killed due to gun violence than almost all other European countries (46, 47). Sweden has also seen an increase in the use of hand grenades and explosive devices (48). These changes could have an adverse effect on the perceived dangers of the task environments that officers are required to operate within, thus affecting the mental health of future officers.

In addition, in recent years, the Swedish Police Authority has faced difficulties recruiting new, potential police officers. For example, between 2019 and 2020, several positions at the schools were not filled. This raises the question of whether less competition for places at the academy could have had a negative effect on the health of those who have been admitted to the schools. Furthermore, the criteria for admission have undergone changes between the last study in 2010 and the present day, most notable among these changes are perhaps a lowered minimum age for admission from 20 to 18, removed language test (17, 49), and lowered minimum score on the UNIQ-test, which is intended to measure the *g-factor* (50); the minimum score for admission has been lowered from 4 to 3, thus requiring a score lower than the population mean (51).

In the present study, data from a cohort from 2009 were compared to data collected from another cohort in 2020. While the cross-sectional design precludes causal inferences between the changes now described and differences in symptoms of psychological distress among recruits, the aforementioned changes make comparisons between the cohorts relevant (52). Moreover, while it can be assumed that police recruits, given the recruitment process they have undergone, are likely to have a lower prevalence of mental health disorders, keeping in mind the responsibilities that come with the job and the challenges that officers face—simply assuming is not enough. Given that very little attention has been given to the mental health and distress among police recruits, there appears to be a gap in knowledge as to if the negative effects of police work are present already during training when students are faced with the potential dangers and risks with their future work.

Research Aims and Questions

The overall aim of the present study is to examine if there are any differences in the psychological distress of police recruits in two cohorts, as well as in comparison with the general population, in order to deepen our understanding and knowledge of the importance of mental health and its potential negative consequences on police recruits. The control variables include age, gender, and educational attainment.

METHODS

Data Collection

In the present study, two cohorts of police recruits, one from 2009 and one from 2020, will comprise the study sample; the duration and overall contents in terms of mental preparedness training were the same for both cohorts. Respondents in the 2009 cohort were recruited from one of three universities in Sweden that, at the time, provided basic training programs for police officers. Respondents in the 2020 cohort were recruited from four out of five universities that currently provide basic training programs for police officers. Participation was voluntary for both cohorts, and all respondents received information on the aim and scope of the respective studies. Respondents were also asked to fill out a written consent form before completing the included surveys. Both cohorts filled out sociodemographic questionnaires as well as the Symptom Checklist (SCL-90-R).

Data collection for the 2020 cohort was initiated in early 2020; initially, the data collection was intended to include more recruits as well as police officers in Sweden. However, the COVID-19 pandemic forced a halt to data collection through face-to-face meetings, and instead the surveys were transferred to an online survey platform: LimeSurvey. Recruits were then contacted through their respective schools and asked to participate in the study. Recruits were asked to complete the same survey, and written consent was obtained through the LimeSurvey platform.

Data collection for the 2009 cohort was conducted during face-to-face meetings.

Survey Measures

Sociodemographic Questionnaires

The sociodemographic questionnaires were developed independently and contained questions specific to each one. Both questionnaires included information on age (continuous), gender ("male," "female"), marital status ("single," "other," and "married"), educational attainment ("high school" or "college"), and children ("parent" or "no children"), which could thereafter be compared between the two cohorts.

SCL-90

The SCL-90 was developed by Derogatis and Cleary (53) as an instrument to assess psychological problems and symptoms of psychopathology in both patient and general populations. The instrument consists of 90 items, with each item scored on a five-point Likert scale ranging from 0 = "not at all" to 4 "extremely." In the present study, a Swedish translation of the instrument was used. The Swedish version of the instrument has been validated and psychometrically evaluated, and normative data from both patients (N = 1,782) and the general population (n = 1,016) are available (54). For the present study one justification for using the SCL-90 was the availability of previous data in a comparable cohort, thus enabling comparisons between both general population as well as a similar cohort (20). The SCL-90 measures nine dimensions of symptoms: somatization, obsessive-compulsive symptoms, interpersonal sensitivity, hostility, depression, anxiety, paranoid ideation, phobic anxiety, and psychoticism. Results from the SCL-90 can also be divided into three global indices that are indicative of psychopathology and level of distress: the Global Severity Index (GSI), Positive Symptom Index (PST), and Positive Symptom Distress Index (PSDI). The GSI reflects overall psychological distress, regardless of dimension, and Positive Symptom Total (PST) is the number of items answered positively (above 0). The PSDI indicates the intensity of symptoms, and it is calculated by dividing the total score by the number of positive items (54, 55). Previous studies on psychometric properties of the instrument have shown mixed results in terms of the factor structure of the nine subscales, limiting its use for more detailed discrimination between symptom groups. However, several studies have verified its usefulness as a screening tool, as well as for between-group comparisons in both clinical and research settings, with the global indices (GSI, PST, and PSDI) being particularly useful for assessing mental distress and the presence of symptoms of psychopathology (54, 56, 57).

Ethical Approval

Ethical approval for the present study was obtained from the Swedish Ethical Review Authority, with protocol number 2019-05208 for the 2020 cohort, and the Ethics Committee at Umea University approved the study protocol (Dnr 08-018M) for the 2009 cohort.

TABLE 1 | Distribution of sociodemographic characteristics by cohort.

Characteristic	*N*	Overall, *N* = 376 *N* (%)	2020, *N* = 376 *N* (%)	2009, *N* = 101 *N* (%)	*p*-Value
Gender	376				0.09
Male		246 (65%)	180 (65%)	66 (65%)	
Female		130 (35%)	95 (35%)	35 (35%)	
Degree	376				<0.001
High school		256 (68%)	210 (76%)	46 (46%)	
College		120 (32%)	65 (24%)	55 (54%)	
Marital status	376				0.4
Single		164 (44%)	116 (42%)	48 (48%)	
Relationship		133 (35%)	103 (37%)	30 (30%)	
Other		79 (21%)	56 (20%)	23 (23%)	
Parent	376				0.044
No		315 (84%)	224 (81%)	91 (90%)	
Yes		61 (16%)	51 (19%)	10 (9.9%)	
		(mean/±SD)	**(mean/±SD)**	**(mean/±SD)**	
Age	376	27.1 (5.2)	27.9 (5.5)	25.1 (4.0)	<0.001

P-values indicate differences between cohorts.

Statistical Analysis

The data were analyzed using R (58) and STATA (59). We applied bivariate analyses, including t-tests and chi-square tests, to examine the differences in continuous and categorical sociodemographic variables, respectively, between the two cohorts (**Table 1**). Cohen's d was used to assess the magnitude of differences (60). We used the values originally stipulated by Cohen as a rough guideline in determining magnitude with the following levels of d: 0.2, 0.5, and 0.8 indicative of small, medium and large effects, respectively (60, 61). Statistical significance was defined as $p < 0.05$.

Multivariate analysis of variance (MANOVA) was conducted with cohort, gender, parent, and educational attainment as independent variables and the three global indices (GSI, PST, and PSDI) as dependent variables to assess differences between cohorts and sociodemographic factors.

Prior to running the MANOVA, data were explored to ensure that the necessary assumptions for the test were met. To detect multivariate outliers, Mahalanobis distances were calculated (p = 0.001 and DF = 5). A number of outliers were found in both cohorts (n = 6 for 2020 and n = 3 for 2009) and were removed from the subsequent analysis. Data from both cohorts were also compared to general population data using gender-stratified one-sample t-tests, and data from the general population were collected from Fridell et al. (54).

RESULTS

The sample for the study consisted of two cohorts of police recruits (2009 and 2020) with a total of 376 police recruits from a Swedish basic training program for police officers (see **Table 1**).

TABLE 2 | SCL90 means.

Subscale	Male					Female				
	General pop.	2009	*d*	2020	*d*	General pop.	2009	*d*	2020	*d*
Som	0.41	**0.28**	−0.40	**0.25**	−0.51	0.49	**0.27**	−1.05	**0.32**	−0.502
Sub2	0.48	**0.64**	0.31	0.54		0.57	0.58		**0.69**	0.225
Sub3	0.33	0.31		**0.41**	0.21	0.49	0.40		0.46	
Sub4	0.39	0.48		**0.46**	0.16	0.72	**0.56**	−0.36	0.64	
Sub5	0.33	0.34		**0.40**	0.20	0.56	**0.39**	−0.54	0.48	
Sub6	0.29	**0.10**	−1.25	**0.17**	−0.52	0.34	**0.08**	−1.61	**0.15**	−0.896
Sub7	0.09	**0.06**	−0.25	0.11		0.18	**0.09**	−0.68	0.17	
Sub8	0.32	**0.20**	−0.41	0.35		0.38	**0.17**	−0.66	0.32	
Sub9	0.12	0.16		**0.16**	0.16	0.18	0.16		0.19	
GSI	0.33	0.32		0.36		0.45	**0.33**	−0.48	0.44	
PST	23.4	**18.9**	−0.31	**20.7**	0.16	26.5	**19.9**	−0.56	**20.6**	−0.369
PSDI	1.38	1.41		1.33		1.43	1.42		1.42	

General population data from Fridell et al. (54). Bold text indicates significant p-value ($p < 0.05$) for mean-differences between general population and respective cohort.

The original dataset contained 400 respondents in total, but 24 were removed because of missing sociodemographic variables.

Mental Health Compared to General Population

Data from the present study were compared to general population data (from 2002) by gender and cohort in the corresponding age groups. In the 2009 cohort, both males and females had lower or insignificantly different mean scores than the general population. Males scored higher on obsessive compulsion than the general population ($t = 2.4794$, $p = 0.0158$, effect size $= 0.31$). As for the 2020 cohort, females similar to the 2009 cohort had lower or insignificantly different mean scores across the subscales and global indices, except for obsessive compulsion with borderline significant results ($t = 1.9882$, $p = 0.05$, effect size $= 0.23$). Their male counterparts had less homogenous differences, with significantly lower scores in interpersonal sensitivity, hostility, and PST, and significantly higher scores in psychoticism, anxiety, and depression (see **Table 2**). Thus, males from the 2020 cohort stood out when compared to the general population of the same gender, even though females in both cohorts as well as females in the general population overall had higher means in all sub-scales as well as global indices compared to their male counterparts.

MANOVA

A one-way MANOVA was performed to assess differences in mental health between the cohorts. Box's M was used to check the homogeneity of covariance assumption, with a given *p*-value < 0.001, indicating that the assumption was violated. Therefore, Pillai's Trace was used, as it is robust to such violations (62). Pillai's Trace with only cohort as the fixed factor showed a significant difference between with only cohort as the fixed factor showed a significant difference between the two cohorts [$V = 0.027$, $F_{(3,327)} = 3.042$, $p = 0.029$]. A test of between-subjects effects, however, showed that the differences for GSI and PSDI were insignificant ($p = 0.242$ and 0.343, respectively) with PSDI being borderline significant ($p = 0.053$). Subsequent MANOVAs using Pillai's Trace and the remaining sociodemographic variables, as fixed factors, showed significant differences in educational attainment [$V = 0.046$, $F_{(3,321)} = 6.627$, $p \leq 0.001$] and marital status [$V = 0.046$, $F_{(3,322)} = 1.329$, $p = 0.02$]. The main effects were significant for GSI ($p = 0.008$) and PSDI ($p \leq 0.001$), with respondents with a college degree having lower means than those with a high school degree. The mean PST did not show statistical difference between categories of educational attainment ($p = 0.542$) (**Table 3**). Regarding marital

TABLE 3 | MANOVA (Crude and adjusted means).

	Indices					
	GSI		PSDI		PST	
	Crude mean	Adjusted mean	Crude mean	Adjusted mean	Crude mean	Adjusted mean
Cohort						
2009	0.327	0.179	1.374	1.284	19.701	11.808
2020	0.368	0.205	1.338	1.263	23.081	14.066
Gender						
Male	0.348	0.289	1.332	1.314	21.892	18.469
Female	0.375	0.309	1.383	1.363	22.602	18.789
Degree		0.240				
High school	0.395	0.144	1.342	1.261	24.467	15.889
College	0.272***		1.362***	1.286	16.904	9.986
Parent						
No	0.374	0.229	1.356	1.295	23.011	14.933
Yes	0.253	0.155	1.301	1.252	16.667	10.942
Marital status						
Relationship	0.301*	0.162	1.341*	1.288	19.220	11.234
Single	0.425	0.261	1.380	1.313	25.564	16.308
Other	0.297*	0.153	1.288*	1.219	19.297	11.269

*$p < 0.05$, ***$p < 0.001$.

status, the main effect was similarly significant for GSI and PSDI ($p = 0.007$ for both) and insignificant for PST ($p = 0.136$). Being in a relationship (married or living together with a partner) or otherwise (in a partnership but not living together, unmarried) were associated with lower GSI and PSDI and insignificant differences for PST.

Scores Above Cut-Off for Swedish Patient Data

Using the mean scores of the Swedish normative data for the patient group as a cut-off, respondents with scores above the patient level for GSI (1.02 for males and 1.21 for females, respectively) were extracted from the data. A total of four females (all in the 2020 cohort) and 11 males ($n = 3$, 2009) were identified. Given the low numbers, statistical comparisons within the group were not deemed relevant, but interestingly, only one individual had a college degree, none had children, and one respondent was aged > 30. Scores among the respondents ranged between 1.1 and 1.8 for males and 1.2 and 1.6 for females.

DISCUSSION

In the present study, we aimed to examine the differences between two cohorts of Swedish police recruits, using control variables such as age, gender, children, and educational attainment. The study has some limitations that should be addressed when analyzing the results. The SCL-90-R measures psychological distress and symptoms of psychopathology at a very limited time (7 days). Thus, the results are at least on an individual level more sensitive to being affected by temporary fluctuations in psychological distress and therefore represents a snapshot of the psychological distress of the recruits. Also, the differences in the size of the samples could be a factor in the results, with smaller group sizes yielding less power in the analysis. However, given the lack of previous research on the topic, the results can be of importance not least for future research.

While the multivariate analysis between the two cohorts was significant, follow-up univariate analysis showed that only the difference in the number of positive symptoms (PST) was borderline significant at $p = 0.053$. This despite the fact that, at a societal level, there has been an increase in mental health disorders in the period of 2006–2020, in the comparable age group of 16–29 years old (63). These differences could be mitigated by the tests that the recruits go through before admission, despite the changes in recruitment and the increase in the number of recruits admitted.

Educational attainment appeared to have a positive effect on the psychological distress of police recruits, with significant differences for both the GSI and PST indices. While this study does not provide answers as to why educational attainment appears to be a protective factor in terms of prevalence of symptoms of mental health disorders, the results can still be of interest in terms of how to recruit police officers, and the value of higher education for police officer performance and longevity. This also adds to extant research on police officer performance in conflict situations, where educational attainment has been shown to have a positive effect on the use of force and verbal communication, where officers with a higher education degree are less likely to use coercive communication, use of force, and are less likely to receive complaints from the public (64, 65).

Compared with the general public normative data from 2002, recruits from both cohorts had mean GSI scores that were insignificantly different (lower for 2009 males and females, higher for 2020 males) from the Swedish general population, except for females in the 2009 cohort that had a significantly lower mean. Recruits from both cohorts, regardless of gender, also reported fewer psychopathological symptoms than their general population counterparts. This is perhaps not surprising, given that recruits have undergone rigorous testing, including psychological evaluations. The fact that the male 2020 cohort scored significantly higher on some subscales than their male counterparts from the general population is, however, something that could warrant further attention, even when taking the small effect sizes in to account. For example, with the exception of females in the 2009 cohort, the mean scores for obsessive compulsion were higher than the general population in the corresponding age group. This could for example be indicative of an educational climate that fosters fear of making mistakes and hampers the ability to take initiative and think freely. On a positive note, the low score across both cohorts, regardless of gender, with regard to hostility compared to the general population, could have several positive effects. Notably, previous studies have shown a relationship between anger/hostility and vulnerability to PTSD (36). A possible alternative explanation for this finding is that the subjects included in the present investigation are amidst their education and have not yet been faced with the challenges present in the line of duty. Future studies should examine how these scores change when police officers face the darker sides of police work and society.

While the number of respondents who scored above the cut-off for Swedish patient means, and therefore showed symptoms indicative of psychological distress, was low ($n = 15$), it was still noteworthy and could have implications not only for the respondents in question, but for those that they will possibly interact with in the future. As police officers, these individuals will be exposed to high levels of stress, shift-work, and other risk correlates of serious mental health issues, such as suicide, in which police officers and other emergency personnel have been shown to have increased risks (66).

The fact that there were more males than females with these high scores could perhaps be indicative of a lower propensity to actively seek help for these issues, which could increase the severity of the symptoms in the long term. This finding is in line with extant research on police help-seeking behaviors that have shown considerable stigmas surrounding mental health issues and a macho-culture associated with police work, where even officers with suicidal ideation rarely sought psychological help (37, 67, 68). It is vital that police education programs effectively identify individuals who already suffer from mental health disorders during their educational time, and that these are given proper attention and support. Previous research has shown that one reason for maladaptive help-seeking behaviors

could be because officers are under constant (perceived) scrutiny, and that fear of, for example, being disarmed, could lead to individuals hiding symptoms of mental health disorders (69). If mental health-related issues are addressed in an open and effective manner, police work is also rich in protective factors, such as camaraderie and support (66). However, for these protective factors to be effective, the stigmas need to be removed, thereby hindering social withdrawal and covering up symptoms of mental health issues. To our knowledge, the help-seeking behaviors and attitudes toward mental health issues among recruits have not been explored to the same extent as among police officers, and the results of the present study warrant further investigation into these issues.

Prospective, longitudinal studies following recruits from admission and into their careers could provide important answers on how these individuals are supported, to what extent they are discovered during training, and what implications the presence of psychopathology during training has for their future careers.

CONCLUSIONS

While the vast majority of recruits in the sample studied had results on the SCL-90-R that were indicative of low prevalence and intensity with regard to psychological distress, a number of recruits reported scores above the Swedish patient mean. While studies focusing on psychological distress among police recruits are rare, these results add to previous studies that identify the time in training as a potentially stressful environment even for the recruits (33). In addition, with the data available in the present study, mean scores appeared to be affected by educational attainment as well as the relationship status of the respondents. This finding could be useful for the recruitment of officers, where educational attainment has previously been shown to positively influence conflict behaviors, but could also positively affect the mental health of future officers. Further studies should be conducted with regard to the help-seeking behaviors of police recruits and the educational climate at the schools, where recruits appear to be under a lot of pressure, evident in high scores on obsessive compulsion, for example. While, at least in the Swedish context, mental preparedness is, in fact a part of the curriculum, interventions targeting the stigmas of poor mental health and the importance of seeking help could be of value. Such interventions, aimed at college students, have been shown to have positive effects both in the short- and long-term (70). While the studies on the topic of interventions aimed at resilience training for police recruits are scarce, previous studies have suggested that such interventions are likely most effective already early in the training of the recruits (71). While the declines in mental health of police officers are well-documented, our study - in line with the few previous studies that have been conducted on the topic, suggest that more research is needed and that this decline could start already during academy training.

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 Swedish Ethical Review Authority and the Ethics Committee at Umea University. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ME, MG, and MP conceived the study and where responsible for the first draft. MG, MP, and A-KH contributed by commenting on the manuscript and approved the final version. ME and MP conducted the data analysis. All authors contributed to the article and approved the submitted version.

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The Moderating Effects of Social Media Activities on the Relationship Between Effort-Reward Imbalance and Health and Wellbeing: A Case Study of the Oil and Gas Industry in Malaysia

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Background: Social media activities affect every aspect of human life, be it personal, social or professional. Previous studies have confirmed the role of social media in affecting health in terms of releasing stress and providing social support. Increased occupational health disorders and increased time spent on social media activities motivate us to investigate this phenomenon in the context of occupational health. Therefore, the objective of this study is to measure the effects of social media activities related to personal and social life as well as work-life on health and wellbeing of office employees, on their job efforts and job rewards, and in moderating the effect of effort-reward imbalance on health and wellbeing.

Methods: Initially, to develop constructs related to social media activities, web-based structured interviews were conducted with five office employees working in the oil and gas industry for the last 5 years. Then, using an online questionnaire survey, data was collected from 424 office employees working in the oil and gas industry in Malaysia. Using statistical software for social science (SPSS) and Smart PLS, exploratory factor analysis and confirmatory factor analysis were conducted to identify reliability and validity (discriminant validity, convergent validity and composite validity) of the constructs. Following this, path analysis was conducted and the moderating effects were identified.

Results: Social media activities related to work-life decrease health and wellbeing by 11% and weaken the negative effect of effort-reward-imbalance on health and wellbeing by 17.6% at a 1% level of significance. The results of social media activities related to personal and social life strengthen the negative effect of effort-reward imbalance on health and wellbeing by 12% and negatively affects health and wellbeing and job rewards by 13, 55%, respectively. The direct effect of effort-reward imbalance and job efforts is significantly negative on health and wellbeing by 59 and 10%, respectively.

Conclusion: It is concluded that social media activities of the office employees significantly moderate the effect of effort-reward imbalance on health and wellbeing and intervene in job rewards in the organizations. Hence, the effect of social media activities reduces the health and wellbeing of office employees.

Keywords: effort-reward imbalance, health and wellbeing, social media activities, stress, office employees

INTRODUCTION

A healthy workforce is critical for organizational productivity and sustainability. Psychosocial hazards are the biggest concern for the health and wellbeing of employees worldwide. According to an Alternative International Assignments (AIA) survey (1), more than 50% of Malaysian employees suffer from work-related stress. Among them, 7% experience moderate to high levels of anxiety, and most of them are aged 18 to 40 years. Referring to the effort-reward imbalance (ERI) model proposed by (2), workers employ great effort but receive little reward and this is stressful for them; this imbalance leads to strain and long-term health concerns, such as hypertension (3, 4).

According to Rugulies, Aust (5), the effort-reward imbalance is the leading cause of mental health disorders. Several studies have identified the effects of effort-reward imbalance on health outcomes, such as sleep disturbance and fatigue (6, 7), suicidal ideation (8, 9), depressive mode and work-life balance (10), and diabetes and obesity (11). Similarly, Juvani et al. (12) found that among work stressors, effort-reward imbalance and injustice increase the risk of disability, while injustice itself leads to effort-reward imbalance. Several investigations have been conducted on the impact of effort-reward imbalance on health and wellbeing (i.e., diabetes, depression, suicidal ideation, hair cortisol, psychological health, and physiological health) (13, 14), but the factors causing effort-reward imbalance have been scarcely investigated. Among them, Heckenberg et al. (15) investigated employee traits, and found that employees with the mindfulness trait are less prone to stress; while Porru et al. (16) argued that employees with over-commitment tend to get more stressed. Therefore, to reduce occupational stress, employees use different tactics, such as smoking (17), alcohol use (18), and medical leave (19, 20).

Of late, social media is being used to release stress (21–23). However, the effect of social media on coping with stress has been investigated in the setting of students and patients only (21–23). None of the studies has identified the role of social media in the context of occupational stress (effort-reward imbalance). According to global social media statistics, about 4.48 billion people are using social media actively in 2021; whereas Malaysian statistics of social media users report 86% of the population is using social media. Social media, in terms of health improvement, is being studied; it includes coping with stress (24, 25), social support (26), stress identifiers (26), and stress releasers (22). Thus, social media is a broad platform, and its effects on occupational stress, such as that caused by effort-reward imbalance, cannot be ignored.

To identify the role of social media activities by employees, the first objective of this study is to measure the effect of stress related to effort-reward imbalance on the health and wellbeing of office employees. We investigated this aspect in the context of office employees because of their online work. They spend most of their time online using laptops and androids/tablets. The second objective of the study is to identify the effect of social media activities on the job reward of office employees.

This study has two major managerial implications. By identifying the negative effect of social media on job reward, the study evinces employee's social life interference in job reward determination. Hence, job reward that is less than the job effort generate stress within employees. Consequently, adverse employee health lowers their productivity, specifically, and the organization, as a whole. However, this managerial problem can be mitigated in two ways: first, organizations can investigate their managerial decisions, which are influenced by the social media activities of employees; and second, managers can ensure necessary measures are taken to separate employee's professional life from their personal and social life. In addition, employees should be briefed about social media usage in safety training, so that their job reward is not influenced by their social media activities.

This study adds to the body of knowledge on social media activities, which can be used by other studies to measure usage of social media and to identify its impact on other relevant constructs, such as organizational performance and organizational goodwill, among others. This study identifies two new relationships: one is between social media activities and job reward, and the other is how social media activities moderate the relationship between effort-reward imbalance and the health and wellbeing of office employees. The underpinning theory in this study is the conservation of resources (COR) theory.

The remainder of the study is organized as follows: in the next section, the background of the study and research hypotheses are given. This is followed by research methodology and data analysis, with the results presented after that. Findings, discussion and conclusion are given in the final section.

THEORETICAL BACKGROUND AND HYPOTHESES

This study is based on the COR model (27, 28) that has been frequently used to explain the phenomena of stress in a range of settings (29–32). This is a resource-based model and proposes that people are motivated to acquire new resources (acquisition) in addition to retain, accumulate and preserve their existing resources (conservation). Resources are those

things which people value, such as status, energy, condition and objects (33). Resources are divided into four categories (28): energy resources, such as knowledge, money and time; work resources, such as job status and reputation; material resources, such as financial and material stability; and personal resources, such as optimism as well as interpersonal resources, such as friendship and feeling valuable to others (34). This theory supposes that individuals select resources appropriately in order to maximize existing resources and to avoid future loss (27, 28, 35). Several studies have successfully applied the COR theory (36–38). For example, Halbesleben and Bowler (39) demonstrated that a higher stressor generates higher value to obtain resources in which social support is obtained through social exchange. Similarly, individuals acquire social support through social media forums, specifically in response to stress (40). According to the COR theory (41), individuals are goal-oriented and have the motivation to acquire resources, likewise, employees are motivated in the organizations to please their superiors / supervisors to gain job rewards, to get relaxation in job efforts, to initiate and maintain relationships, status building, and to release job stress (42, 43). George et al. (44) evinced that social media networking helps individuals to release stress. Specifically, they turn to social media in their down-time (stressed due to effort-reward imbalance). They disclose about themselves on social media (45, 46) for social acceptance and to get sympathy/suggestions (resources) (47). These acquired resources can generate new rewards (resources) as well as replenish expected job rewards (existing resources) (48). Therefore, COR theory supports in modeling the effect of social media activities (acquired resources) on job effort and rewards imbalance (ERI), and in moderating the relationship between ERI and health and wellbeing. Further, it is also concluded that individuals conserve and acquire resources through social media activities and these resources affect their job rewards. The proposed model of this study is as in **Figure 1**.

Research Hypotheses

Evidence suggests that social networking sites (SNS) is altering social dynamics at both the micro- and macro-levels, with both online and offline consequences (49, 50). Because online social networking has become so prevalent, SNS users report a higher level of emotional support and camaraderie than average Internet users. Social media activities include self-disclosure; expression of feelings, emotions, opinions, anger and happiness; reacting to other social media posts; and reacting to other comments via likes, dislikes and complements (51–55). Social media activities are part of one's private life and individuals use these activities to gain social support and conserve resources (i.e., social capital, social status, and image building through self-disclosure, to gain information etc.). Users engage in social media activities related to personal, social and work life, according to the COR theory (29, 32, 56). In previous studies, it has been found that individuals use social media disclosure to gain social rewards in the form of gratifications and satisfaction (57, 58); and extrinsic and intrinsic rewards (49, 59). Furthermore, social media networking and activities affect peers / colleagues' behavior (60), which consequently affect superior's decisions related to job reward (61). Therefore, it cannot be concluded that user's intention to increase job rewards will actually increase rewards. This depends on user's COR since the theory proposes that individuals lacking in resources are vulnerable to experiencing loss spirals, whereas those with a lot of resources gain even more resources (48). Loss spirals as explained Sayre et al. (62) and Hobfoll (40), occurs when individuals expand resources but these resources are not available to cope with future loss threats. Therefore, in line with previous findings, in this study, we hypothesize that:

H1: Social media activities related to work life affect job reward.

H2: Social media activities related to personal and social life affect job reward.

Job reward lesser than job efforts, lead to effort-reward imbalance (63). Consequently, effort-reward imbalance generates stress (2). To release this stress, in their down-time, firstly, employees seek support from social media (58, 64–66). Through social media activities, individuals make comparisons (67). Subsequently, if individuals find themselves better than others, they feel satisfied, but if they determine their worth as lower than others, they get more depressed (68, 69). Secondly, individuals release stress by sharing their feelings of frustration and suffering on social media networks (70), and get sympathy and suggestions from social media friends (71). Accordingly, they reduce their job efforts, but in some cases, job efforts adversely affect health and wellbeing (72). This shows that social media activities moderate the effects of effort-reward imbalance on health and wellbeing. Therefore, we hypothesize that:

H3: Social media activities related to social and personal life significantly moderate the relationship between effort-reward imbalance and health and wellbeing.

H4: Social media activities related to work life significantly moderate the relationship between effort-reward imbalance and health and wellbeing.

H5: Job effort-reward imbalance has a significantly negative impact on health and wellbeing.

H6: Job effort has a significantly negative effect on health and wellbeing.

H7: Job reward has a significantly positive effect on health and wellbeing.

On the probability of getting benefits or losses from social media activities, the COR theory proposes its effect on health and wellbeing (40). Social media activities involve social comparisons (67, 73–76). The social comparison theory proposes that individuals determine their values based on how they stack up in comparison to others (76). If individuals find themselves deprived of resources, such as income and health during social comparisons, it will have an adverse effect on their health (77). Pham-Kanter (78) argued that during social comparisons, individuals find their relative position and this relative position affects health and wellbeing; it has also been found that very low position leads to cardiovascular morbidity and ulcers; while very high position decreases the probability of hypertension (78). Bao et al. (79) found negative effects of social media on wellbeing. Heidrich and Ryff (80) evinced that the effect of social comparison on health depends on upward and downward

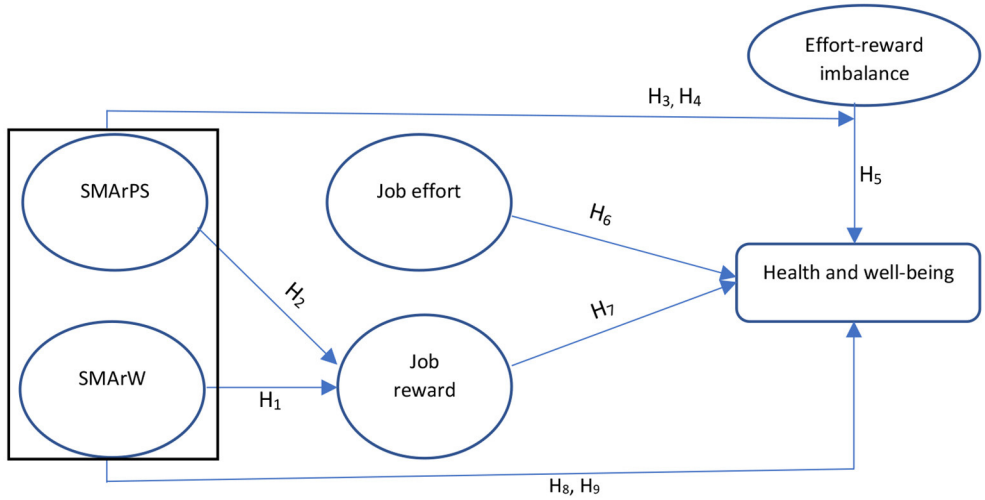

FIGURE 1 | The conceptual framework: Social media activities moderating the association between effort-reward imbalance and health & well-being.

comparisons; further, they added that more frequent social comparisons worsen health. Hence, it is hypothesized that:

H8: Social media activities related to work affect health and wellbeing.

H9: Social media activities related to personal and social life influence health and wellbeing.

RESEARCH METHODOLOGY

To achieve the objectives of the study, quantitative research method was used mainly. Therefore, the data was collected through an online survey using a questionnaire. The respondents were approached by online mode through LinkedIn application and emails. But beforehand, in-depth interviews were conducted in order to develop new measurement items and constructs used in this study. Measurement items were developed and the questionnaire was constructed following the guidelines provided by Dillman (81) and Hinkin (82). To measure health and wellbeing, a scale developed by VanderWeele (83) was adopted and extended by adding four items: (i) If you have sleeping disorders, how would you rate it?; (ii) If you have difficulty with remembering, how would you rate it?; (iii) If you have concentration problems, how would you rate it?; and (iv) If you have experienced stomach disorder, how would you rate it? Four items related to mental health were adopted from the questionnaire of Copenhagen psychosocial questionnaire (Version III): (i) If you experienced neck/shoulder pain, how uncomfortable is this?; (ii) If you have experienced lower back pain, how uncomfortable is this?; (iii) If you have experienced eye strain (blurred vision/headache), how uncomfortable is this?; and (iv) If you have experienced leg pain, how uncomfortable is this?." Items related to musculoskeletal health were adopted from a questionnaire from Cornell university (84) and measured on a scale ranging from 0 to 10.

Items related to effort-reward imbalance were adopted from Siegrist, Starke (63). Four items for job effort and seven items for job reward, measured on a 5-point-likert scale, ranging from strongly disagree to strongly agree, were adopted from Siegrist et al. (63). Effort-reward imbalance was calculated according to the formula: $e/(r \times c)$, where c is the ratio of the number of items (here: 4/7) (63, 85).

For items related to social media activities, a survey instrument was prepared to measure the following two dimensions of social media activities of employees: social media activities related to personal life; and social media activities related to professional life, based on a comprehensive review of literature. Initially, in-depth interviews were conducted with five office employees from the oil and gas industry in Malaysia. The five interviewees were selected based on their 5 years' experience as office employees in the industry. They provided information based on their actual knowledge and experiences. Then, 12 items were developed based on interviews and literature review.

For content validity, the questionnaire was sent to three industry experts, two policy experts and three academic experts. Based on the expert's evaluation, item content validity (I-CVI) and scale content validity (S-CVI) were calculated and the results were favorable as each item was found to be valid by obtaining a score >0.78 (86). Content validity was 0.94 for relevancy and 0.98 for simplicity, i.e., greater than the standard criteria of 0.90 recommended by Polit and Beck (86).

Then, for content validity, the questionnaire was pilot tested by collecting data from 70 office employees selected randomly. After removing responses with missing values, 66 responses were used to test for reliability of the questionnaire through Cronbach' alpha via SPSS. Reliability of the questionnaire was confirmed through Cronbach's alpha of ≥ 0.75. After this, stratified random sampling technique was used to collect data from 471 office employees in small, medium and large companies, who carried out operations in exploration, production and development.

Responses with missing values and same responses (neutral for each question) were removed from the data. The remaining 424 responses were used for further data analysis. Normality of the data was tested through skewness and kurtosis. Herman's single factor test was used for common method bias (CMB). CMB basically occurs in survey research when all data (independent variables, dependent variables and mediating and moderating variables) are collected using the same method (87, 88). Data free from CMB is necessary for accuracy of the results; otherwise, it can bias the reliability and validity of the measures (89), as well as the estimates of the effects in regression (90).

Exploratory factor analysis was then used to reduce the summarized information contained in the observed variables of health and wellbeing and social media activities, and to identify theoretically meaningful constructs (91, 92).

The factor structure derived from exploratory factor analysis (EFA) was used to specify the measurement model using confirmatory factor analysis (CFA). CFA is a statistical technique which is used to verify the factor structure of a set of observed variables (93, 94). CFA was carried out using SPSS and smart PLS. According to Hubley and Zumbo (95), construct validity comprises convergent and discriminant validity. Therefore, convergent validity was assessed using average variance extracted (AVE), i.e., total of all standardized factor loadings divided by the number of items in each factor (96). Discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio as suggested by Henseler et al. (97). Finally, through sequential regression, the effect of social media activities on job reward and the effect of job reward on health and wellbeing were measured. Further, the moderating effect of social media activities on the relationship between effort-reward imbalance and health and wellbeing was tested.

RESULTS

Demographic Results

The sample of this study comprises 424 office employees working in the oil and gas industry in Malaysia. Their demographic profile is presented in **Table 1**. Male respondents constitute 66.7% and female respondents comprise 33.3%. About 97.6% of the respondents are Malaysian nationals, and the remaining (2.4%) are from other countries. As for age group, more than 70% of the respondents are 31 to 50 years. Of this, 41.5% are from the age group of 31 to 40 years; 30.7% are in the 41 to 50 years age group; 17.5% are in the 21 to 30 years age group; and 10.4% are from the age group of 51 to 60 years. Statistics of education show that respondents with bachelor's degree constitute 68.4% and 21% have a master's level of education, while 4.5% have a PhD degree, 2.1% are diploma holders, and 4% have different levels of education, such as foundation and professional qualifications. In terms of job experience, more than 70% of the respondents have more than 8 years, and 12.5% have job experience of 2 to 4 years. Based on the designation, executives account for 41.3% of the study sample; 36.1% are middle managers; 20.8% are top managers; and non-executives comprise 1.9%. About 90.6% of the respondents are permanent employees; and 9.4% work on a contract basis.

TABLE 1 | Respondent's demographic characteristics.

Demographic	Frequency	Percentage
Gender		
Male	283	66.7
Female	141	33.3
Nationality		
Malaysian	414	97.6
Others	10	2.4
Age		
21–30 years	74	17.5
31–40 years	176	41.5
41–50 years	130	30.7
51–60 years	44	10.4
Education		
Diploma	9	2.1
Bachelor degree	290	68.4
Master degree	89	21.0
PhD	19	4.5
Others	17	4.0
Job experience		
<2 years	4	0.9
<2 to 4 years	53	12.5
<4 to 6 years	35	8.3
<6 to 8 years	34	8.0
<8 years	298	70.3
Designation		
Top manager	88	20.8
Middle manager	153	36.1
Executive	175	41.3
Non-executive	8	1.9
Job status		
Permanent	384	90.6
Contract	40	9.4

Exploratory Factor Analysis Results

EFA was used to understand the factor structure and for item reduction (98). Initially, 21 items were used for the factor structure for the health and wellbeing construct (**Table 2**). This resulted in six factors but three items were interdependent. Therefore, the three items related to the factor of general health were removed and EFA was conducted again using varimax rotation (98) based on eigen value of >1. Consequently, 19 items with six factors (happiness and life satisfaction, character and virtue, close social relationship, mental health, musculoskeletal health, and financial and material stability) were extracted; the factor loading for each item was >0.40 (99, 100). Kaiser-Meyer-Olkin (KMO) and Barlett's test of Sphericity value of 0.78, which is >0.5, indicates the sample is adequate to conduct EFA (101), which was conducted for the social media activities construct. For this, two factors (social media activities related to personal and social life (five items), and social media activities related to work life (five items), were extracted based on eigen value >1 (**Table 3**). Factor loading was > 0.40 and the sample was adequate

TABLE 2 | Factor loadings by EFA of Health and wellbeing.

Domain	Items	1	2	3	4	5	6
Happiness and life satisfaction	Overall, how satisfied are you with life as a whole these days?	0.853					
	In general, how happy do you usually feel?	0.841					
Character and virtue	I always act to promote good in all circumstances, even in difficult and challenging situations.		0.801				
	I am always able to give up some happiness now for greater happiness later.		0.739				
Close social relationships	I am content with my friendships.			0.899			
	I am content with my relationships.			0.870			
	My relationships are as satisfying as I would want them to be.			0.858			
Mental health	If you have sleeping disorders, how frequently do you experience it?				0.851		
	If you have difficulty with remembering things, how frequently do you experience this?				0.803		
	If you have concentration problem, how frequently do you experience this?				0.694		
	If you experienced eye strain (Blurred vision/headache), how frequently you suffer?				0.668		
Musculoskeletal health	If you experienced neck pain, how would you rate it?					0.925	
	If you experienced upper back pain, how would you rate it?					0.897	
	If you experienced lower back pain, how would you rate it?					0.871	
	If you experienced legs pain, how would you rate it?					0.636	
Financial and material stability	How often do you worry about being able to meet normal monthly living expenses?						0.798
	How often do you worry about safety?						0.794
	How often do you worry about food?						0.778
	How often do you worry about housing?						0.773

to conduct the analysis as the value of KMO and Barlett's test was >0.50 (**Table 4**).

Confirmatory Factor Analysis Results

Factors identified through CFA were verified. For CFA, the model was fit as a reflective measurement model (**Table 5**). Outer loadings for all the items of >0.40, AVE of >0.50, and reliability measures of >0.70, were found as recommended by Darsono et al. (102).

Reflective Measurement Model

The results of the reflective measurement model presented in **Table 5** exhibit the values of outer loading ranged from 0.61 to 0.92 for all the indicators of latent constructs. The outer loadings value > 0.70 indicates reliability of the items in the latent construct (103). However, the values between 0.40 and below 0.70 also considered as reliable if the deletion not leads to an increase in composite reliability and average variance extracted (103). Therefore, the items with outer loadings ranged from 0.61 to below 0.70 were not eliminated from the model because the removal was causing reduction in the overall reliability of the model.

Reliability and Validity Results

Unidimensionality of the constructs were measured through Cronbach's alpha. As shown in **Table 5**, value of Cronbach's alpha

TABLE 3 | Factor loadings by EFA of Social media activity.

Domain	Items	1	2
Social media activities related to personal and social life	I am an active social media user	0.547	
	I do share about my interests on social media freely	0.806	
	I share my opinions about different things on social media freely	0.814	
	I do not hide my interests on social media	0.724	
	I like reactions by people on my social media posts	0.493	
Social media activities related to work	I often share my work-related happiness on social media		0.599
	I often share my work promotions and achievements on social media		0.669
	I often share work related sufferings on social media		0.847
	I share work related injustice on social media		0.856
	I keep an eye about my workmate's activities on social media		0.907

TABLE 4 | KMO and Bartlett's test.

Kaiser-Meyer-Olkin measure of sampling adequacy.	0.787	
Bartlett's test of Sphericity	Approx. Chi-Square	5289.902
	df	171
	Sig.	0.000

is between 0.70 and 0.93. which is greater than the recommended threshold value of 0.70 (101, 104). Composite reliability measures the extent to which a set of construct item's share in measuring the construct. The threshold value for composite reliability is $\geq$ 0.70 (105), and the value of composite reliability in this study ranges from 0.80 to 0.94.

Discriminant validity was assessed through the HTMT ratio (97) for reflective constructs. The value of HTMT ratio should be $<$0.90 (106) for discriminant validity, and this study met the criteria as shown in **Table 6**.

Moderating Effect

Figure 2 shows that negative relationship between effort-reward imbalance and health and wellbeing is decreased by social media activities related to work life. Whereas, social media activities related to personal and social life strengthen the negative relationship between effort-reward imbalance and health and wellbeing (**Figure 3**).

Common Method Bias

According to Podsakoff and Organ (88), CMB can occur in research if data of all the variables related to one study are collected through the same method. It can affect accuracy and robustness of the results. Therefore, to detect CMB, EFA was used, whereby all the study items were grouped into a single factor (107). It was found that one factor accounts for 14.6% of the variance, which is less than the recommended 50%. Thus, the data used for hypotheses testing in this study does not suffer from CMB.

Path Analysis Results

The results of the structural model show (**Table 7**) that job reward is affected by social media activities related to work and personal and social life. Both the variables account for 28% variation in the job reward. Social media activities related to personal and social life decrease job reward by 55% at the 1% level of significance; while the effect of social media activities on work life increases job reward by 5% but insignificantly.

Job efforts significantly decrease health and wellbeing by 10%; while job reward increases health and wellbeing by 15% significantly. Effort-reward imbalance decreases health and wellbeing by 59%. Social media activities related to work increase the effect of effort-reward imbalance on health and wellbeing by 17.6% significantly; while social media activities related to personal and social life decrease the effect of effort-reward imbalance on health and wellbeing by 12% at the 5% level of significance. The R-squared value shows a 63% variation in health and wellbeing due to the independent and moderating variables.

DISCUSSION AND CONCLUSION

Social media is increasingly penetrating every aspect of people's lives and affects their health and wellbeing (79), be it personal, social or professional (108). In this regard, this study evidenced intervention of employee's personal and social life into their professional lives such as effort-reward imbalance through social media activities. The study highlights the rational behavior of the employees on social media in influencing their job rewards. However, it indicates malpractices of rewarding in the organizations, which need to be addressed. Further, this study explains the behavior of the employees on social media in managing their stress related to effort-reward imbalance through online comparisons and underpinning theory of conservation of resources.

Findings from the interviews revealed social media behavior of the office employees. We find that social media has become a necessity. Employees use social media to get information (109–111) about peers, superiors, bosses and the organization. For this purpose, they follow social media timeline of their workmates

TABLE 5 | Results of reflective measurement model.

Latent variables	Item indicators	Outer loadings	VIF	Cronbach's α	CR	AVE
Social media activities related to work life	SMArW1	0.659	1.566	0.791	0.852	0.538
	SMArW2	0.724	1.808			
	SMArW3	0.862	2.438			
	SMArW4	0.61	1.487			
	SMArW5	0.786	1.465			
Social media activities related to personal and social life	SMArPS1	0.872	2.978	0.93	0.947	0.78
	SMArPS2	0.897	3.384			
	SMArPS3	0.894	3.317			
	SMArPS4	0.873	2.948			
	SMArPS5	0.881	3.112			
Job efforts	JE1	0.755	1.369	0.699	0.8	0.501
	JE2	0.676	2.091			
	JE3	0.709	2.037			
	JE4	0.688	1.077			
Job rewards	JR1	0.858	3.095	0.916	0.933	0.666
	JR2	0.75	2.014			
	JR3	0.752	1.863			
	JR4	0.819	2.291			
	JR5	0.853	3.126			
	JR6	0.845	2.93			
	JR7	0.826	2.686			
Effort-reward imbalance	ERI	1	1	1	1	1
Health and wellbeing	HW			0.905	0.90	0.509
Happiness and life satisfaction	HW1HLS1	0.931	2.41	0.867	0.937	0.882
	HW2HLS2	0.948	2.41			
Character and virtue	HW3CV1	0.891	1.635	0.768	0.896	0.811
	HW4CV2	0.910	1.635			
Close social relationships	HW5CSR1	0.869	1.781	0.797	0.908	0.831
	HW6CSR2	0.898	1.781			
	HW7CSR3	0.922	3.716			
Financial and material stability	HW8FMS1	0.848	1.99	0.863	0.907	0.708
	HW9 FMS2	0.842	2.077			
	HW10FMS3	0.880	2.344			
	HW11FMS4	0.795	1.851			
Mental health	HW12MH1	0.725	1.354	0.831	0.889	0.667
	HW13MH2	0.797	1.889			
	HW14MH3	0.885	3.184			
	HW15MH4	0.851	2.542			
Musculoskeletal health	HW16MsH1	0.898	2.396	0.812	0.889	0.73
	HW18MsH3	0.919	3			
	HW19MsH4	0.676	1.525			

and other people of interest. Related to their behavior of sharing / disclosing on social media, it is found that individuals freely share about their personal lives (happiness, sufferings and other activities) whereas they are careful in sharing about their work life. Thus, it demonstrates that individual's social media activities differ in terms of personal and work life. This is supported by the results of exploratory and confirmatory factor analysis, the tests for validating the questionnaire.

Through path analysis, we find that social media activities related to personal and social life increase the effect of stress related to job effort-reward imbalance on health and wellbeing. One of the potential reasons could be social comparisons on social media (68, 69, 112). This is because when people compare their lives with others on social media, and find themselves not better off in terms of income, reputation and enjoyment, they feel dissatisfied. Dissatisfaction increases stress and deteriorate

TABLE 6 | Hetrotrait-monotrait ratio.

	CSR	CV	ERI	FMS	HLS	HW	JE	JR	MH	MSH	SMArPS	SMArPS*ERI	SMArW	SMArW*ERI
CSR														
CV	0.614													
ERI	0.361	0.404												
FMS	0.251	0.229	0.304											
HLS	0.555	0.688	0.547	0.318										
HW	0.801	0.762	0.744	0.628	0.794									
JE	0.394	0.451	0.16	0.118	0.292	0.43								
JR	0.344	0.439	0.468	0.214	0.428	0.566	0.39							
MH	0.446	0.443	0.677	0.134	0.446	0.867	0.372	0.513						
MSH	0.159	0.103	0.545	0.091	0.193	0.638	0.137	0.279	0.578					
SMArPS	0.425	0.484	0.477	0.23	0.401	0.618	0.524	0.573	0.576	0.302				
SMArPS*ERI	0.12	0.038	0.069	0.058	0.109	0.135	0.102	0.122	0.083	0.116	0.237			
SMArW	0.313	0.239	0.052	0.125	0.165	0.27	0.505	0.141	0.16	0.081	0.358	0.164		
SMArW*ERI	0.087	0.109	0.282	0.039	0.046	0.084	0.131	0.043	0.036	0.056	0.114	0.425	0.091	

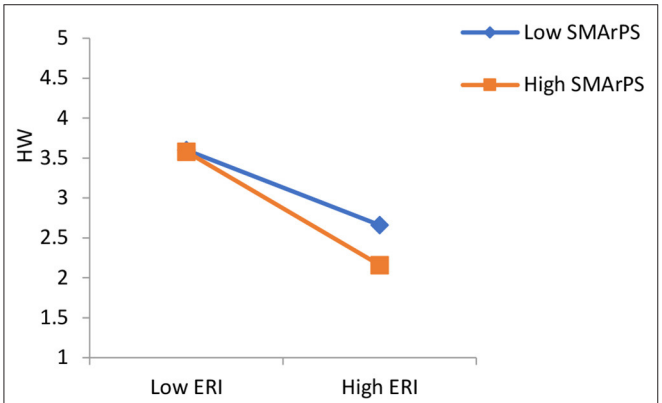

FIGURE 2 | The moderating effect of SMArPS on the relationship between ERI and HW.

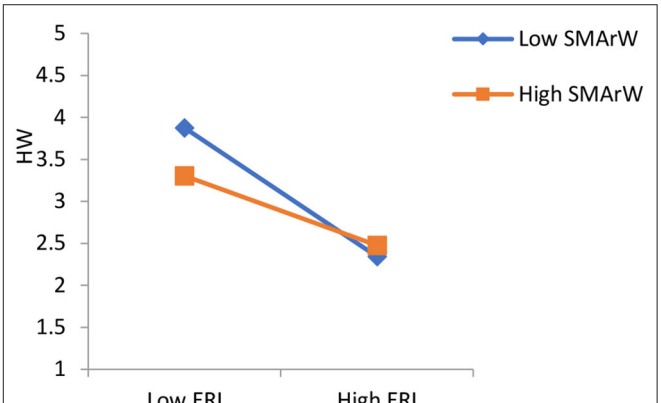

FIGURE 3 | The moderating effect of SMArW on the relationship between ERI and HW.

health. On the other hand, social media activities related to personal and social life decrease job reward; this may be due to employees sharing their personal and social life and their perception of superiors on social media. This perception could be due to the personality of the employee depicted through social media, whereby the boss does not consider him or her suitable for promotion to a higher post. Another reason could be the jealousy factor raised by making his/her life's comparison with the employee's personal and social life. This affects superior's decisions in terms of obliging employees, such as granting vacation and promotion to the employee.

Social media activities related to work life reduce stress related to effort-reward imbalance on health and wellbeing. It shows that employees release stress by sharing their sufferings related to job, looking at peer's social media posts and by receiving sympathies to their own social media sharing. Therefore, through social media activities employees build personal relations to the superiors and via this unofficial forum convey their messages related to injustice in balancing job effort-rewards. Which, decreases the effects (68, 69) of effort-reward imbalance on health and wellbeing. Another reason could be the age of employees, as it has also been posited by other studies that stress among young adults is greater (113) than older adults, where more than 50% of the respondents were young adults in this study with the age group of 21 to 40 years.

Further, in this study, the results of effort-reward imbalance and job efforts affecting health and wellbeing negatively, are consistent with previous findings, such as Leineweber et al. (19), Siegrist and Li (114), Sparks et al. (115) and Haley and Miller (116). The results of the positive relationship between job reward and health and wellbeing are in line with other studies (117–120). However, in this study, we find both financial and non-financial job rewards affect health and wellbeing positively; whereas in the previous mentioned studies, only financial incentives were studied as job reward. Therefore, this study validates the findings of Giles, Becker (117); Paul-Ebhohimhen and Avenell (119);

TABLE 7 | Structural model results.

Hypothesis	STD coefficient (β)	SE	R^2	Results
H_1:SMArW→ JR	0.050	0.048	0.28	Rejected
H_2:SMArPS→ JR	−0.55*	0.042		Accepted
H_3:SMArW*ERI→ HW (Moderating effect)	0.176*	0.047	0.63	Accepted
H_4:ERI→ HW	−0.59*	0.042		Accepted
H_5:JE→ HW	−0.10*	0.034		Accepted
H_6:JR→ HW	0.15*	0.039		Accepted
H_7:SMArPS*ERI→ HW (Moderating effect)	−0.12**	0.046		Accepted
H_8: SMArPS→ HW	−0.13*	0.042		Accepted
H_9: SMArW→ HW	−0.11*	0.040		Accepted

*1% level of significant, **5% level of significant.

Giles, Robalino (118) and Wall, Mhurchu (120), in the context of office employees in Malaysia.

Hence, it is concluded that social media activities affect health and wellbeing of office employees as well as cause occupational stress, which arises through effort-reward imbalance; while the effect of social media activities in moderating the effect of effort-reward imbalance on health and wellbeing is different for social media activities related to work life and social media activities related to personal and social life. Further, the effect of social media activities related to personal and social life on job rewards indicates employee's private life intervenes in their professional life, which is a major risk to social freedom, and to the health and wellbeing of employees.

Theoretical Implications

This study expands the underpinning theory of COR. Previously, it was found that social media activities, such as networking, sharing of feelings, disclosing about oneself, and relationship building, serve as an energy resource to obtain valued resources in response to stress (56, 70). However, these social media resources returned in the form of compliments negatively affect health and wellbeing of the employees. As for experiencing loss spirals (40), it occurs when resources are expanded but are not available to cope with future loss threats and can potentially lead to further loss (48). Similarly, this study identifies the increasing effects of effort-reward imbalance on health and wellbeing, moderated by social media activities related to personal and social life.

Managerial Implications

The study findings are critical for health and wellbeing of the employees, employers and the policy makers. This study identified effort-reward imbalance which has negative effect on health and wellbeing of the office employees in oil and gas industry Malaysia. Therefore, appropriate measures should be taken to balance the job efforts and job rewards, and to improve health and wellbeing of the office employees. Moreover, management can balance the efforts and reward by reducing job efforts through improvements in job design. The negative effect of social media activities on health and wellbeing embodies problematic social media behavior of the employees, which needs to be investigated in future academic research and by the department of research and development in the organization.

Furthermore, significant moderating effect of social media activities on the relationship between effort-reward imbalance and health and wellbeing indicates intervention of employee's personal life into professional life. Such as positive effect of social media activities related work life increases job rewards. On the other hand, social media activities related to personal and social life decreases job rewards. Therefore, necessary measures should be taken by the employer to reduce the intervention of employee's personal life into work life. In this regard, firstly, the study suggests monitoring of superior's behavior in managing organizational employees at each level, especially in determining job rewards. Secondly, organizations need to ensure employee's professional life is separated from their personal and social life, so that employees can concentrate on their office work without having the tension of integrating private life into professional life. Thirdly, the subject of safe social media behavior must be included in trainings related to safety behavior in the organization, so that stress among employees generated from social media activities, for example, by social comparisons, misleading information and fake compliments, could be minimized.

The study produces the prevalent factors of psychosocial hazards in existing practices of the office employees and the management. Such as social media activities related to personal, social and professional life in effecting effort-reward imbalance and moderating its effect on health and wellbeing. Role of social media activities which is intervening personal and social lives of the employees into professional lives, can be addressed in the health and safety policies of the organizations. So, that we can remove the association of social media activities and management decisions, that is increasing the effect of psychosocial hazards (effort-reward imbalance) on health and wellbeing.

Limitations and Future Research

This study could be enhanced in future by investigating and validating the moderating effect of social media activities related to personal, social and work life, on the relationship between effort-reward imbalance and health and wellbeing, in different cultural settings, organizations, and level of employees in the organization. This study was conducted in the context of office employees, as they have more likelihood of engaging with social media activities due to the nature of office work being online for them. Secondly, this study is cross-sectional; the results of this study can be validated in longitudinal study settings and by increasing sample size.

Further, in this study, respondents aged 21 to 40 years are vulnerable social media users. The results for older

employees may be different because they are prostrate in social media networking, and this can be investigated in future for additional findings.

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 Management and Humanities, University Technology PETRONAS, Malaysia. The patients/participants provided their written informed consent to participate in this study. 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

NK contributed in write-up, literature review, data collection, and data analysis. AI reviewed, funded, and supervised the research work. All authors contributed to the article and approved the submitted version.

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Attention to Progression Principles and Variables of Exercise Prescription in Workplace-Related Resistance Training Interventions: A Systematic Review of Controlled Trials

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Background: The workplace is an important setting for adult health promotion including exercise training such as resistance training (RT). Since the reporting of exercise training interventions is generally inconsistent, the objective of this systematic review was to investigate the attention to principles of RT progression and variables of RT exercise prescription in workplace-related RT interventions.

Methods: A systematic literature search was conducted in the databases LIVIVO, PubMed, SPORTDiscus, and Web of Science (2000–2020). Controlled trials with apparently healthy "employees" and a main focus on RT were included. RT principles and variables were extracted and rated by two reviewers (reported, not reported, or unclear). Sum scores for each RT intervention and percentages regarding each principle and variable were calculated.

Results: Overall, 21 articles were included (18 primary studies, 3 protocols). Summarized narratively, the interventions showed different positive effects on strength- or performance-related and/or health- or complaint-related outcomes. The reporting of the RT principles and variables was varied [progressive overload: 94% of the studies, specificity: 78%, variation (periodization): 39%, muscle action: 94%, loading: 94%, volume; 67%, exercise selection: 89%, exercise order: 47%, rest periods between sets: 33%, rest periods between exercises: 27%, repetition velocity: 44%, and frequency: 100%].

Conclusion: Several key RT principles and variables were reported inconsistently, reducing reproducibility and pointing to the need for standardized RT intervention reporting in workplace-related interventions. Exercise science and workplace promotion should be further linked, since accurate reporting is a prerequisite for transferring robust findings into practice.

Keywords: health promotion, workplace, resistance training, reporting, transfer

INTRODUCTION

For years, the workplace has developed into an important setting regarding adult health promotion, as it is one setting of everyday life where health is created and lived (1). Since working adults spend almost half of their waking hours at work (2), large and diverse groups of the population can be reached there. Accordingly, the workplace also offers an environment for health-promoting exercise training (3).

In general, the multiple positive health benefits of physical activity (PA) and fitness training are well documented (4–8). In this respect, workplace-related PA interventions conducted directly at the workplace and, where appropriate, also during working hours, have shown positive effects on, e.g., activity behavior, physical fitness and cardio-metabolic health, musculoskeletal disorders, and the prevention of work-related pain (9–13). They improve overall well-being and work ability, reduce sickness absenteeism and sick leave, and can generate a positive financial return (14–16).

Besides the general health-promoting effects of PA, scientific findings emphasize the independent positive effects of resistance training (RT) on health (17, 18). RT attenuates the age-related decrease in muscle mass and strength (19, 20), improves health-related quality of life (21), and there is an inverse association of muscular strength and fitness with all-cause mortality, even after adjusting for cardiorespiratory fitness or proven risk factors (22–25). Considering the workplace setting, the "medicine" RT (26, 27) shows inter alia positive effects on physical (e.g., pain reduction) and work-related (e.g., productivity) factors of employees (28–33).

However, the mode of exercise training seems to be decisive for achieving positive effects, which is why optimal planning is essential (33). The proper application of training principles leads to improvements of components of fitness or health through physical adaptions. In order to optimize effectiveness so that improvements occur, targeted (resistance) training is supposed to be designed according to basic principles (34–36). A RT program should be systematically altered according to the foremost principles of RT progression to make the body adapt to changing stimuli: progressive overload, specificity, and variation (periodization) (37, 38). Furthermore, proper RT exercise prescription involves several key variables: muscle action, loading, volume, exercise selection, exercise order, rest periods between sets and exercises, repetition velocity, and frequency (37–39). Nevertheless, systematic reviews show that the application and reporting of principles and guidelines of exercise training is inconsistent and could be improved in intervention studies in general (40–45) and in RT studies in particular (46–48).

Given the great potential of workplace-related interventions to reach diverse adult target groups in the context of health promotion, RT interventions in this setting should be reported as comprehensively as possible to facilitate replicability and thus transfer of promising approaches. Thus, based on the outlined state of research, the question of this systematic review was: How are the principles of RT progression and variables of RT exercise prescription applied in studies involving workplace-related RT interventions?

METHODS

This systematic review was conducted in accordance with the PRISMA-recommendations (49, 50).

Inclusion/Exclusion Criteria

The studies were selected according to the PICOS criteria (participants, interventions, comparators, outcomes, study design) (50) as well as setting, language and time frame.

Intervention studies with apparently healthy "employees" (defined as working-age adults in full- or part-time-employment) without restrictions regarding sex or job/type of occupation were taken into account, while studies with specific patient populations or populations focusing on specific diseases or comorbidities were not. To be included, studies must have examined an intervention with at least one study arm with main focus on RT (mentioned in the rationale, hypothesis and/or methods section) conducted within the workplace-context and/or at the workplace ("workplace-related") and had other training forms included for warm-up or cool-down only. Studies with alternative PA interventions without a main RT focus (general fitness training, other training forms, mixed PA interventions) and multicomponent interventions were excluded. Due to the review focus, no restrictions were placed on the comparison groups (no intervention, non-RT intervention, minimal intervention, waitlist control etc.) and the outcome measurements.

Therefore, any prospective research study (experimental design) with a workplace-related RT intervention and a comparator group [randomized controlled trials (RCTs), Cluster RCTs, controlled trials] with no limitation on the length of the intervention or a follow-up was considered. RCTs are generally the most powerful experimental design but to include them alone may be too restrictive to investigate workplace-related RT interventions as many studies occur in naturalistic workplace settings where RCTs are not always possible (51). The language limitation was English or German and the time limitation was from January 2000 to December 2020 due to past developments in the field of health promotion and especially workplace health promotion [e.g., Jakarta Declaration on Leading Health Promotion into the 21st Century (52) and Luxembourg Declaration on Workplace Health Promotion (53)].

Information Sources and Search

A computerized systematic literature search was conducted in LIVIVO, PubMed, SPORTDiscus, and Web of Science at the end of January 2021. Search terms related to workplace interventions (e.g., "worker*," "employe*," and "workplace"), RT (e.g., "resistance," "weight," or "strength" and "training" or "exercise") and controlled trials (e.g., "controlled study" OR "RCT") were used with operators ("OR," "AND," and "NOT) and truncations ("*") with appropriate adjustments for each database (**Supplementary Table 1**).

Study Selection

Articles were imported into the literature management program Rayyan (54). After removing all duplicates, two reviewers (GS and LB) independently screened all titles/abstracts in a first step and full texts in a second step based on the inclusion/exclusion criteria. Any disagreements were resolved by consensus or consulting with a third reviewer (OM). If the full texts were secondary analyses, the corresponding primary studies were additionally searched for and included instead (if eligible and not already included). If underlying study protocols were mentioned, these were additionally used for data collection regarding the RT intervention.

Data Collection and Items

On a first constructed form, the following study characteristics were extracted: name of first author and year, study design, study sample [including occupation description, baseline sample size, sex, and age (years)], RT intervention (general description of all study interventions and period, frequency and duration, location, and supervision of the RT study arm). In addition, significant effects of the included RT interventions were listed with respect to the control group with a focus on the intervention period only (without considering possible follow-ups).

Using a second constructed form, principles of RT progression (37, 38) and variables of RT exercise prescription (37–39) were extracted from the methods sections of the included articles or additionally from the underlying study protocols, respectively, and rated independently by two reviewers (GS and LB) according to the working understandings (**Tables 1**, **2**). Principles and variables were rated as follows: yes (+) "reported/applied," no (−) "not reported/not applied," or unclear (?) if it was unclear or inconsistent whether a principle/variable was reported/applied. "Not applicable" (na) was recorded for "exercise order" and "rest between exercises" if only one exercise was used and for "rest between sets" if only single sets were used. Disagreements were resolved through personal communication or consulting with a third reviewer (OM).

Study Quality

All included studies were subjected to the Effective Public Health Practice Project's (EPHPP) quality assessment tool for quantitative studies (55, 56). Two reviewers (LB and OM) independently assessed the quality of the studies reaching consensus through discussion [consulting a third reviewer in case of uncertainties (GS)]. According to the EPHPP

TABLE 1 | Principles of resistance training progression (working understandings).

Principle	Working understanding
Progressive overload (prog over)	Gradually and systematically increasing the stress on the body during training by changing one or more training variables, which is necessary for further improvement
Specificity (spec)	Specificity is the physiological adaptation to the type of stimulus applied, which is why effective programmes are designed to target-specific training goals
Variation (periodization) (per)	Training variation, or periodization, describes the systematic process of making changes to one or more program variables over time to keep the training stimulus challenging and effective
Classical	High training volume and low intensity at the beginning, while in the course of the training the volume decreases and the intensity increases
Reverse	Intensity is initially at its highest and volume at its lowest, while the intensity decreases and the volume increases as the training progresses
Undulating	Allows variation of volume and intensity by rotating different protocols to train different components of neuromuscular performance within one cycle

Compare Ratamess et al. (37) and Kraemer and Ratamess (38).

TABLE 2 | Variables of resistance training exercise prescription (working understandings).

Variable		Working understanding
Muscle action (m act)		Most resistance training programs primarily involve dynamic repetitions with both concentric and eccentric muscle actions (whereas isometric actions play a secondary role)
Loading (load)		Proper loading increase follows e.g. one or more of the following schemes: based on a percentage of the one-repetition maximum, based on a targeted repetition number, or within a prescribed repetition zone
Volume (vol)		Summation of the total number of repetitions and sets performed during one training session (thus also determined by the number of exercises)
Exercise selection (ex sel)		Selection based on multiple modalities (single- and multiple-joint, unilateral and bilateral, and, e.g., free weights or machines etc.) with corresponding exercise specifications
Exercise order (ex ord)		Sequence of exercises, e.g., using a precise scheme (whole-body training, upper/lower body split training and muscle group split training)
Rest periods (r per)	Between sets (bet s)	Varying according to the complexity of the exercise, the training goal (objective for incorporating the exercise into the program) and the training status of the individual
	Between exercises (bet ex)	
Repetition velocity (vel)		Speed at which dynamic exercises are performed, which is given in seconds and the relationship is between the concentric and eccentric phases
Frequency (freq)		Frequency describes the number of workouts within a period of time (depending on several factors such as intensity, volume, training level, training goals, and recovery ability)

Compare Ratamess et al. (37), Kraemer and Ratamess (38), and Bird et al. (39).

dictionary (57), the first six components were included in the assessment (selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts) and rated as weak, moderate or strong. Since it is impossible to blind participants and instructors in RT studies, blinding according to the EPHPP is assessed on two levels: whether the outcome assessor(s) were aware of the intervention or exposure status of participants and whether the study participants were aware of the research question (55). The assessment is based on the extent to which both, one or none are fulfilled (57).

Data Analysis and Synthesis of Results

The significant effects of the study arm(s) with RT in the intervention studies (pre-post, compared to the control group) were summarized narratively.

Reported/applied (+) principles of RT progression and variables of RT exercise prescription were given a score of "1," not reported/not applied (−) and unclear (?) a "0," and not applicable (na) no score. Sum scores of progression principles and exercise prescription variables were calculated and corrected for the number of "na." Percentages of RT intervention descriptions reporting/applying each principle and variable were also calculated (proportion relative to the total number).

RESULTS

Study Selection

The systematic search resulted in 7.427 articles and after removing duplicates and screening titles/abstracts a total of 105 potentially relevant articles were assessed for eligibility. Based on the full-text assessments, 1 additional primary study and 3 study protocols were added, resulting in 21 articles remaining for the qualitative synthesis (18 studies, 3 protocols) (**Figure 1**).

Study Characteristics

Table 3 presents the characteristics of the 18 included primary studies. The majority were RCTs [9 studies (58, 59, 64–67, 69, 70, 73, 74)] and another described as feasibility study (71). Furthermore, there was one non-randomized CT (62) and 6 cluster RCTs (60, 61, 63, 68, 72, 75), with 2 each evaluating a subgroup of the intervention groups in an overarching study (60, 63).

The target groups were diverse in terms of types of occupation, with employees in inactive work environments (e.g., white collar/office desk work, laboratory technicians), physically active jobs (hospital porters, firefighters, army employees, musicians) or also blue collar workers (manufacturing, slaughterhouse, bus drivers). Some studies specified eligible participants in terms of health status or physical complaints (e.g., neck/shoulder or low back pain) whereas others targeted employees generally. The baseline sample size in the studies ranged from 23 (71) to and 549 (61) participants, with four studies including females only (58, 67) or predominantly females (>80%) (59, 75) and 5 studies males only (65, 74) or predominantly males (66, 68, 70), respectively. The majority of studies had, on average, middle-aged samples.

The RT interventions used different materials or equipment, such as dumbbells, elastic bands or machines, in different organizational forms [ranging from, e.g., training consisting of only one exercise or even one single set (59, 65, 66) to circuit training in groups (62)] with the sessions being supervised to varying extents (fully, alternating to minimal, and not at all). The majority of studies were conducted directly at the workplace, although three studies had the option of exercising at home (64, 67, 71). Interventions that included training in groups and/or used larger equipment took place in associated training/therapy departments (65, 66) or in fitness centers/training facilities within the workplace (69, 72, 74) or in close proximity (62), respectively. The intervention periods were between 6 weeks (67) and 12 months (61) with a frequency of at least 1-2 times/week (60, 65) up to sometimes several times/day (60, 72), with most interventions conducting RT 2-3 times/week.

Study Quality and Results

Overall, with 9 out of 18 studies, the majority of studies were rated as moderate (59, 62, 64–66, 68–70, 75), six studies were again rated as weak (58, 60, 61, 63, 71, 74), and the remaining three studies were rated as strong (67, 72, 73) (**Table 3**). In summary, study design and data collection methods were rated as the strongest across all studies, while the distribution of the other components was more varied (weak/moderate/strong) (**Supplementary Table 2**).

Within the workplace-related RT interventions, different positive effects (pre-post-intervention) were reported (**Table 3**).

Significant improvements in (muscular) strength- or performance-related outcomes as a result of RT intervention were reported in 10 studies. Upper limb strength (neck, shoulder, or wrist) after an specific RT program was examined in four studies (58, 59, 67, 73). Comparable to this, four studies examined the strength/endurance of the back or trunk (64–66, 68). The other two studies performed multi-joint exercises to assess strength/performance effects to correspond to the whole-body training conducted in the interventions (62, 74).

Significant improvements regarding pain- or complaint-related outcomes were reported in 13 studies. Most frequently, the intensity and/or duration of neck or upper back/limb pain or headache was examined (eight studies) (58–61, 63, 70, 73, 75), often using variants of a visual analog scale. The other studies assessed either complaints in the lower back or lower extremities or a general pain condition without specifying more precisely the body region (62, 64, 67, 71, 74).

Further different outcomes assessed for which significant improvements were shown included muscle tenderness (59), functional status or mobility (65, 66, 69), well-being (62, 72), work-related outcomes such as disability, functionality, satisfaction, impairment, or absenteeism (60, 62, 70, 73, 74).

In two studies, pre-post improvements also occurred in the control groups, as these were a comparison with regular physiotherapy (66) or a comparison with low-intensity strength training, respectively, although in the latter study, only the high-intensity intervention group also showed significant effects regarding strength (65).

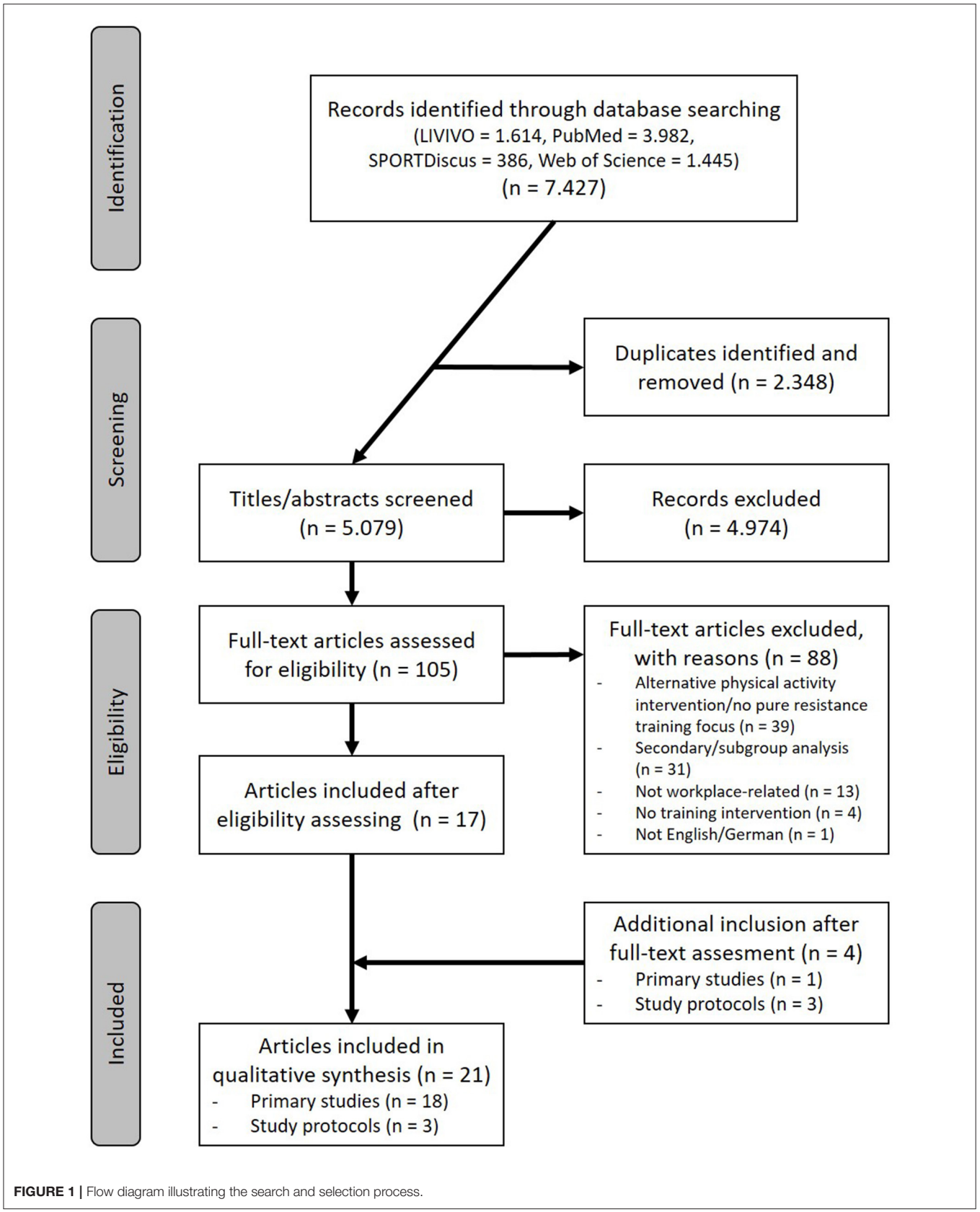

FIGURE 1 | Flow diagram illustrating the search and selection process.

TABLE 3 | Included primary studies.

No	References	Study design	Study sample			Intervention	Significant effects (RT, pre-post-intervention)	Study quality (EPHPP)[a]
			Occupation	**Total: a) baseline sample size, b) sex, c) age (years) Intervention groups: a) baseline sample size, b) sex, c) age (years)**	**General descriptions of interventions**	**RT study arm(s): a) intervention period b) frequency and duration c) location d) supervision**		
1	Andersen et al. (58)	Randomized controlled trial	Employees with monotonous and repetitive tasks (computer work common) and chronic neck muscle pain	Total: a) $n = 48$, b) 100% ♀, c) not sp. IG1:a) $n = 18$, b) 100% ♀, c) 44 ± 9 IG2: a) $n = 16$, b) 100% ♀, c) 45 ± 9 CG: a) $n = 14$, b) 100% ♀, c) 42 ± 8	IG1: high-intensity specific strength training for the neck and shoulder muscles (dumbbell exercises) IG2: high-intensity general fitness training (bicycle ergometer) CG: health counseling on a group level and an individual level, not offered any physical training	a) 10 weeks b) 3 × 20 min/week c) at the workplace d) supervised	Muscle strength (shoulder) ↑ Trapezius muscle pain (general pain since the last training session) ↓ Trapezius muscle pain (worst pain since the last training session) ↓	Weak
2	Andersen et al. (59)	Randomized controlled trial	Employees (white-collar organizations) with frequent neck/shoulder pain	Total: a) $n = 198$, b) 88% ♀, c) not sp. IG1: a) $n = 66$, b) 88% ♀, c) 44 ± 11 IG2: a) $n = 66$, b) 88% ♀, c) 42 ± 11 CG: a) $n = 66$, b) 88% ♀, c) 43 ± 10	IG1: resistance training (shoulder abductions/lateral raises with elastic bands) (2 min sessions) IG2: resistance training (shoulder abductions/lateral raises with elastic bands) (12 min sessions) CG: information on general health (weekly e-mailed information and provision of internet links)	a) 10 weeks b) 5 × 2 or 5 × 12 min/week, respectively c) at the workplace d) unsupervised (initial training instruction and explanation, optional help available)	Muscle strength (shoulder) ↑ (both IGs) Neck/shoulder pain intensity ↓ (both IGs) Neck/shoulder muscle tenderness ↓ (both IGs)	Moderate

(Continued)

TABLE 3 | Continued

No	References	Study design	Study sample		Intervention		Significant effects (RT, pre-post-intervention)	Study quality (EPHPP)[a]
3	Andersen et al. (60)	Cluster randomized controlled trial	Office workers (national public administrative authority) with and without neck and/or shoulder pain	Total: a) $n = 449$, b) 62% ♀, c) 46 ± 10 IG1: a) $n = 116$, b) 62% ♀, c) 47 ± 10 IG2: a) $n = 126$, b) 69% ♀, c) 46 ± 10 IG3: a) $n = 106$, b) 58% ♀, c) 45 ± 10 CG: a) $n = 101$, b) 58% ♀, c) 46 ± 10	IG1: specific strength training for the neck and shoulder muscles (dumbbell exercises) (once/week) IG2: same as IG1 (3 times/week) IG2: same as IG1 (9 times/week) CG: not offered any physical training	a) 20 weeks b) 1 × 60 or 3 × 20 or 9 × 7 min/week, respectively. c) at the workplace d) every other training session supervised	Neck and shoulder pain intensity (last 3 months) ↓ (all three IGs) Work disability ↓ (IG1 and IG2)	Weak
4	Blangsted et al. (61)	Cluster randomized controlled trial	Office workers (public administration)	Total: a) $n = 549$, b) 64% ♀, c) n.r. IG1: a) $n = 180$, b) 70% ♀, c) n.r. IG2: a) $n = 187$, b) 64% ♀, c) n.r. CG: a) $n = 182$, b) 59% ♀, c) n.r.	IG1: specific resistance training for the muscles in the shoulder and neck region (dumbbells, static exercises, rowing and kayaking ergometer) IG2: all-round physical exercise (physical exercises introduced at the worksite, mixture of activities) CG: encouraged to form groups to improve existing nonoptimal health and work conditions (not performing additional physical activity)	a) 12 months b) 3 × 20 min/week c) at the workplace d) 2/3 supervised	Neck and shoulder symptoms intensity (last 3 months) ↓ Neck and shoulder symptoms duration (last 3 months) ↓	Weak
5	Escriche-Escuder et al. (62)	Non-randomized controlled trial	Hospital porters (university clinic) with at least one episode of musculoskeletal pain during the last month	Total: a) $n = 37$, b) 73% ♀, c) n.r. IG: a) $n = 19$, b) 89% ♀, c) 53 ± 9 CG: a) $n = 18$, b) 56% ♀, c) 49 ± 11	IG: brief whole-body resistance training in groups in circuit (elastic band and body weight exercises) CG: maintenance of usual activity	a) 9 weeks b) 5 × 15 min/week c) site close to the workplace d) supervised	Muscle strength (push-ups) ↑ Back muscular endurance ↑ Pain overall status ↓ Pain intensity (hips/thighs and ankles/feet, last three months) ↓ Well-being ↑ Work satisfaction ↑ Work impairment ↓ Desire exercising ↑ Energy ↑	Moderate

(Continued)

TABLE 3 | Continued

No	References	Study design	Study sample		Intervention		Significant effects (RT, pre-post-intervention)	Study quality (EPHPP)[a]
6	Gram et al. (63)	Cluster randomized controlled trial	Office workers (national public administrative authority) [same target group as in (60)]	Total: a) $n = 351$, b) 62% ♀, c) n.r. IG1: a) $n = 126$, b) 69% ♀, c) 46 ± 10 IG2: a) $n = 124$, b) 58% ♀, c) 45 ± 11 CG: a) $n = 101$, b) 58% ♀, c) 46 ± 10	IG1: specific strength training for the neck and shoulder muscles (dumbbell exercises), regularly supervised [same group as IG2 in (60)] IG2: same as IG1, minimally supervised CG: not offered any physical training	a) 20 weeks b) 3 × 20 min/week c) at the workplace d) every other training session supervised or minimally supervised (only initial instructions for two sessions), respectively	Neck pain intensity (last 7 days) ↓ (IG2 vs. CG) Headache intensity (last month) ↓ (both IGs) Days with headache (last month) ↓ (both IGs)	Weak
7	Haufe et al. (64)	Randomized controlled trial	Employees from medium-sized companies (desk work and manufacturing)	Total: a) $n = 226$, b) 60% ♂, c) 43 ± 10 IG: a) $n = 112$, b) 57% ♂, c) 44 ± 10 CG: a) $n = 114$, b) 62% ♂, c) 42 ± 11	IG: exercises without equipment particularly for the trunk musculature CG: asked to continue the current lifestyle	a) 5 months b) 3 × 20 min/week c) at the workplace or at home d) initial instruction and supervision once a month	Muscle strength (back extension) ↑ Low back pain (last 7 days) ↓	Moderate
8	Helmhout et al. (65)	Randomized controlled trial	Army employees with non-specific low back pain (longer than 12 weeks)	Total: a) $n = 81$, b) 100% ♂, c) n.r. IG: a) $n = 41$, b) 100% ♂, c) 41 ± 10 CG: a) $n = 40$, b) 100% ♂, c) 40 ± 9	IG1: high-intensity training program of the isolated lumbar extensor muscle groups (lower back machine) CG: non-progressive, low-intensity resistance protocol (lower back machine) (below strength training stimulus)	a) 12 weeks b) 1 × 5-10 min/week (weeks 1-2) and 2 × 5-10 min/week (weeks 3-12), respectively c) associated training/therapy department d) supervised	Comparable positive effects in both IG and CG (functional disability due to low back pain, self-experienced health, fear of movement) with back extension strength ↑ in IG	Moderate
9	Helmhout et al. (66)	Randomized controlled trial	Army employees (predominantly male soldiers) with non-specific non-acute low back pain	Total: a) $n = 127$, b) 97% ♂, c) not sp. IG: a) $n = 71$, b) 97% ♂, c) 37 ± 11 CG: a) $n = 56$, b) 96% ♂, c) 35 ± 11	IG: lumbar extensor strength training program (lower back machine) CG: regular physical therapy (exercise therapy and aerobic activities)	a) 10 weeks b) 2 × 5-10 min/week c) associated training/therapy department d) supervised	Positive effects comparable to those of CG (on back extension strength, low-back specific functional status, patient-specific functional status, and global perceived effect)	Moderate

(Continued)

TABLE 3 | Continued

No	References	Study design	Study sample		Intervention		Significant effects (RT, pre-post-intervention)	Study quality (EPHPP)[a]
10	Li et al. (67)	Randomized controlled trial	Employees (monotonous jobs, daily computer use) with chronic work-related neck pain	Total: a) $n = 109$, b) 100% ♀, c) n.r. IG1: a) $n = 38$, b) 100% ♀, c) 36 ± 8 IG2: a) $n = 35$, b) 100% ♀, c) 34 ± 9 CG: a) $n = 36$, b) 100% ♀, c) 34 ± 8	IG1: neck resistance training (progressive) (elastic bands) IG2: neck resistance training (fixed load) (elastic bands) CG: health-related information, discussions, and presentations	a) 6 weeks b) at least 3 times/week (duration n.r.) c) both at the workplace and at home d) supervision once a week	Neck muscle strength (flexion, extension, lateral flexion) ↑ (both IGs) Pain intensity ↓ (both IGs, greater effect in IG1) Pain threshold ↓ (both IGs) Neck disability ↓ (both IGs)	Strong
11	Mayer et al. (68)	Cluster randomized controlled trial	Full-duty career firefighters (fire stations of a municipal fire department)	Total: a) $n = 96$, b) 91% ♂, c) 35 ± 9 IG: a) $n = 54$, b) 82% ♂, c) 38 ± 10 CG: a) $n = 42$, b) 96% ♂, c) 31 ± 8	IG: exercise (mat-based core exercises and back extension exercise on a Roman chair) plus usual physical fitness routine CG: usual physical fitness routine alone	a) 24 weeks b) 2 × 10 min/week c) at the workplace d) supervised	Back muscular endurance ↑ Core muscular endurance ↑	Moderate
12	Mulla et al. (69)	Randomized controlled trial	Office employees (automotive industry)	Total: a) $n = 43$, b) 63% ♀, c) n.r. IG: a) $n = 21$, b) 57% ♀, c) 44 ± 11 CG: a) $n = 22$, b) 68% ♀, c) 43 ± 10	IG: leg-strengthening classes (exercises to target major muscle groups) CG: maintenance of usual activity	a) 12 weeks b) 3 × 45 min/week c) on site gymnasium/fitness center d) supervised	Lower extremity functionality ↑ Mobility ↑ (walk test ↓, stair climbing test ↓)	Moderate
13	Muñoz-Poblete et al. (70)	Randomized controlled trial	Manufacturing workers exposed to excessive effort and repetitive tasks principally with the upper limbs (furniture manufacturing)	Total: a) $n = 109$, b) not sp., c) not sp. IG: a) $n = 52$, b) 79% ♂, c) 29 ± 5 CG: a) $n = 53$, b) 83% ♂, c) 28 ± 5 (data only available for completers)	IG: resistance-based exercise program for the upper limbs (elastic bands) CG: stretching exercises	a) 16 weeks b) 3 × 15 min/week c) at the workplace d) supervised	Upper limb pain intensity ↓ Work functionality ↑	Moderate
14	Nygaard Andersen et al. (71)	Randomized controlled feasibility study	Professional symphony orchestra musicians	Total: a) $n = 23$, b) 61% ♀, c) n.r. IG: a) $n = 12$, b) 67% ♀, c) 45 ± 11 CG: a) $n = 11$, b) 55% ♀, c) 47 ± 8	IG: high-intensity specific strength training, focusing on the neck and shoulder muscles (dumbbell exercises)	a) 9 weeks b) 3 × 20 min/week c) at the workplace or at home d) supervised	Pain intensity (last 7 days) ↓	Weak

(Continued)

TABLE 3 | Continued

No	References	Study design	Study sample		Intervention		Significant effects (RT, pre-post-intervention)	Study quality (EPHPP)[a]
					CG: high-intensity general fitness training for the legs only (bicycle ergometer)			
15	Sjögren et al. (72)	Cluster randomized controlled trial (cross-over)	Office workers (public administration)	Total: a) $n = 90$, b) 73% ♀, c) 46 ± 9 IG: a) $n = 55$, b) 84% ♀, c) n.r. CG: a) $n = 35$, b) 57% ♀, c) n.r.	IG1: light resistance training (six dynamic symmetrical movements, air resistance equipment) CG: same as IG after 15 week no-intervention (cross over)	a) 15 weeks b) 5 × 6 min/week (weeks 1-5) and 7-8 × 8 min/week (weeks 6-15), respectively c) training facility of the workplace d) non-supervised (guidance in three group sessions at 5-week intervals)	Subjective physical well-being ↑	Strong
16	Sundstrup et al. (73)	Randomized controlled trial	Slaughterhouse workers with chronic pain in the shoulder, elbow/forearm, or hand/wrist, and work disability	Total: a) $n = 66$, b) 77% ♂, c) n.r. IG: a) $n = 33$, b) 76% ♂, c) 48 ± 9 CG: a) $n = 33$, b) 79% ♂, c) 43 ± 9	IG: high-intensity resistance training for the shoulder, arm, and hand muscles (small training equipment) CG: ergonomic training and education	a) 10 weeks, b) 3 × 10 min/week c) at the workplace d) supervised	Muscle strength (wrist and shoulder) ↑ Pain intensity (shoulder, elbow/forearm, and hand/wrist) (last 7 days) ↓ Work disability ↓	Strong
17	Zavanela et al. (74)	Randomized controlled trial	Bus drivers	Total: a) $n = 132$, b) 100% ♂, c) n.r. IG: a) $n = 60$, b) 100% ♂, c) n.r. CG: a) $n = 72$, b) 100% ♂, c) n.r.	IG: resistance training (whole-body program) CG: maintaining normal daily activities	a) 24 weeks b) 3 times/week (weeks 1-8) and 4 times/week (weeks 9-24) (duration n.r.), respectively c) on site gymnasium/fitness center d) supervised	Muscle strength (bench press, leg press) ↑ Muscular endurance (sit-ups, push-ups, trunk flexibility) ↑ Pain incidence (back, legs, arms, shoulders, and head) (last 2 weeks) ↓ Blood pressure ↓ Worker abseentism ↓	Weak
18	Zebis et al. (75)	Cluster randomized controlled trial	Industrial workers (laboratory technicians, repetitive tasks and data processing)	Total: a) $n = 537$, b) n.r., c) n.r. IG: a) $n = 282$, b) 89% ♀, c) 42 ± 11 CG: a) $n = 255$, b) 80% ♀, c) 42 ± 10	IG: high-intensity strength training for the neck and shoulders (dumbbell exercises) CG: advice to stay physically active and supervisor consultation (once a week)	a) 20 weeks b) 3 × 20 min/week c) at the workplace d) every other training session supervised	Neck pain intensity (last 7 days) ↓	Moderate

IG, intervention group; CG, control group; n.r., not reported.↑ or ↓, outcome increased or decreased ($p \leq 0.05$). [a]*See* ***Supplementary Table 2*** *for the quality assessment of all EPHPP components.*

Resistance Training Intervention Reporting

The rating of the RT interventions in terms of attention to principles of progression and variables of exercise prescription is listed in **Table 4** and reported in detail in **Supplementary Table 3**. For the assessment, protocols could also be taken into account for 4 of the 18 primary studies, as one protocol (76) refers to the two aforementioned studies that each evaluate a subset of the intervention groups in an overarching study (60, 63).

Principles of Resistance Training Progression

Overall, 70 % of the principles of RT progression (**Table 1**) were reported in the included studies (38/54), ranging from 1 to 3 principles with 6 of the 18 studies reporting all 3 principles (58, 60, 63, 71, 73, 75) (**Table 4**). The principle of progressive overload was explicitly stated in all but one study (94%, 17/18). Specificity, in turn, was documented for 78% (14/18), whereby the four studies classified as "unspecific" were rated as "unclear" as they reasoned whole-body trainings with its impact on, among other things, musculoskeletal pain (62), subjective physical well-being (72) or absenteeism (74), or investigated a specific osteoarthritis training in a general target group (69). The least documented principle is variation understood as systematic variation of both intensity and volume over the course of training (periodization) (**Table 1**) with 39% (7/18) describing classical (58, 62, 71, 73) or classical/undulating (60, 63, 75) models, respectively. Two studies were rated as unclear because in the first case, training was only performed at a lower intensity and a higher volume in the first 2 of the 12 intervention weeks and the change after week 3 does not appear to be systematic (65) [moreover, the same research group did not apply any periodization in another included subsequent study (66)] and in the second case, although an increase in volume is indicated to some extent by increased duration and number of repetitions, no change in intensity is described (69).

Variables of Resistance Training Exercise Prescription

Overall, 69% of all variables of resistance training exercise prescription (**Table 2**) were reported in the included studies (103/150, corrected for the number of "not applicable") (**Table 4**). The variable muscle action is reported in 94% (17/18), describing concentric, eccentric as well as isometric muscle action, with the only missing studies most likely using dynamic exercises but not explicitly stating this (74). Loading is applied in 94% (17/18) and was predefined as, e.g., prescribed repetition range for an exercise or a session (59, 65, 66, 68), as a percentage of a certain repetition maximum or the maximal strength (58, 60–63, 67, 71, 73–75), based on a rating of perceived exertion (69, 72), or as a fixed weight during a defined intervention phase (70). The only "unclear" study indicated load adjustments by therapists on site without explaining the procedure in more detail (64). The training volume, which can be recognized by an indication of the number of exercises, sets and repetitions, was given in 67% (12/18). The exercise selection was named in 89% (16/18) of the studies, while the exact exercise order was only clearly described in 47% (7/15) (corrected for single exercise interventions), as in some cases it remained unclear whether the order or numbering in the article texts remained the same throughout the intervention phase. Corrected for single exercise interventions and single set interventions, rest periods between exercises and between sets were also reported comparatively infrequently at 33% (4/12) and 27% (4/15) respectively, which also applies to the repetition velocity (given in seconds) [44% (8/18)]. Finally, all studies 100 % (18/18) applied the frequency of the training sessions (compare also **Table 3**).

DISCUSSION

To the best of our knowledge, this review is the first to specifically address attention to progression principles and variables of exercise prescription in workplace-related RT interventions. The main finding of the analysis was that several important RT principles and variables were inconsistently reported. While the goal of this systematic review was not to evaluate whether general RT recommendations were followed, the results do highlight some gaps in reporting (and potential for intervention planning).

The principle of progressive overload was mentioned in almost all studies indicating that there is agreement on the importance of increasing the stress to achieve adaptations and improvements. Due to the often limited time available for interventions at the workplace (79, 80), progressive overload provides the foremost basis for effective but also efficient interventions.

The principle of specificity was rated as unclear in four studies, as these (62, 69, 72, 74) used a more general training approach. Specific training should ensure that the most optimal type of exercise is chosen for a desired outcome (e.g., specific neck and shoulder training to prevent or reduce pain). Nonetheless, non-specific whole-body training could be reasoned from a primary prevention perspective since regular RT has a wide range of health-enhancing effects (17, 26, 81, 82). Depending on possibly rather broader intervention goals in the context of workplace health promotion (such as increasing well-being, reducing physical complaints, increasing or maintaining work ability), the exact specificity of RT may seem less necessary than, e.g., in rehabilitation or high-performance sports.

It is noticeable that the majority of the studies did not specify a periodization model, which not only represents a reporting gap but also a potential for intervention optimization from the perspective of exercise science. Research shows that systematic variation in both intensity and volume leads to increased adaptation over time (83–85), which is therefore relevant in recreational or health promotion contexts. Additionally, changing one or more variables over time could have a motivating effect (86) and might have a positive influence on adherence, especially in rather less training-experienced target groups in the workplace context.

Commonly reported variables of RT exercise prescription in the included studies were muscle action, load, volume, and frequency. Therefore, in general, it was reported what was exercised, how often and with what load. Especially the determination (and continuous realization) of an appropriate load is the prerequisite for training progression.

TABLE 4 | Application of principles of progression and variables of exercise prescription.

No	References	Principle			Sum score[a]	Variable									Sum score[b]
		Prog over	Spec	Per		M act	Load	Vol	Ex sel	Ex ord	R per		Vel	Freq	
											Bet s	Bet ex			
1	Andersen et al. (58)	(+)	(+)	(+)	3/3	(+)	(+)	(+)	(+)	(+)	(–)	(–)	(?)	(+)	6/9
2	Andersen et al. (59)	(+)	(+)	(–)	2/3	(+)	(+)	(+)	(+)	(na)	(+)	(na)	(+)	(+)	7/7
3	Andersen et al. (60) [protocol: (76)]	(+)	(+)	(+)	3/3	(+)	(+)	(?)	(+)	(+)	(+)	(–)	(–)	(+)	6/9
4	Blangsted et al. (61)	(+)	(+)	(–)	2/3	(+)	(+)	(+)	(+)	(?)	(–)	(–)	(–)	(+)	5/9
5	Escriche-Escuder et al. (62)	(+)	(?)	(+)	2/3	(+)	(+)	(+)	(+)	(+)	(na)	(+)	(+)	(+)	8/8
6	Gram et al. (63) [protocol: (76), same as (60)]	(+)	(+)	(+)	3/3	(+)	(+)	(?)	(+)	(+)	(+)	(–)	(–)	(+)	6/9
7	Haufe et al. (64)	(–)	(+)	(–)	1/3	(+)	(?)	(?)	(?)	(–)	(–)	(–)	(?)	(+)	2/9
8	Helmhout et al. (65)	(+)	(+)	(?)	2/3	(+)	(+)	(+)	(+)	(na)	(na)	(na)	(+)	(+)	6/6
9	Helmhout et al. (66) [protocol: (77)]	(+)	(+)	(–)	2/3	(+)	(+)	(+)	(+)	(na)	(na)	(na)	(+)	(+)	6/6
10	Li et al. (67)	(+)	(+)	(–)	2/3	(+)	(+)	(+)	(+)	(?)	(na)	(–)	(+)	(+)	6/8
11	Mayer et al. (68)	(+)	(+)	(–)	2/3	(+)	(+)	(+)	(+)	(?)	(na)	(+)	(+)	(+)	7/8
12	Mulla et al. (69)	(+)	(?)	(?)	1/3	(+)	(+)	(–)	(?)	(–)	(–)	(–)	(–)	(+)	3/9
13	Muñoz-Poblete et al. (70)	(+)	(+)	(–)	2/3	(+)	(+)	(–)	(+)	(?)	(–)	(?)	(+)	(+)	5/9
14	Nygaard Andersen et al. (71)	(+)	(+)	(+)	3/3	(+)	(+)	(+)	(+)	(+)	(–)	(–)	(–)	(+)	6/9
15	Sjögren et al. (72)	(+)	(?)	(–)	1/3	(+)	(+)	(+)	(+)	(+)	(na)	(+)	(+)	(+)	8/8
16	Sundstrup et al. (73) [protocol (78)]	(+)	(+)	(+)	3/3	(+)	(+)	(+)	(+)	(+)	(–)	(–)	(?)	(+)	6/9
17	Zavanela et al. (74)	(+)	(?)	(–)	1/3	(?)	(+)	(+)	(+)	(?)	(+)	(+)	(–)	(+)	6/9
18	Zebis et al. (75)	(+)	(+)	(+)	3/3	(+)	(+)	(?)	(+)	(?)	(–)	(–)	(?)	(+)	4/9
Proportion		94% (17/18)	78% (14/18)	39% (7/18)	70% (38/54)	94% (17/18)	94% (17/18)	67% (12/18)	89% (16/18)	47% (7/15)	33% (4/12)	27% (4/15)	44% (8/18)	100% (18/18)	69% (103/150)

prog over, progressive overload; spec, specificity; per, variation (periodization); m act, muscle action; load, loading; vol, volume; ex sel, exercise selection; ex ord, exercise order; r per, rest periods (bet s = between sets, bet ex, between exercises); vel, repetition velocity; freq, frequency; RT, resistance training. See ***Supplementary Table 3*** *for the citations or text passages on which the decisions were based. Note: [a]Possible maximum score = 3. [b]Possible maximum score = 9 (depending on the correction for the number of "na").*

Although the load is generally specified in almost all studies (**Supplementary Table 3**), the exact procedures for load determination often remain rather unclear. A more precise description of the protocols or test methods used, e.g., to determine the RM or the maximal strength, would increase transparency beyond the mere mention of load and provide added value in terms of practice transfer. Moreover, with regard to training conduction, it would be critical to question the extent to which study participants are able to continuously manage the load when interventions consist of (sometimes predominantly) unsupervised training sessions (59–61, 63, 64, 67, 72, 75). As an example, the included study by Andersen et al. in which the two intervention groups performed lateral raises with elastic bands (one single-set and one multi-set group) can be referred to (59). In the associated process evaluation, 40% of participants with low adherence responded, among other things, that they felt the load progression was too fast (87). Particularly in conjunction with lower adherence, this could influence the effectiveness. For workers—some of whom may have little experience with exercise training—it may be difficult to self-direct load to, e.g., predefined repetition ranges in such a way that a constant impactful stress is ensured over the course of the intervention.

The selection of exercises was usually shown in the corresponding descriptions and illustrations, while the order of the exercises remained unclear in some studies. As complex exercises were not performed in all studies, a specific sequence, e.g., multi-joint to single-joint exercises within a session (37, 39), appears negligible in some cases, although research suggests that the exercise order should be based on priority with respect to the program goal and regardless of whether the exercise involves a relatively large or small muscle group (88). However, the intervention transparency could easily be improved by a short textual reference. Moreover, the more precise implementation (rest periods between the exercises and the sets and repetition velocity) remained partly unclear. From an exercise science perspective, rest periods in particular are important for both training planning and management (89, 90). Also, rest periods are relevant from a transfer point of view, as they determine the detailed implementation in practice, and already brief descriptions (e.g., timing or autoregulatory) would facilitate intervention replication.

In summary, reporting of RT in workplace-related interventions appears inconsistent, which is in line with reviews in, e.g., rehabilitative contexts (46–48), hindering both the replication and validation of results in follow-up studies and the implementation of successful interventions. Therefore, the use of standardized exercise-reporting tools should be further encouraged. Current guidelines from the equator network, such as the consensus on exercise reporting template (CERT) (91) or the template for intervention description and replication (TIDieR) (92), provide comprehensive guidance and were developed to address the issues outlined above. The CERT, e.g., does not only refer to the intervention itself, but also to the actual conduction (including individualization or adverse events) and implementation (including teaching/supervising expertise or setting in which exercise training is performed) (93). Thus, further important contextual factors would be captured in a more comprehensive description.

Regardless of the reporting analysis, the included studies illustrate the multifaceted nature of potential workplace-related RT interventions for adult health promotion. RT represents a promising health promotion intervention component in many respects for a wide variety of target populations (27, 33, 82, 94, 95) (for employees with, e.g., different gender, age, occupational background, or exercise experience). Most of the included studies used only small equipment such as elastic bands or dumbbells, which basically allows exercise to be performed on site (or at home) without major organizational hurdles. For interventions again with group trainings or using machines, facilities are needed to keep distances short (fitness center or training facility in the building or in close proximity). However, given the small number of exercises in most studies (**Supplementary Table 3**) and the small amount of time required (session duration) combined with reduced or minimal supervision, the possibility of implementing RT interventions at the workplace is generally emphasized.

Strengths and Limitations

The main strength of the present review is the emphasis on the fundamentals of RT progression and exercise prescription (37–39). The assessment approach—oriented on a protocol by Westra et al. on the quality of RT description in COPD trials (96)—is comparatively comprehensive in terms of analyzing the reporting of RT interventions and provides a more detailed insight than, e.g., analyzing according to the so-called FITT-VP components (frequency, intensity, time, type of exercise, volume, and progression).

Since the main purpose of the review was not to investigate whether the reporting influences the intervention effects, the narrative analysis of the significant effects can be seen as a limitation. Determining the extent to which progression principles and variables of exercise prescription are attended is a critical first step in advancing knowledge of workplace-related RT interventions. Their impact on effectiveness should be explored in future analyses.

The main limitation of the review was the strict limitation to studies with a main focus on RT. During the full-text assessments, 28 studies alone were excluded that had a RT component within an intentionally mixed or multicomponent intervention. These studies would have required detailed analysis of all components (e.g., training principles for other training forms, theoretical basis for educational programs), which would have exceeded the review focus. Nevertheless, the present results should raise awareness for improved reporting not only for interventions with a main focus on RT. Future challenges will lie in the comparable reporting of training principles in more individualized or tailored approaches (33, 97) that take into account individual prerequisites and workloads in training planning and management. In addition, some studies did not definitively identify the extent to which they were workplace-related indicating the need for a better contextual description (such as location and integration into the working day).

CONCLUSIONS

Based on the great health-promoting potential of workplace-related interventions and the often limited time available for interventions at the workplace, RT interventions in this setting should be designed to be as effective as possible. However, without comprehensive information on the actual design of workplace-related RT interventions, it remains difficult to implement optimally dosed interventions for a desired benefit in different employee target groups. Therefore, a detailed description is also relevant from a transfer perspective.

In order to increase the reproducibility of RT interventions, exercise-reporting tools should be applied more frequently (98). Furthermore, findings from exercise science should be increasingly incorporated into RT interventions in the context of workplace-related health promotion. There is still potential, especially in the integration of periodization models and the reporting of rest periods.

DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

GS: conceptualization, writing—original draft, visualization, and project administration. GS and LB: methodology. GS, LB, and OM: formal analysis and investigation. AS: resources and supervision. LB, OM, and AS: writing—review and editing. All authors have read and approved the final manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.832523/full#supplementary-material

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Effects of Workplace Gossip on Employee Mental Health: A Moderated Mediation Model of Psychological Capital and Developmental Job Experience

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Research has demonstrated the effects of workplace gossip on employees' work attitudes and behaviors. However, little emphasis has been placed on the psychological influence of workplace gossip on employees. The present study investigated the relationships among workplace gossip, psychological capital, and individual mental health. Data were collected in three waves from 222 full-time employees of a Taiwanese tourism company to explore the effect of workplace gossip on employees' mental health. The results suggested that workplace gossip was associated with employees' mental health through psychological capital. Moreover, developmental job experience plays a moderator role in the relationships among workplace gossip, psychological capital, and mental health. A moderated mediation model was also proposed in this study.

Keywords: workplace gossip, psychological capital (PsyCap), developmental job experience, mental health, mediated moderation model

INTRODUCTION

Workplace gossip (WG) is a frequent occurrence in organizations (1). An employee "producing, listening to, or otherwise participating in evaluative comments" of work-related issue about an absent person would be classified as a WG participant (2). Specifically, researchers have classified WG into two types (1, 3): workplace positive gossip (WPG) and workplace negative gossip (WNG). Participating in these two types of WG can have opposite effects on employee work attitudes, work behaviors, and work outcomes (4). For example, engaging in WPG is positively related to organizational citizenship behaviors (3) and negatively associated with gossiper's employee cynicism (2), whereas participating in WNG may decrease gossipers' work-related in-role performance and job-related well-being (3) or increase employee deviance workplace behaviors (3) and cynicism toward organization (2). Although prior studies have identified WG as a crucial factor that could significantly influence employee work-related attitudes and outcomes in the workplace, little is known about the psychological influences and processes of WG on employees. The present study was designed to uncover the effects and psychological mechanisms of WG on employee mental health (MH).

We sought to explain the relationship between WG and individual MH by employing psychological capital theory, in contrast to previous studies that have shown scant interest in WG as a psychological resource. The psychological capital theory argues that psychological capital (PsyCap) is a type of psychological resource that determines individuals' psychological well-being and behaviors (5). Previous work suggested that WG could be a social cue for an individual to shape the meaning of social information concerning their experiences in specific environments (1, 6), which implies WG could be regarded as a personal resource that individuals use to understand the work environment. Furthermore, cognitive appraisal theory (7) suggests that these personal resources may trigger psychological states of emotion. Thus, the present study tested the hypothesis that WG is a type of social cue implying personal psychological resource consumption when interpreting social information (6), and resource obtainment when exchanging social information (8). When an employee participates in WG, PsyCap dynamics may be influenced, which then affects individuals' MH.

Few studies have investigated the moderating effect of different variables on the relationship between WG and outcomes. Here we probed the boundary effect of developmental job experience (DJE), which refers to self-development opportunities at work (9). Prior studies have demonstrated that individuals with DJE are more sensitive to social information and interpret social cues from a more systematic perspective (10), which may interact with WG interpretation. Specifically, employees with high DJE would be better able to comprehend the social cues of WG than those employee with low DJE. Thus, we hypothesized that DJE could be a key moderating factor, which suggests there is a practical implication for organizations to strengthen the positive effects of WG on employee PsyCap and MH (through PsyCap) or counteract negative effects by helping employees to cope with WG.

THEORY AND HYPOTHESES

Relationship Between Workplace Gossip and Mental Health

WG is defined as idle talk that involves the exchange of personal information and judgments about colleagues who are not present (11). It is considered a type of social interaction and a source of social information (2). Previous research categorized WG into two types (1, 3). WPG refers to positive statements about an absent colleague, such as their achievements, promotions, or receipt of praise from supervisors. Conversely, WNG is negative statements about the gossip target, such as their deviant behaviors, demotions, or inadequate work abilities. Engaging in WPG and WNG leads to different employee reactions and outcomes in organizations. For instance, Kuo et al. (1) suggested that employees engaging in WPG are exposed to more positive social cues, thereby facilitating their psychological attachment and considerably reducing workplace cynicism. In contrast, employees engaging in WNG experience an unpleasant atmosphere and decreased psychological attachment, which in turn, increases the frequency and tendency of employee cynicism. Therefore, the two types of WG can shape different employee attitudes toward the organization.

Studies have identified WG as channels of informal communication (2) for casual or unconstrained social information (12), even if the information is inaccurate or incomplete. Thus, gossip fulfills a social function by creating close bonds and enforcing workplace norms (3). Moreover, Kuo et al. (1) identified WG as a type of social information that conveys social cues to individuals. WG participants receive specific social cues about their discussion targets when they gossip. These social cues influence an individual's attitude, behavior, and needs through construction of meaning with socially acceptable reasoning, which can provide information on salient expectations and logic (13). Cognitive appraisal theory suggested that the personal mental state of emotion is affected by appraising or evaluating received information (7, 14, 15). Following this reasoning, gossipers engaging in WPG are exposed to positive social cues; gossipers who are interpreting, appraising, or evaluating these social cues may positively enhance their mental states of emotion, feelings, attitudes, and behaviors at work. For example, when employees receive positive social cues, they exhibit higher psychological affect and more positive emotions (16), which may increase their positive MH (17). Conversely, WNG participants receive negative social cues of deleterious information that may have adverse psychological effects. That is, gossipers may negatively interpret, appraise, or evaluate these social cues when participating in WNG, which may exacerbate their mental states. Researchers demonstrated that individuals exposed to negative social cues experience higher work strain, stress, and depression (18) and have lower psychological well-being (19) in the workplace, and this could negatively affect their MH.

When employees engage in WG, specific social cues affect their MH. However, positive gossip implies more affirming social cues, so employees may receive more positive information that improves their MH. Conversely, WNG delivers deleterious information, resulting in more negative social cues and information that adversely affect MH. Accordingly, the following are proposed in this paper:

Hypothesis 1a: Participating in WPG is positively correlated with gossiper's MH.
Hypothesis 1b: Participating in WNG is negatively correlated with gossiper's MH.

Relationship Between Workplace Gossip and Psychological Capital

PsyCap is defined as a positive psychological state that helps achieve positive organizational behaviors with four dimensions: self-efficacy, hope, optimism, and resilience (5). In the context of cognitive appraisal theory, the social cues of WG may affect the personal positive psychological state of PsyCap by interpreting, appraising, or evaluating the relevant information (15). In addition, PsyCap can also be regarded as a psychological resource (20) that provides a competitive advantage and a subjective sense of well-being (5). Following this logic, WG serves as a kind

of social cue that requires psychological resources to interpret, but it also shapes an individual's sense of reality and their perception of the meaning of individuals or organizations (1). Thus, psychological resources are spent to interpret, attribute, and cope with social cues from WG (21). WG is also a way to obtain social information and exchange social resources (22) that individuals use to facilitate personal capabilities in social systems such as workplaces (8). In other words, WG both provides social cues that individuals can leverage to gain social resources from information exchange and simultaneously depletes psychological resources to interpret them. Accordingly, this article proposes that there is a dynamic relationship between WG and PsyCap from the following perspectives.

First, WG affects an employee's self-efficacy and hope. Informal work-related social cues provided by WG represent individual opinions and others' perspectives on work-related information in the organization, serving as reference points and adjusting individuals' self-efficacy (23). Based on cognitive appraisal theory, when personal emotion is evoked by interpreting, appraising, or evaluating the relevant information, an individual will adopt a coping strategy to strengthen or erase the mental states of emotion (7, 14, 15). When gossipers interpreting social cues from idle talk, they engage in the social information process (13), leading them to make social comparisons between themselves and the gossip target (3) and gain or lose personal resources from the social information (24). For example, WPG enhances the reputation of the absent target by highlighting exemplary behaviors or praising persons in the organization. These positive social cues and information may evoke individual positive mental states of emotion (7, 15). To strengthen this positive mental state (14), employees who participate in WPG may regard gossip targets as role models for social learning and hope to mimic them to also reach positive achievements. Therefore, WPG enhances one's desires to improve capabilities and increases their motivation to attain desired outcomes (12). Although WPG participants consume their resources to interpret the social information cues, they also obtain more positive psychological resources of self-efficacy and hope. Thus, participating in WPG positively affects an individual's self-efficacy and hope of PsyCap to achieve positive outcomes.

Conversely, WNG refers to negative evaluation about the absent target's reputation. Kuo et al. (1) posited that work-related WNG can be a sign of an awareness that the WNG target does not reach the expectations of their work tasks assigned by an organization or supervisors. Thus, individuals engaging in such negative chatter imply that the gossip targets are inferior in their capabilities and behaviors when dealing with work-related duties. In other words, these negative evaluations imply that the gossip target needs to improve their capabilities to meet the task or challenge. Based on cognitive appraisal theory, these negative evaluations of a colleague may also evoke the gossiper's negative mental states when they interpreting, appraising, or evaluating the WNG information (7, 14, 15). Specifically, WNG implies that everyone is uncertain how his or her performance would be evaluated by others. Ashford (25) contended that individuals become more cautious and unconfident about how their behaviors or results will be evaluated by others under a high degree of uncertainty. Brady et al. (3) demonstrated that when there is an unknown range of performance evaluation, individuals adopt social comparisons to compare themselves with others when engaging in WNG. Therefore, due to the uncertainties of evaluation from others, a WNG gossiper is not sure if their capabilities are definitely better than the gossip target in the social comparison process. In other words, the WNG gossiper becomes anxious about his or her own capabilities with regard to others' perspectives. Moreover, WNG participants may have less confidence and experience more pressure to identify whether they could better complete the task assigned by their organization or supervisors due to the uncertainty of their performance when delivering others' negative evaluations; otherwise, they may fall victim to negative gossip (1). Therefore, WNG participants may experience more pressure at work and decreased self-efficacy and hope in work-related tasks due to fear of failure. Furthermore, research has demonstrated a strong negative direct effect of WNG on employees' self-efficacy and motivation for success (3, 26). Thus, WNG participants consume their resources to interpret WNG and also experience reduced self-efficacy and hope.

Second, WG may affect employee optimism and resilience. Studies have suggested that employees engage in WG to gain social resources (8). Gossip provides social support by establishing social bonds and trust relationships (22), which may influence individual optimism (27) and resilience (28). Thus, a social resource exchange may exist during WG. From the cognitive appraisal perspective (14), gossipers engaging in WPG may receive positive social information that yields more social support resources in the form of inspiration and energy to reach a positive mental state of emotion (29). Accordingly, individuals with more social support resources have more optimism towar life (30) and more resilience when facing difficulties (31). In contrast, WNG would evoke a individual negative mental state of emotion (15), Turner et al. (32) pointed out that participating in WNG may ruin relationships due to the negative information intended to depreciate others. Moreover, the gossiper may be regarded as a non-credible communicator if the information is rumored (33). Thus, when an individual with poor relationships is regarded as non-credible in the workplace, he or she may be ostracized by other colleagues and receive few social resources or less social support (34), which can ultimately diminish their optimism about work and reduce their resilience following a work setback.

Here we argue that WG may offer positive and negative social information cues for employees to adjust their attitudes and behaviors due to upward and downward comparisons, affecting individuals' self-efficacy and hope for positive outcomes. WG may also provide or block social resources that influence employees' optimism and resilience at work. Thus, this study proposes the following:

Hypothesis 2a: Participating in WPG is positively correlated with gossiper's PsyCap.

Hypothesis 2b: Participating in WNG is negatively correlated with gossiper's PsyCap.

Relationship Between Psychological Capital and Mental Health

Positive psychological resources are the core construct of PsyCap (35), and individuals require these resources to maintain and develop their psychological well-being (36). Studies have identified that individuals with greater PsyCap experience less stress (37), anxiety (38), and depression (39). Moreover, researchers have determined that increases in individuals' PsyCap enhance the perception of well-being and reduce symptoms of mental illness (40). This study followed previous work to verify the relationship between PsyCap and MH and proposed the following:

Hypothesis 3: PsyCap is positively correlated with MH.

Mediating Role of Psychological Capital

Furthermore, this study proposed that WG may affect MH through PsyCap. WG frequently occurs with informal social interactions when people can deliver or exchange social cues for informal social resources (8). Such exchanged informal social resources can result in personal resource spending on interpreting WG social cues (1), but they also confer the resource gains of social information and social support (8). Specifically, gossipers determine the reliability and value of WG from other employees' perspectives, which costs personal social and psychological resources and unscrambles the social cues from their own perspectives. When gossipers interpret WG from their unique perspective, they could acquire social and psychological resources that affect their PsyCap. However, participating in different types of WG would cause different results of the PsyCap dynamic.

WPG enhances gossipers' hope and self-efficacy by motivating them to reach similar achievements as those of the gossip target due to social comparison (3). Furthermore, WPG participants can gain a sense of trust and social support from others because of the positive information transmission (29), thereby enhancing individuals' optimism and resilience. Therefore, participating in WPG would have positive effects on gossiper's PsyCap. In contrast, WNG participation may reduce gossipers' self-efficacy and hope due to exposure of the negative social cues of fear of being negatively evaluated by others (25). In addition, when the negative evaluation of WNG is fake or exaggerated, the gossiper may affect the relationships among gossipers, gossipees, and gossip targets, which could also damage the gossiper's reputation or trustworthiness. Therefore, WNG gossipers may lose social resources and support from others after they speak ill of others, thereby affecting their optimism and resilience. Therefore, PsyCap is affected when individuals' self-efficacy, hope, optimism, and resilience change from participating in WG.

When employees' PsyCap is influenced by WG, it may continue to affect their MH. The conservation of resources theory suggested that individuals could acquire, maintain, and foster psychological resources from WG to prevent future resource depletion (36), implying that PsyCap is a key factor for individuals to maintain and protect their mental well-being from threat or loss (37), burnout (38), and illness (40). Here we further propose that when employee gaining PsyCap from engaging in WPG, there are indirect positive effects on gossipers' MH. In other words, PsyCap from WPG would serve as a positive influence on participants" MH, while participating in WNG would cause gossipers to lose PsyCap and indirectly and negatively affect gossipers' MH. Therefore, besides the direct effect of WG on PsyCap, we expect that WG may have indirect effects on participators' MH through PsyCap.

In summary, we predicted that PsyCap plays a mediator role in the relationship between WG and individuals' MH. Thus, this study proposed the following:

Hypothesis 4a: PsyCap mediates the positive relationship between WPG and MH.

Hypothesis 4b: PsyCap mediates the negative relationship between WNG and MH.

Moderating Effect of Developmental Job Experience

As opposed to organizations' and managers' attempts to minimize the influence of WG on employee (41), this study seeks to use the function of work itself to help employees cope with WG. DJE is a process of self-development in which employees learn, growth, and improve their capabilities through effectively accomplishing their role task or achieving their goals (9). We choose three suitable dimensions identified by McCauley et al. (9) for staff members (rather than top-level leadership) to measure DJE. The first is unfamiliar responsibilities that require an employee to take on different or new roles and tasks and are often assigned when the organization implements a job transition. The second is high-level responsibility for assigned tasks that are highly visible to management and substantially affect high-level stakeholders or the organization. The third is working across boundaries that an employee with little formal authority may be asked to coordinate with other internal peers, departments, and supervisors or individuals external to the organization. Previous studies have reported that DJE has significant effects on individuals' information processing (42). Therefore, we expect that the interaction between WG and DJE would have a moderating effect on PsyCap and MH.

WG is a type of informal information resource with uncertain reliability and validity (1, 8) that might interact with DJE. For instance, employees with relatively high boundaries of DJE have a superior background in interacting with others and processing ambiguous information (42) and are better able to judge WG reliability and accuracy. Furthermore, an employee with a higher unfamiliar responsibilities of DJE has higher comprehensive abilities, interpersonal capabilities, and adaptability (10), which could help that individual to view gossip from a systematic perspective (43). Moreover, employees with significant high-level responsibility of DJE exercises would accomplish their role tasks with this in full consideration. As a result, they would view WG more critically and identify underlying causes and consequences (44) rather than accepting it at face value.

When employees with high DJE participate in positive gossip, they critically think about the reasons for the gossip targets' positive outcomes (42) and learn from their successes. Therefore, they would obtain more self-efficacy, hope, and motivation from

WPG if they have high DJE. Such employees thus interpret WPG as a valuable learning resource that provides psychological support to help them acquire higher achievement. However, employees with lower DJE obtain fewer resources to learn from WPG. That is because that lower DJE employees take WPG at face value, they lack sufficient experience to excavate the deeper meaning in WPG about one's achievement. Similarly, when employees with high DJE engage in WNG, they critically think about the underlying causes (42, 43) of mistakes and how to correctly view and treat negative results realized by the gossip target. WNG thus provides more optimism and resilience for those with high DJE, helping them learn from and avoid the negative gossip targets' failures. In other words, employees with high DJE interpret WNG as a warning to avoid making the same mistakes, or they seek resources to overcome the negative results. In contrast, employees with lower DJE lack sensitivity to these negative results as a sign to consider making the same mistake and thus receive few resources for facing the same problems. Moreover, employees with lower DJE may even spend resources to erase the fear of being next negative gossip target if they do not achieve the expected task results. Thus, the following hypothesis is proposed:

Hypothesis 5a: DJE moderates the relationship between WPG and PsyCap such that the effect of WPG on PsyCap is stronger with higher DJE.
Hypothesis 5b: DJE moderates the relationship between WNG and PsyCap such that the effect of WNG on PsyCap is stronger with lower DJE.

Based on the discussion of the relationships among WG, PsyCap, MH, and DJE, the present study predicted that the moderating effect of DJE has far reaching effects on employees' MH through PsyCap, which means that DJE moderates the indirect effect of WG on MH through PsyCap. Thus, this research further proposes a moderated mediation model as follows:

Hypothesis 6a: DJE moderates the relationship between WPG and MH through PsyCap such that the effect of WPG on MH is stronger with higher DJE.
Hypothesis 6b: DJE moderates the relationship between WNG and MH through PsyCap such that the effect of WNG on MH is stronger with lower DJE.

METHODS

Participants and Procedures

Participants were full-time employees working in the same company in the tourism industry in Taiwan. Data were collected with anonymous paper questionnaires with supervisor cooperation at a travel agency in Taiwan. A collection approach of three waves over 3 months was adopted to minimize the single time-point method bias (45). Each participant was assigned a random identity code for their questionnaires. Instructions and return envelopes were also provided to participants. Furthermore, researchers provided an NT$150 gift voucher to participants who completed all items in the three waves of data collection to increase their motivation. At Time 1, researchers distributed 300 copies of Wave 1 questionnaires and received 262 responses. One month later, researchers sent out Wave 2 questionnaires to participants who had answered questionnaires in Wave 1 and collected 239 responses. A month later, researchers distributed the final wave of questionnaires to participants who had completed Waves 1 and 2. This study collected 222 responses (74.00% response rate). The sample demographics were as follows: 167 women (75.20%) and 55 men (24.80%), mean age of 36.82 ($SD = 7.54$), the majority held a bachelor's degree (83.80%), the average employee average tenure was 10.24 years ($SD = 7.17$), 137 were married (61.70%), and 146 participants were staff (65.80%).

Measures

WG (Wave 1)

WG was measured in Wave 1 using a 12-item questionnaire on work-related gossip, with six items for WPG and six for WNG developed by Kuo et al. (1). A sample item for WPG is "Have you recently gossiped about a colleague's excellent job performance?" A sample for WNG is "Have you recently gossiped about a colleague's carelessness and poor work engagement?" All items in this research were scored using six Likert-type response options ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

DJE (Wave 1)

This study assessed DJE with the 20-item Job Challenge Profile (46) in Wave 1. A sample item is "This job asks you to manage something with which you are unfamiliar."

PsyCap (Wave 2)

This study measured PsyCap using the 24-item Psychological Capital Questionnaire (5) in Wave 2. A sample item is "If I find myself in a jam at work, I could think of many ways to get out of it."

MH (Wave 3)

The 12-item version of the General Health Questionnaire Scale (47) was used to assess MH in Wave 3. A sample item is "Have you been able to face your problems?" Furthermore, this study used a scoring system wherein a higher score implying better MH.

Control Variables (Wave 1)

The study controlled for several factors to minimize the effect of demographic variables (gender, age, educational level, job tenure, marital status, and position). We also controlled for job stress, with a single item from the study by Elo et al. (48), as it may be related to PsyCap (49) and MH (50).

RESULTS

Table 1 presents the means, standard deviations, bivariate correlations, and Cronbach's alpha values. The results indicates that WPG was positively correlated with MH ($r = 0.15$, $p < 0.05$) and PsyCap ($r = 0.24$, $p < 0.001$). PsyCap was significantly positively correlated with MH ($r = 0.54$, $p < 0.001$). WNG negatively correlated with MH ($r = -0.24$, $p < 0.001$) and

TABLE 1 | Variables means, standard deviations, reliabilities, and correlations ($N = 222$).

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender†	0.25	0.43												
2. Age	36.82	7.54	−0.01											
3. Education†	2.91	0.39	0.11	−0.17**										
4. Tenure (years)	10.24	7.17	0.02	0.81***	−0.14*									
5. Marital status†	0.38	0.49	0.15*	0.32***	−0.01	0.22**								
6. Position†	1.44	0.69	0.21**	0.48***	0.03	0.54***	0.24***							
7. Job stress	4.23	1.15	0.04	0.05	−0.09	0.06	−0.04	0.03						
8. WPG	4.52	0.68	0.12	0.00	0.08	0.04	−0.02	0.16*	−0.05	(0.70)				
9. WNG	3.28	1.01	−0.09	0.09	−0.09	0.13	−0.01	0.10	−0.02	0.41***	(0.83)			
10. PsyCap	4.45	0.46	0.18**	0.12	−0.03	0.16*	0.19**	0.18**	0.05	0.24***	−0.18**	(0.90)		
11. MH	4.28	0.58	0.12	0.06	0.09	0.04	0.14*	0.16**	−0.29***	0.15*	−0.23***	0.54***	(0.83)	
12. DJE	3.88	0.55	0.17*	0.05	−0.01	0.11	0.02	0.18**	0.14*	0.35***	0.16**	0.24***	−0.09	(0.78)

Cronbach's alpha, α is presented in the diagonal.
†Gender (0, female; 1, male); Education [1, junior high school or below; 2, (vocational) senior high school; 3, bachelor's degree; and 4, master or above]; Marital status (0, single; 1, married); Position (1, staff; 2, junior manager; 3, mid-level manager; and 4, senior manager).
**p < 0.05, **p < 0.01, and ***p < 0.001.*

TABLE 2 | Results of confirmatory factor analyses of the measures ($N = 222$).

Model	Factors	χ^2	df	$\Delta\chi^2$/df	CFI	IFI	RMSEA
Hypothetical model	5 factors	274.43	109		0.90	0.91	0.08
Model 1	4 factors	323.16	113	12.18	0.88	0.88	0.09
Model 2	3 factors	567.24	116	41.83	0.73	0.74	0.13
Model 3	2 factors	692.25	118	46.42	0.66	0.67	0.15
Model 4	1 factor	1,216.07	119	121.61	0.35	0.37	0.20

Hypothetical model (5 factors: workplace positive gossip; workplace negative gossip; psychological capital; mental health; developmental job experience).
Model 1 (4 factors: workplace positive gossip and workplace negative gossip merged; psychological capital; mental health; developmental job experience).
Model 2 (3 factors: workplace positive gossip, workplace negative gossip and developmental job experience merged; psychological capital; mental health).
Model 3 (2 factors: workplace positive gossip, workplace negative gossip and developmental job experience merged; psychological capital and mental health merged).
Model 4 (1 factor: all variables are merged into one factor).

PsyCap ($r = -0.18$, $p < 0.01$). The correlation coefficient results initially support H1, H2, and H3.

Model Analyses

The study used confirmatory factor analysis (CFA) in AMOS 21 software with parceling rules (51) to test the fit of the hypothesized model. The overall CFA results indicated that the hypothetical five-factor model demonstrated a good fit with the data [$\chi^2 = 274.43$, comparative fit index (CFI) = 0.90, incremental fit index (IFI) = 0.91 root mean square error of approximation (RMSEA) = 0.08]. This study also tested four other alternative-factor models. Other models' goodness-of-fit statistical results indicated that the hypothetical five-factor model had a better fit for data (**Table 2**). In sum, model comparison results suggested that the hypothetical constructs were a good fit for statistical significance.

Hypothesis Testing

PROCESS macro software (52) is used to analyze complicated research models. In this study, we used three existing model syntaxes of constructions (mediation, moderation, and moderated) in the PROCESS macros to perform hypothesis testing.

Hypotheses 1a and 1b stated that WG would correlate with MH. The results of simple linear regression test in PROCESS macro software are presented in **Table 3**. The study controlled for demographic variables and job stress. WPG positively correlated with MH ($\beta = 0.21$, $p < 0.001$), and WNG negatively correlated with MH ($\beta = -0.20$, $p < 0.001$), which supported Hypotheses 1a and 1b. Similarly, Hypotheses 2a and 2b were also supported by positing that the relationship between WPG and PsyCap was positively correlated ($\beta = 0.25$, $p < 0.001$) and WNG and PsyCap were negatively correlated ($\beta = -0.16$, $p < 0.001$) As shown in **Table 3**, the findings also supported Hypothesis 3, which proposed that PsyCap has a positive relationship with MH. When this study regressed PsyCap on MH, we observed a positive relationship between PsyCap and MH ($\beta = 0.69$, $p < 0.001$).

This study further used mediation testing in PROCESS macro software to test the mediating effect of Hypotheses 4a and 4b, and the results illustrated that PsyCap mediates the relationship between WG and MH. As mentioned previously, WG, PsyCap, and MH were positively (WPG) and negatively (WNG) correlated. Therefore, we regressed WPG on MH while controlling for PsyCap. The results revealed that the standardized coefficient was significantly lower ($\beta = 0.06$, $p > 0.05$). Moreover, the standardized coefficient significantly decreased for WNG

TABLE 3 | Regression results for simple mediation ($N = 222$).

Variables			*B*	*SE*	*t*	*p*
Direct and total effects						
WPG → MH			0.21	0.06	3.68	0.000
WNG → MH			−0.20	0.04	−5.09	0.000
WPG → PsyCap			0.25	0.05	5.33	0.000
WNG → PsyCap			−0.16	0.03	−5.08	0.000
PsyCap → MH			0.69	0.07	9.98	0.000
PsyCap → MH (controlling for WPG and WNG)			0.62	0.07	8.46	0.000
WPG → MH (controlling for PsyCap)			0.06	0.05	1.09	0.28
WNG → MH (controlling for PsyCap)			−0.10	0.04	−2.76	0.006
	Value	***SE***	**LL 95% CI**		**UL 95% CI**	
Indirect effect and significance of WPG on MH						
Bootstrap	0.15	0.04	0.09		0.24	
Indirect effect and significance of WNG on MH						
Bootstrap	−0.10	0.02	−0.15		−0.06	

Standardized regression coefficients are reported. Bootstrap sample size = 50,000.
LL, lower limit; CI, confidence interval; UL, upper limit.

($\beta = -0.10$, $p < 0.01$). The aforementioned evidence initially supported that PsyCap had a mediating effect on the relationship between WG and MH. We also estimated indirect effects using a bootstrap approach with 95% confidence intervals (CIs). The results in **Table 3** indicate that PsyCap mediated the relationship between WG and MH ($\beta = 0.15$ for WPG, $\beta = -0.10$ for WNG). Ultimately, the results of bootstrap testing revealed that the 95% CIs did not contain zero for WPG (0.09, 0.24) or WNG (−0.15, −0.06) analyses. Overall, Hypotheses 4a and 4b were supported.

Hypotheses 5a and 5b proposed that DJE moderates the relationship between WG and PsyCap. **Table 4** presents the results of a simple moderating effect using the moderation test in the PROCESS macro software. The interaction of DJE and WG was statistically significant for both WPG ($\beta = 0.23$, $p < 0.001$) and WNG ($\beta = 0.14$, $p < 0.01$). The 95% CIs showed that neither *WPG* × *DJE* (0.12, 0.36) nor *WNG* × *DJE* (0.05, 0.24) contained zero. Furthermore, this study examined conditional effects by dividing DJE into three groups at the mean and one standard deviation above and below the mean to represent low-, medium-, and high-level moderators. The results of the conditional effects of each group on DJE (**Table 4**) show that the effect of WPG on PsyCap was positively statistically significant at the high level ($\beta = 0.33$, $p < 0.001$) but not at the low level ($\beta = 0.08$, $p > 0.05$). The moderated effect of WNG on PsyCap was significant at the low level ($\beta = -0.23$, $p < 0.001$) but not at the high level ($\beta = -0.07$, $p > 0.05$). **Figures 1**, **2** present the moderating effects of DJE on the relationship between WG and PsyCap. Hypotheses 5a and 5b were supported by our findings.

Hypotheses 6a and 6b stated that DJE moderates the mediated relationship between WG and MH through PsyCap. Hypotheses 6a and 6b were examined using the moderated mediation model test in the PROCESS software, which assessed the conditional indirect effect of DJE at different levels. **Table 4** presents the moderated mediation results for MH. The results indicated that the index of conditional indirect effects of moderated mediation ($\beta = 0.15$ for WPG, $\beta = 0.10$ for WNG) were significant in WPG (0.06, 0.27) and WNG (0.03, 0.18), as they did not contain zero at the 95% CI level. We also tested the moderated mediation effect at all levels of means in two types of WG (**Table 4**). As for WPG, the moderated mediation effect was significant at a high level ($\beta = 0.22$) for the 95% CIs (0.14, 0.33); WNG was significant at a low level ($\beta = -0.16$), with 95% CIs not containing zero (−0.23, −0.11). Hence, Hypothesis 6a and 6b were supported.

DISCUSSION

This study was designed to explore the effect of WG on participators' MH by assessing PsyCap as the underlying mediated mechanism and investigated the moderating effect of DJE. This study conducted three waves of data collection with 222 full-time employees from a Taiwanese tourism company who were invited to participate. The results revealed that WPG and WNG positively and negatively affected participators' MH, respectively. The two relationships were differentially mediated by PsyCap. Furthermore, employees with higher DJE exhibited greater capacity to positively interpret WPG and cope with WNG, which ultimately affected individual's PsyCap and had indirect effects on individual's MH. Therefore, DJE played a moderating role among WG, PsyCap, and MH.

Theoretical Implications

The study makes four contributions to the literature on WG. First, this study determined that WG would affect individuals' psychological health, which have rarely been investigated. Moreover, we observed that WPG enhances MH, whereas WNG has a negative impact. The results also showed that both types of

TABLE 4 | Regression results for moderation ($N = 222$).

Simple moderation results for PsyCap					
Values of moderators in *Simple moderated effect*	**Conditional effect**	***SE***	**Boot LL 95% CI**	**Boot UL 95% CI**	***p***
DJE × WPG	0.23	0.06	0.12	0.36	0.000
−1 *SD* (3.33)	0.08	0.06	−0.04	0.20	0.19
M (3.88)	0.20	0.05	0.12	0.30	0.000
+1 *SD* (4.42)	0.33	0.06	0.23	0.45	0.000
DJE × WNG	0.14	0.05	0.05	0.24	0.003
−1 SD (3.33)	−0.23	0.04	−0.32	−0.16	0.000
M (3.88)	−0.15	0.03	−0.22	−0.09	0.000
+1 SD (4.42)	−0.07	0.04	−0.16	0.02	0.088
Moderated mediation results for MH (WPG)					
Values of moderators in *Moderated mediation effect*	**Conditional indirect effect**	***SE***	**Boot LL 95% CI**	**Boot UL 95% CI**	
−1 SD (3.33)	0.06	0.48	−0.04	0.15	
M (3.88)	0.14	0.04	0.07	0.22	
+1 SD (4.42)	0.22	0.05	0.14	0.33	
Index of moderated mediation	**Index**	***SE***	**Boot LL 95% CI**	**Boot UL 95% CI**	
DJE (WPG)	0.15	0.05	0.06	0.27	
Moderated mediation results for MH (WNG)					
−1 SD (3.33)	−0.16	0.03	−0.23	−0.11	
M (3.88)	−0.10	0.02	−0.15	−0.07	
+1 SD (4.42)	−0.05	0.03	−0.11	0.01	
Index of moderated mediation	**Index**	***SE***	**Boot LL 95% CI**	**Boot UL 95% CI**	
DJE (WNG)	0.10	0.04	0.03	0.18	

Standardized regression coefficients are reported. Bootstrap sample size = 50,000.
LL, lower limit; CI, confidence interval; UL, upper limit.

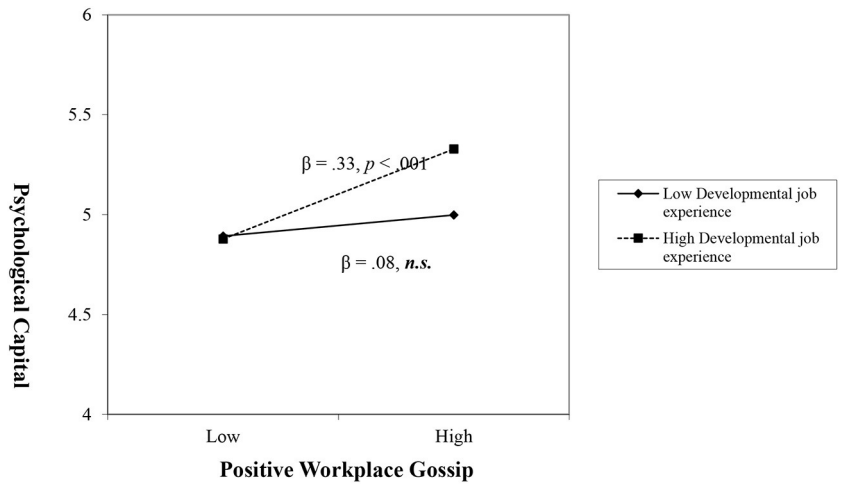

FIGURE 1 | Moderating effect of developmental job experience on the relationship between workplace positive gossip and psychological capital.

WG should be assessed (2, 3), and although WPG is a deviant behavior, it has potential for serving a social function at work.

Second, the present study proposed an alternative psychological mechanism of PsyCap to explain the underlying effects of WG on participators' MH. Although previous studies have described possible mechanisms from cognitive, affective, emotional, or psychological perspectives (4), few studies have conceived of WG as a personal resource that may affect individual MH from a psychological resources perspective. The findings suggested that individuals engaging in different types of WG may cause different dynamic changes in PsyCap based on their interpretation of WG social cues (1), which might differentially affect gossipers' MH. Furthermore, our results suggest that engaging in WG can be a channel for individuals

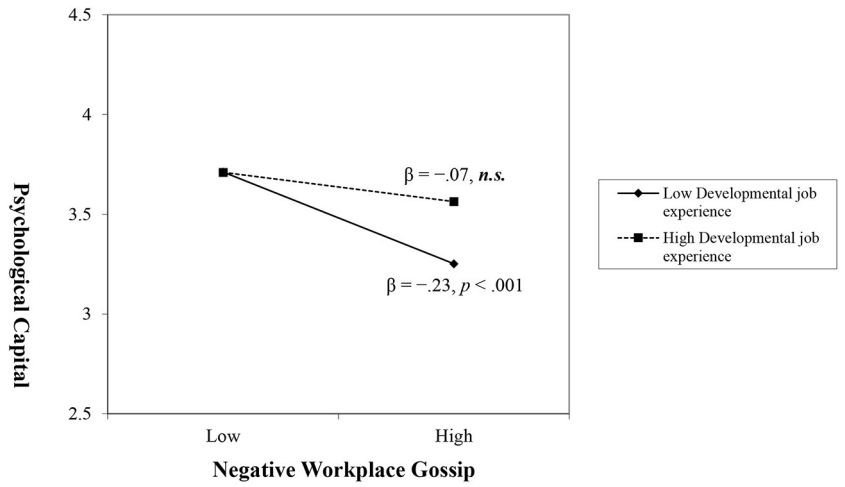

FIGURE 2 | Moderating effect of developmental job experience on the relationship between workplace negative gossip and psychological capital.

to exchange personal resources, and further explained how and why WG can be interpreted as a psychological resource to affect gossiper's MH through PsyCap.

Third, this study identified the boundary conditions for the effect of WG on participators' MH. The results highlight an important moderator of both WPG and WNG. Our findings of moderated effects reaffirm prior studies demonstrating that employees with high DJE tend to have a more sensitive and systematic approach to social cue interpretation (9, 10). Specifically, our results showed that the direct effects of WPG on PsyCap and indirect effects of WPG or MH through PsyCap would be strengthened for employees with high DJE. Moreover, an employee with significant DJE would attenuate the negative effects of WNG on PsyCap or MH through PsyCap, which means that high DJE would provide a coping mechanism for them to mitigate the negative effects of WNG engagement. Thus, this study identified that DJE could interact with individuals' social information processing (13) and demonstrated the individual differences of DJE during social cue interpretation (42). In summary, this study identified a valuable boundary condition in the relationships among WG, PsyCap, and MH.

Practical Implications

In practical terms, WG frequently occurs in daily conversations (19), so it is important for employees, managers, and organizations to realize its meaning in organizational settings (1). The findings of the present study suggest the following implications.

Firstly, as indicated in previous studies, WG cannot be viewed only as deviant behavior but as one that offers the positive functions of enhancing information exchange in organizations, facilitating friendships, or providing entertainment (2, 11). Specifically, WPG participation positively correlates to participators' PsyCap and MH (through PsyCap), whereas engaging in WNG is negatively related to gossipers 'PsyCap and MH (through PsyCap). Thus, the first intervention for managers is to guide employees to talk about more positive gossip when they engage in idle talk behaviors. For example, managers can encourage employees to discuss others' positive evaluations during break times or post bulletin board notices in the break room. Moreover, managers could also offer public praise for outstanding employee performance (53), which could provide a topic for informal chats. However, our results do not indicate that managers should intentionally create opportunities for positive gossip to improve employees' MH. While managers cannot completely prevent WNG (21, 26, 29), they can minimize its occurrence (41). Liu et al. (21) suggested that organizations can establish a zero-tolerance organizational culture or issue rules and norms for WNG. Moreover, managers can educate employees (19) about why and how negative gossip can diminish PsyCap and exacerbate MH issues.

Secondly, this research revealed the moderating effect of DJE, which can help individuals intensify the positive effects of WPG and cope with the negative effects of WNG. As for interventions, managers can assign extra challenge tasks or implement job transitions that help employees develop new skills (46). Managers could also assign employees a highly interactive recurrent task in cooperation with peers, supervisors, and colleagues in other departments or provide task opportunities to deal with government officials or suppliers. By meeting these challenges, employees could enhance their DJE. Organizations could also communicate the meaning of DJE by encouraging employees to voluntarily accept challenging tasks (10).

Limitations and Future Directions

This study also has limitations. First, due to convenience sampling, this study only tested one specific industry. Hence, this study did not test the effects of industry differences on hypotheses. The service industry, like the tourism industry, provides more opportunities for employees to interact at work or interact with suppliers, customers, or other companies outside the organization than the manufacturing industry

(54). Therefore, the tourism industry may have a higher frequency of WG and higher perception and sense of DJE than manufacturing. In the future, researchers could investigate industry differences in WG and DJE to provide holistic and robust perspectives.

Second, we considered gossiper's PsyCap but neglected to control for other relevant contextual variables such as other job resources and job demands (8, 21). Furthermore, we may have overlooked the effects of some personality dispositions (1), a consideration that may have yielded stronger evidence for the predictive power of gossip. Future work should consider controlling for these variables to yield more robust results regarding the effects of WG on employees.

Third, this study only stressed the importance of the moderated effect of DJE, indicating its different functions when coping with the two types of WG. Future investigations can examine more boundary conditions or other multilevel perspectives to clarify other moderating effects of WG on employee attitudes and behaviors.

Forth, this research model only tested the individual-level model. Others have indicated that cross- or multilevel approaches of WG are alternative perspectives for investigating organizational phenomena (1) and suggested that WG can create a social context for employees. Thus, future study can collect and analyze WG from a multilevel perspective to explore the organizational effect on employees' outcomes.

CONCLUSION

This study indicated the effects two types of WG on participators' MH and highlighted the mechanism of the psychological process. WPG (WNG) can be a positive (negative) trigger to enhance (reduce) employee psychological resources. Furthermore, these results revealed a moderating effect on employees with high DJE who have better capabilities to absorb the positive energy of WPG and cope with WNG.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

SC, C-CK, and VK contributed to conception and design of the study. H-CC organized the database. SC and M-CL performed the statistical analysis. SC wrote the first draft of the manuscript. All authors revamped sections of the manuscript and contributed to manuscript revision, read, and approved the submitted version.

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Do Differences in Drinking Attitudes and Alcohol-Related Problems Explain Differences in Sick Leave? A Multilevel Analysis of 95 Work Units Within 14 Companies From the WIRUS Study

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Background: Systematic reviews have shown a strong relationship between alcohol consumption and sick leave. The effect of alcohol consumption on sick leave may, however, vary according to the work environment. While attitudes toward drinking may impact sick leave, there is little research on the contribution of drinking attitudes to sick leave. Moreover, alcohol-related problems and drinking attitudes may be influenced by the broader sociocultural contexts of the organizational units where people work.

Objectives: This study aimed to explore the relationship of alcohol-related problems and drinking attitudes with sick leave while considering the nesting of employees within working units within companies.

Method: Data from the WIRUS (Workplace Interventions preventing Risky alcohol Use and Sick leave) study were linked to company-registered sick leave data for 2,560 employees from 95 different work units in public (n = 9) and private companies (n = 5) in Norway. Three-level (employee, work unit, and company) negative binomial regression models were estimated to explore the 12-month prospective association of alcohol-related problems and drinking attitudes with four measures of sick leave (one-day, short-term, long-term, and overall sick leave days). Models were adjusted for gender, age, cohabitation status, educational attainment, work position, and employment sector.

Results: We observed higher variation of one-day, short-term, and overall sick leave days between companies than between work units within companies (15, 12, and 30% vs. 0, 5, and 8%, respectively). However, neither alcohol-related problems nor drinking attitudes were associated with sick leave and, thus, those variations in sick leave were not explained by alcohol-related problems or drinking attitudes.

Conclusion: Our findings suggest company-level differences are more important than within company differences when explaining differences in sick leave. While alcohol-related problems or drinking attitudes were not associated with sick leave, future studies may need to explore the role of company policies, practices, or social norms in variations in sick leave rates.

Keywords: alcohol consumption, workforce, public health, attitudes, absenteeism, presenteeism

INTRODUCTION

Health-related leaves have been linked to lifestyle behaviors, with alcohol consumption playing a major role (1–6). Risky alcohol use [i.e., a drinking pattern that raises the likelihood of medical, social, occupational, and economic problems (7)] increases the risk of long-standing illnesses and injuries (8–10) as well as mortality. For instance, in Europe, about 800 daily deaths are attributable to alcohol use and abuse (11). Alcohol consumption is not equal across Europe and, for instance, in 2018, one to three out of ten Norwegian employees were found to be characterized as risky drinkers (12). Norway's alcohol consumption (7.5 liters per capita in 2017) is higher than the average worldwide consumption of 6.4 liters per capita per year (13). Recent studies from Norway on alcohol and work impairment have found that alcohol consumption diminishes work performance (i.e., presentism) (3, 14). Risky alcohol use also can increase the risk of work-related injuries (15) and sick leave (16–18). One study on Norwegian employees found an increase of 13% in sick leave when the total alcohol consumption increased by one liter (19). Moreover, an Australian study reported that employees with monthly risky drinking patterns are about 8.7 times more likely to report alcohol-related sick leave than employees with low-risk drinking patterns (20).

The impact of alcohol consumption on sick leave could result in one or just a few days of absence due to alcohol intoxication and hangovers. For instance, employees are more likely to take a sick leave after consuming alcohol the previous night (21–23). The impact can also be related to long-term sick leave due to negative health and social effects of alcohol consumption over time (24, 25). However, the evidence on the relationship between alcohol consumption and sick leave is mixed. Several studies have found sick leave to be more likely to occur among individuals with alcohol-related problems (6, 19, 26–36), others report U-shaped associations (2, 24, 37, 38), and others have found no association (39–42) or negative associations (43), so that sick leave would be less common among those with higher levels of alcohol consumption. Some of the disparity in findings may be due to methodological differences in the operationalization of alcohol consumption and sick leave, or in the adjustment for confounders.

Sick leave imposes practical as well as financial burdens for individuals, businesses, and societies (5, 44, 45). Employees may face layoff consequences. Businesses may be forced to reschedule or reassign work duties to other existing employees or may need to recruiting temporary workers to mitigate the effect of a missing worker. The welfare system may need to absorb the cost of the leave (46–48). Sick leave, both in terms of spells and their duration, may be affected by a wide range of factors, including individual characteristics (e.g., age, gender), health conditions, working conditions, or the organization of work (49–51). Further, workers' decisions about their illness behavior may be affected by the ability to attend due to poor health but also by organizational values (52, 53). The workplace provides a significant cultural and social context in which, through social interaction processes, workers share and acquire knowledge regarding the expected behaviors and attitudes for effective participation in a work setting (54, 55). The interactions between characteristics of individuals and characteristics of working groups matter (56–58). Workgroup norms and attitudes toward drinking are found to be strong predictors of drinking behaviors (59–61) and work impairment (62). Moreover, workgroup norms concerning work attendance are suggested to be significant predictors of sick leave (63–65). Given this evidence, it is surprising that the majority of the prior research has focused mainly on the role of individual determinants. To fully understand the relationship between alcohol behavior and sick leave, it is important to assess the potential determinants at the individual (e.g., sociodemographic, drinking behaviors) and group levels (e.g., social norms and attitudes toward drinking). In addition, sick leave may also vary by business given differences in workplace's policies and practices regarding accruing and use of sick leave. Thus, there is a need to consider individual, group, and employer-level differences when studying the relationship between alcohol and sick leave.

Moreover, differences in sick leave also exist by country. These differences are related to variation in the definition of sick leave, culturally determined behaviors, and sick leave benefits schemes, which makes international comparisons challenging (66, 67).

Even between Scandinavian countries, known by their similar approach to the welfare state (68), there are also differences, with Norway showing the highest rate of sick leave (46) before the COVID-19 pandemic started. During the COVID-19 pandemic, Norway still had the highest sick leave rate in the European Union (5.7%) (69, 70). Further, binge drinking is also frequent in Norway, which is a risk factor for short- and long-term health issues and social problems (11). The most recent study in Norway estimated that alcohol-related absence constitutes about 1% of the total sick leave and about 3% of short-term sick leave (71). However, no recent research has explored the relationship between drinking attitudes and sick leave in Norway.

Therefore, given the gaps identified in the literature, this study aimed to explore the relationship of alcohol-related problems and drinking attitudes with sick leave, while considering the nesting of employees within working units within companies in Norway.

MATERIALS AND METHODS

Design

This study is part of the Norwegian national WIRUS (Workplace Intervention preventing Risky Use of Alcohol and Sick leave) project and was designed as a cohort study on a sample of employees in 14 companies in Norway. More details and other results from the WIRUS project are published elsewhere (3, 12, 14, 59, 72–80).

Sample and Data Collection

Employees (blue, white, or pink-collar worker, or manager, i.e., a salaried worker) from 95 different work units were recruited from nine public and five private companies in Norway. These companies were categorized in accordance to the European Classification of Economic Activities (81), including: transportation and storage ($n = 1$), manufacturing ($n = 3$), public administration ($n = 5$), health care service ($n = 3$), accommodation ($n = 1$), and education ($n = 1$). The average work unit size had 27 employees (min. 10, max. 50).

A total of 17,855 employees from 19 companies were invited to participate in a web-based survey *via* their employer-provided e-mail addresses. Altogether, 5,076 employees accepted to complete the survey (28.5% response rate). WIRUS screening data regarding the included companies were collected from June 15, 2015 to 14 December, 2017. In 2020, company-registered sick leave data was collected for the 12-month follow-up period after each individual's baseline WIRUS screening (i.e., 2016 to 2018). Given delays due to the COVID-19 situation, data from five of the companies ($n = 1,794$ employees) was not available and, thus, these employees were excluded from the study. Further, after excluding participants without valid information on the key variables (e.g., alcohol-related problems, drinking attitudes, and sick leave), the final sample included 2,560 employees (50.4%) from 14 companies. Characteristics of the study sample are shown in **Table 1**.

The final sample was predominantly female ($n = 1,685$; 65.8%), with more than two-thirds aged 40 or older, 14% reporting living alone, three out of four having completed university/college education, and approximately two out of ten being managers. Most respondents in the final sample (89.3%) were employed within the public sector companies (manufacturing, public administration, health care, and education), while the remaining were employed within private sector companies (transport, manufacturing, public administration, and health care). After comparing the study sample with the invited sample, only the proportion of employees age ≥40 was somewhat higher in the study sample (69.5 vs. 64.5%).

TABLE 1 | Study sample characteristics ($N = 2,560$).

Characteristics	Study sample *n* (%)
Gender	
Male	875 (34.2)
Female	1,685 (65.8)
Age	
≤39	780 (30.5)
≥40	1,780 (69.5)
Cohabitation status	
Living alone	357 (14.0)
Living with others	2,203 (86.0)
Educational attainment	
Primary/lower secondary	66 (2.6)
Upper secondary	568 (22.2)
University/college	1,926 (75.2)
Work position	
Worker[a]	2,062 (80.5)
Middle manager/senior executive	498 (19.5)
Branches	
Transport	62 (2.4)
Manufacturing	184 (7.2)
Public administration	1,647 (64.3)
Health care services	528 (20.6)
Accommodation	26 (1.0)
Education	113 (4.5)
Employment sector	
Private	275 (10.7)
Public	2,285 (89.3)

[a] *Including blue, white- and pink-collar workers.*

Measures

Alcohol-Related Problems

The ten-item Norwegian translation of the Alcohol Use Disorders Identification Test (AUDIT) were used to measure alcohol-related problems. The AUDIT was developed by the World Health Organization (WHO) and is widely used to assess alcohol consumption and related problems in a wide range of settings and populations (7, 82). Each of the ten item is scored from 0 to 4, so the total score can range from 0 to 40. AUDIT covers three key domains including alcohol intake (items 1–3), dependence on alcohol (items 4–6), and alcohol-related harms (items 7–10). There is support for considering AUDIT as a one-factor tool indicating different levels of alcohol-related problems, as

a two factor (drinking patterns and consequences) tool, or as three factors (drinking habits, alcohol dependence, and harmful alcohol use) (83, 84). However, the most recent confirmatory factor analysis of AUDIT based on WIRUS data (74) supports the use of AUDIT as a unidimensional measure of alcohol-related problems and so we used it as such in the present study. AUDIT's internal consistency in the present sample was acceptable (Cronbach's $\alpha = 0.78$). For this study, we treated the AUDIT scores as a continuous sum score measure where higher scores indicate higher levels of alcohol-related problems.

Drinking Attitudes

Drinking attitudes were measured using the Norwegian translation of the Drinking Norms Scale (DNS) (85). The DNS is a 7-item scale addressing attitudes toward drinking in general (three items) and work-related drinking (four items). Earlier psychometric analyses have suggested using DNS as a unidimensional measure (85) and so we did in this study. Each item was coded on a 4-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree). Negatively worded items (i.e., items 6 and 7) were reverse scored, and the total sum score for all seven items was calculated so that higher scores indicated more positive/liberal drinking attitudes. The DNS's internal consistency in the present sample was acceptable (Cronbach's $\alpha = 0.73$).

Sick Leave

The primary outcome was the number of company-registered days of sick leave during the 12-month follow-up after the baseline WIRUS screening. Leaves due to maternity, pregnancy-related reasons, and non-health reasons (e.g., vacation) were excluded. We created three sick leave measures based on the total number of days on sick leave during the 12-month follow-up period (i.e., length of sick leave): short-term sick leave (i.e., ≤14 days, $n = 1607$, 62.7%, median: 5.0, IQR: 3.0–8.0), long-term sick leave (≥15 days, $n = 348$, 13.6%, median: 42.0, IQR: 21.0–89.0), and total sick leave as the total number of sick leave days within the 12 months of follow-up ($n = 1632$, 63.0%, median: 7.0, IQR: 3.0–25.0). In addition, for one-day sick leaves, the actual number of hours of sick leave taken within a day was registered. In Norway, the hours per week to which a full-time position equates is 37.5 and, so, a full-time working day would be 7.5 hours (86). Therefore, we created a 'one-day sick leave hours' measure summing up the number of hours between 1 and 7.5 for all sick leaves which duration was no longer than 1 day ($n = 1081$, 42.0%, median: 11.0, IQR: 8.0–19.0).

For sensitivity analyses, we created additional metrics: for sick leaves of 14 days or less, we calculated an approximate number of days at risk (i.e., 365 minus total number of days of sick leave lasting longer than 14 days, assuming there could be a difference between a person who has only two short-term sick leaves (≤14 days) during the 12-month follow-up, and another who has several short-term sick leaves within 5 weeks but no long-term sick leave (≥15 days). In addition, we created four measures of sick leave spells [i.e., episodes (87)]: one-day hour (i.e., number of times a person had 1-day h sick leave, median: 2.0, IQR: 1.0–3.0), short-term spells (i.e., frequency of the short-term sick leave days, median: 3.0, IQR: 1.0–5.0), long-term spells (i.e., frequency of the long-term sick leave days, median: 2.0, IQR: 1.0–3.0), and total sick leave spells (i.e., frequency of having sick leave days of any durations, median: 3.0, IQR: 1.0–6.0).

Covariates

Based on prior research (88–91), we included the following co-variables: gender (male, female), age (continuous), cohabitation status (living alone, living with others), educational attainment levels (primary/lower secondary, upper secondary, university/college), work position (employee, middle manager or senior executive), and employment sector (public, private).

Analysis

Descriptive statistics are presented as frequencies and percentages for categorical variables, as means and standard deviations (SDs) for symmetrically distributed continuous variables, and as medians and interquartile ranges (IQRs) for asymmetric continuous variables.

Negative binomial (NB) regression models, crude and adjusted for gender, age, cohabitation status, educational attainment, work position, and employment sector, were used to assess the associations (incidence rate ratios or IRRs, with corresponding 95% confidence intervals or CIs) of alcohol-related problems and drinking attitudes with sick leave. Three-level random intercepts models were used to allow for intra-cluster correlation resulting from clustering of individuals within work units within companies. Sensitivity analyses were performed for short-term sick leave days by including the approximate number of days at risk as an exposure variable. In addition, the same analyses were performed for sick leave spells (87) to make sure that the results are consistent.

All descriptive analyses were performed using IBM SPSS, version 26. Multi-level regression models were running in Stata/SE version 17.0 (92), with function *menbreg*. Statistical significance was set at $p < 0.05$.

Ethics

The study was approved to collect and store sensitive data by the Regional Committees for Medical and Health Research Ethics in Norway (REK) (approval no. 2014/647). Participants received an invitation letter and were informed about the overall aims of the WIRUS study and were assured that their participation was voluntary. All participants provided written informed consent prior to participation and were informed that they could withdraw their consent at any given time without any consequences. Respondents were treated according to the World Medical Association's Declaration of Helsinki (93).

RESULTS

The relationship of alcohol-related problems and attitudes with sick leave are shown in **Table 2**. Adjusting for gender, age [as a continuous variable], cohabitation status, educational attainment, work position and employment sector, alcohol-related problems showed no association with one-day (IRR =

1.00; 95% CI: 0.97–1.04), short-term (IRR = 0.99; 95% CI: 0.98–1.01), long-term (IRR = 0.96; 95% CI: 0.89–1.03), or overall sick leave days (IRR = 0.98; 95% CI: 0.95–1.00) on work units within companies. Similarly, drinking attitudes were not associated with one-day (IRR = 0.99; 95% CI: 0.96–1.04), short-term (IRR = 0.99; 95% CI: 0.96–1.01), and long-term days (IRR = 0.94; 95% CI: 0.88–1.01) on work units within companies. However, we found a slightly negative association between higher scores on drinking attitudes and taking sick leave (IRR = 0.97; 95 % CI: 0.95–0.99), indicating that one-unit higher score on drinking attitude was associated with 3% less sick leave days.

The association between the covariates and sick leave is shown in **Supplementary Table 1**. Compared with males, females had higher one-day (IRR = 1.56; 95% CI: 1.27–1.92), short-term (IRR = 1.70; 95% CI: 1.44–2.00), long-term (IRR = 2.24; 95% CI: 1.61–3.11), and overall sick leave days (IRR = 1.66; 95% CI: 1.46–1.89) and age showed a slightly positive association with long-term days (IRR = 1.02; 95% CI: 1.01–1.03). Public sector employees had higher rate of taking sick leave than private sector employees and higher educational levels (i.e., upper secondary and university/college) was associated with less one-day, short-term, and overall sick leave days compared to lower educational levels (i.e., primary/lower secondary).

Sensitivity analysis showed that adjusting for days at risk did not affect the results noticeably (data not shown), nor did adjusting for age in two categories rather than continuously (shown in **Table 1**). Finally, using sick leave spells as the outcome measure rather than days did not alter the results (**Supplementary Table 2**).

All sick leave metrics showed statistically significant variation across companies, with short-term and overall sick leave also showing variation across work units within companies (**Supplementary Table 3**; Model 0). Between companies' variance in sick leave amounted to 15% of the total variance in one-day sick leave, and 12, 30, and 30% of the variance in short-term, long-term, and overall sick leave days, respectively. The variances in sick leave between work units within companies were generally lower. The co-variables (gender, age, cohabitation status, educational attainment, work position, and employment sector) explained much of the variation between companies, in particular for one-day and short-term sick leave (Model 1). The alcohol-related variables, on the other hand, explained little to none of the variation in sick leave (Models 2–3), and there were still substantial amounts of unexplained variation in long-term and overall sick leave days between companies in the fully adjusted model. The same results were obtained when adjusting for days at risk (data not shown).

DISCUSSION

This study aimed to explore the relationship of alcohol-related problems and drinking attitudes with sick leave, while considering the nesting of employees within working units within companies. The following main findings will be discussed: (i) most of the variance in sick leave (12–30% depending on the sick leave measure) was found between companies, while no more than 8% of the variance was found between work units within companies, (ii) alcohol-related problems showed no association with sick leave days, and (iii) drinking attitude showed no association with sick leave days, but showed a slightly negative association between higher scores on drinking attitudes and overall sick leave days between work units within companies.

The observed higher variation of sick leave between companies than between work-units within companies may be explained by differences in sick leave culture [i.e., self-awareness of others' or one's own attendance behavior or being agreed on a proper level of absence (94)] and social context, outside and inside the workplace (67, 95). Consistent with this notion, shared beliefs about absence and employment, and cultural salience (e.g., absence control system, existing technology, social ecology, friendship patterns, and communication) may be sensible reasons for variations in sick leave (95). For instance, compared to employees with higher empowerment in their jobs, employees having a lower sense of empowerment in their jobs have a stronger feeling of external control and, accordingly, have a concrete perception of taking sick leave (95, 96). However, organizational aspects such as colleagues' and supervisors' behaviors (1, 2, 97–99), the physical and mental load of the job (100, 101), workforce's downsizing (4), ethnic composition (102), job satisfaction (103), and psychiatric morbidity (104) may also contribute to the variation in sick leave between and within companies and their work units. Sick leave due to these factors can be considered as work-related sick leave and may have a greater need for being away from work than sick leave due to non-work-related factors (e.g., sick kids, flu) (105). Further, some of these factors may affect sick leave indirectly through the influence of health behaviors. For instance, colleagues' and supervisors' behaviors or job stress can influence a worker's consumption level of alcohol, which in turn may increase sick leave (1, 99).

Although several studies have explored the association of organizational culture and attitudes with sick leave (65, 106, 107), this study was the first to explore the association between drinking attitudes and sick leave. However, neither alcohol-related problems nor drinking attitudes explained sick leave in our study and drinking attitudes even showed a slightly negative association with overall sick leave. One may assume that companies characterized by more positive drinking attitudes can be characterized by more permissive absence norms, as they may take a more laissez-faire approach to control employees' behavior. However, as no association between alcohol-related problems and sick leave measures was found, finding no association between drinking attitudes and sick leave was unsurprising. In addition, as this study is the first to explore the association between drinking attitudes and sick leave, we thus cannot compare our observed results with other studies.

The lack of association between alcohol-related problems and sick leave is at odd with prior literature showing an alcohol-sick leave association, both among Norwegian employees (19, 22, 23, 29) and other populations (28, 30–36). However, our results are in agreement with other studies reporting no alcohol-sick leave association (39–42), including studies from Norway (39, 40). Overall, our study did not contribute to clarify the relationship between alcohol consumption and sick leave. Discrepancies

TABLE 2 | Association[a] of alcohol-related problems and attitudes with sick leave duration (one-day, short-term, long-term, and overall sick leave days), for 2,560 employees in 95 work units within 14 companies in the WIRUS study.

		Sick leave			
Alcohol-related variables		**One-day hours**	**Short-term days**	**Long-term days**	**Total days on sick leave**
Alcohol-related problems (continuous scores)[e]	IRR^{b}_{crude}	1.01	0.98	0.95	0.97 *
	$IRR^{c}_{adjusted}$	1.00	0.99	0.96	0.98
	95% CI[d]	0.97–1.04	0.96–1.01	0.89–1.03	0.95–1.00
	Likelihood ratio X^2 *p*-value	72.57 < 0.001	111.41 < 0.001	19.82 < 0.05	97.87 < 0.001
Drinking-attitudes (continuous scores)[f]	IRR^{b}_{crude}	0.99	0.98	0.94	0.96**
	$IRR^{c}_{adjusted}$	0.99	0.99	0.94	0.97
	95% CI[d]	0.96–1.02	0.96–1.01	0.88–1.01	0.95–0.99
	Likelihood ratio X^2 *p*-value	72.64 < 0.001	111.90 < 0.001	20.34 < 0.05	99.76 < 0.001

*[a] Results from multilevel negative binomial regression analyses; [b] IRR_{crude} = incidence rate ratio, bivariate association; [c] $IRR_{adjusted}$ = incidence rate ratio, adjusted association adjusted for gender, age, cohabitation status, educational attainment, work position, and employment sector; [d] CI = confidence intervals; [e] Composite score of the ten AUDIT items, potential range = 0–40, higher score indicates presence of alcohol-related problems; [f] Composite score of the seven DNS items, higher score indicates positive/liberal drinking attitudes; *$p < 0.05$; **$p < 0.01$.*

in the literature may be attributed to several factors, mainly about differences in the measurement of exposure and outcome, the type of the organizations studied, or differences in study populations, which also make any direct national or international comparisons complicated.

Compared to other studies, different metrics of alcohol drinking levels and sick leave duration models were employed while referring to the same measure. For instance, in studies reporting an alcohol-sick leave association, short-term sick leave had been measured as ≤3 days (31), ≤7 days (32, 33), with self-reported measures (22, 29, 31), combined with other health issues as mental disorders or anxiety (30, 40). In some cases, there were differences in the measurement of alcohol consumption (e.g., average weekly volume, or alcohol use disorder) (28, 40). Moreover, although our results were consistent with some Norwegian studies (39, 40), those results were focused on individual-level factors and not company-level determinants.

Another reason for the existing discrepancy of findings regarding the association between alcohol-related individual differences and sick leave could be related to the work settings being studied. Some of the prior studies reporting an association between alcohol consumption and sick leave were using a sample of manual employees (19), non-industrial civil servants (32), police officers (34, 35), farm industry employees (36), or public sector employees (31). Although in the present study we used a sample from a wide variety of work settings, almost nine out of ten employees were employed within the public sector in a variety of occupations and industry settings. Some specific work settings may attract individuals with certain attitudes but, also, some shared attitudes and behaviors may form in such settings (65). Moreover, work settings reporting an alcohol-sick leave association may also be affected by the existing alcohol policies in place, birth cohort effect, social regulations, or alcohol availability at work.

Finally, the low participation rate in our study may have biased the associations toward the null. The healthy worker effect may have been compounded with the also known effect of non-responders in health surveys being generally less healthy than responders (108). People with drinking problems may be less prone to participate in surveys or to be in the workforce altogether (109) but also to provide inaccurate self-reports of alcohol consumption (110). Unfortunately, we were not able to control for any of these factors in our study, so more research would be needed to elucidate the true relationship of alcohol-problems and drinking attitudes with sick leave.

Methodological Considerations

This study has several strengths. First, by using multilevel models, we were able to take into account the grouping of individuals within work units and companies. Second, we used company-registered sick leave data, which is considered a "gold standard" (111–114), one found to be valid and more reliable than self-reported sick leave data (46, 111, 115). However, there are some limitations to be considered when interpreting our results.

First, despite the large sample ($n = 2{,}560$), the study's response rate was low (14.3%), which may have implications for the representativeness of our study (116). Also, WIRUS study (3, 12, 59, 76) has an overrepresentation of females, employees with university/college education, employees age ≥40, and employees in the public sector compared with the overall Norwegian workforce. Studies state that health surveys have generally been skipped or underreported by (younger) men, individuals with lower socioeconomic status, and those having drinking problems (117–119), which may lead to an underestimation of the effect of alcohol on sick leave.

Second, alcohol-screening data was self-reported, which may have been affected by social desirability responses (SDR) as people tend to display a favorable image of themselves on surveys (120). However, SDR behavior does not undervalue employed

validated and reliable alcohol measurement instruments (e.g., AUDIT). Another potential issue is recall bias. Shorter reference period may lead to more precise answers but reduce the ability to estimate one's typical alcohol consumption through a year (7, 121–123). Longer reference period (e.g., 1 year) are also recommended (121, 122) when using the AUDIT instrument.

Third, although the AUDIT is a -ecognize scale, other measures of alcohol such as the frequency or quantity of alcohol consumption may be related to sick leave. WIRUS did not included such measures so we could not compare our results with those studies measuring the amount of alcohol consumption.

Finally, although the results out of this study were adjusted for potential confounders, there might be other unmeasured factors of interest (e.g., mental health, diet, smoking, stress, or work conflict) (1, 24, 124, 125).

Implications for Future Research

This study highlights the need for more refined measures and inclusion of other unmeasured factors to confirm the lack of associations of alcohol-related problems, drinking attitudes with sick leave. Also, one may clarify whether the existing high variation of sick leave between companies than between work units within companies is work-related or not. The attributable proportion of taking sick leave is reported to be higher for work-related sick leave factors than for lifestyle-related sick leave factors (124). Hence, knowing this difference may have significant implications not only for occupational risk prevention but also for the reduction of sick leave-related economic outcomes.

Moreover, more work is needed regarding the interaction between the type of employment, as well as the type of job position, and sick leave. Permanent employees tend to report more sick leave than non-permanent employees (49, 126), and employees in managerial positions report less sick leave, but more presentism, than other employees without such positions and responsibilities (127).

Therefore, further research is encouraged since the most recent study on the changes in alcohol consumption, among Norwegians, during the COVID-19 pandemic, has found a notable increase in proportion of heavy drinkers (128).

CONCLUSIONS

Sick leave, which depends on multiple individual and contextual factors, is a key aspect of occupational health. Our study highlights the importance of between company-level differences over between work-units within company differences in relation to sick leave. The observed lack of associations between alcohol-related individual differences and sick leave suggests factors beyond individual characteristics such as organizational culture and the social context may play a role in the occurrence of sick leave. Hence, further research is needed to confirm or refute our findings in different settings while taking into consideration specific company policies or group norms.

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 Regional Committees for Medical and Health Research Ethics in Norway (approval no. 2014/647). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RA: conceptualization, project administration and funding acquisition. NH, ID, and RA: methodology and validation. NH and ID: formal analysis and data curation. NH: writing—original draft preparation. RA, JS, and HS: supervision. All authors: writing—review and editing. All authors have read and agreed, and supervision to the published version of the manuscript.

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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.2022.817726/full#supplementary-material

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Social Support and Coping Style of Medical Residents in China: The Mediating Role of Psychological Resilience

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Objectives: Recent surveys have paid insufficient attention to the psychological status of medical residents, but medical residents, as a special group of medical workers, need to be focused on. This study aimed to investigate medical residents' levels of social support, psychological resilience, and coping style, and explore the mediating role of psychological resilience, which can ultimately provide a new theoretical basis for improving medical residents' psychological status and quality of work and life.

Methods: A total of 577 medical residents from China were investigated by an online questionnaire, using convenience sampling. Associations between social support, psychological resilience, and coping styles were assessed using Pearson correlation analysis. The mediating effect of psychological resilience was tested using SPSS Process.

Results: Positive correlations between social support, psychological resilience and coping style were found ($r = 0.474$, $P < 0.001$; $r = 0.473$, $P < 0.001$; $r = 0.353$, $P < 0.001$). The mediating effect of psychological resilience in the relationship between social support and coping style was significant (95% CI: 0.168, 0.384), and accounted for 25.84%.

Conclusion: Attention should be paid to the psychological status of medical residents, and social support and psychological flexibility can be used to increase the enthusiasm for their coping style and promote their mental health.

Keywords: residents, psychological resilience, social support, coping style, mediation

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INTRODUCTION

Medical residents are primary care physicians in hospitals, mainly responsible for the basic clinical medical work, including receiving patients, recording the course of the disease, and performing certain clinical operations, but need to receive the guidance and supervision of superior doctors (e.g., attending doctors and above). Medical residents must develop specific skills in their chosen area during their residency to maintain the quality of patient care. However, during this period, they suffer from various problems, such as lack of sleep, heavy workload, and salary dissatisfaction (1). A

review study showed that long working hours, as well as their negative impact on personal life, are the most common causes of personnel loss in the department of general surgery (2). Studies have focused on the mental health problems of medical residents and speculated that it may have direct or long-term serious consequences for patients or doctors themselves, but existing research has focused more on occupational burnout (2, 3). The main conclusion was that occupational burnout in medical residents was more severe and higher than that in attendings (2, 4). Occupational burnout was thought to be associated with poor psychological status (3), but few studies have reported the psychological status of medical residents.

Actually, psychological stress should be paid more attention to in the current environment of the coronavirus disease pandemic. The task of preventing and controlling infectious diseases is aggravated, medical human resources are scarce, the pressure on medical staff is higher, and the psychological burden is heavier. Several studies have proposed a potential impact of the pandemic on healthcare professionals' mental health (5–7). It has emphasized that simultaneous mental health informed interventions are necessary to promote coping (7).

Under long-term great pressure, psychological resilience has received some attention as one of the characteristics reflecting psychological status (8, 9). Psychological resilience is the ability to maintain the persistence of one's orientation toward existential purposes (10). It constitutes a horizontal attitude that can be understood as the ability to perseverance overcome difficulties experienced in different areas of one's life and a good awareness of oneself and one's internal coherence by activating a personal growth project (10).

Also, there is evidence that psychological resilience may be associated with coping style and social support (11–13). Coping styles refer to the cognitive and behavioral changes that result from the management of an individual's specific external/internal stressors (12). Social support refers to various types of assistance from social networks and can be formal and/or informal, including emotional and physical support (13). In a cross-sectional study, psychological resilience was a significant factor influencing positive coping styles among Chinese undergraduates (12). Psychological resilience can also affect the way diabetic patients solve problems (14). This may be because individuals with high psychological resilience are more likely to show positive cognitive and coping styles in the face of stressful events; conversely, individuals with low psychological resilience are more negative and prone to negative emotions. Alternatively, other evidence suggested that social support provided by families and medical health care personnel can significantly increase psychological resilience in patients undergoing colorectal cancer surgery (15). And social support was an important factor in the development of psychological resilience among elderly caregivers in Singapore and groups of breast cancer patients in China (13, 16). Perhaps this is because individuals with high levels of psychological resilience will take the initiative to use the source of support around them to solve the problems encountered. It is worth noting that social support, a psychological and material resource provided by a social network (17), is a strong backing for individuals when faced with stress and difficulties, helping to enhance confidence in coping with frustration and affecting the choice of coping style for individuals. Studies have shown that social support could reduce stress, reduce the impact of stressful situations, prepare individuals for difficult conditions, and enhance their coping ability (18).

The aim of this study was (1) to verify the relationship between medical residents' psychological resilience, social support, and coping style, (2) and to explore what role psychological resilience plays between the two, (3) ultimately provide a new theoretical and practical basis for improving medical residents' psychological status and quality of work and life.

Therefore, the following two hypotheses can be proposed:

Hypothesis 1: Psychological resilience, coping style, and social support of medical residents are associated with each other.
Hypothesis 2: Medical residents' psychological resilience plays a mediating role between social support and coping styles.

MATERIALS AND METHODS

Participants and Data Collection

Medical residents were selected using non-probability sampling among the four largest hospitals in Hubei Province. These four hospitals are the largest, highest ranked, with the highest number of beds and outpatient visits in Hubei Province, and also have many relatively standardized medical teams. The questionnaire was released through the online platform and was volunteered by medical residents to participate in the survey. The questionnaire was collected for 2 weeks. To ensure the quality of the questionnaire, questionnaires with an answering time of fewer than 3 mins were excluded, and each IP could only fill in it once, and a total of 577 questionnaires were finally collected.

Tools

Coping Style

The Chinese Trait Coping Style Questionnaire (TCSQ) was used to measure medical residents' coping styles, which included two dimensions: positive and negative coping. Each dimension consists of 10 items on a 5-point Likert-type scale, ranging from 1 (absolutely no) to 5 (absolutely yes), respectively. The difference was obtained by subtracting the total negative coping style score from the total positive coping style score. When the difference is positive, it indicates that individuals prefer a positive coping style. The validity and reliability of the TCSQ have been verified (17, 19).

Social Support

Social support was measured using the Social Support Rating Scale (SSRS) with 10 items (20). The total SSRS score ranges from 12 to 66 points, and higher scores on this measure indicate a higher level of social support. The validity and reliability of this scale in the Chinese population have been validated (21).

Psychological Resilience

The Connor-Davidson Resilience Scale (CD-RISC) was chosen for this study to measure the level of psychological resilience in medical residents (22). The scale is a self-rating scale that was currently translated into multiple versions and was

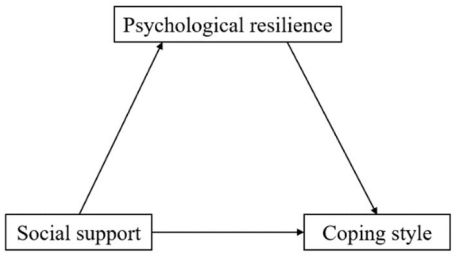

FIGURE 1 | Conceptualized model.

TABLE 1 | Sample characteristics and primary variables ($N = 577$).

	n	Percent (%)/Mean ± SD
Gender		
Male	285	49.4
Female	292	50.6
Age		22.58±2.944
Marital status		
Married	10	1.7
Unmarried	567	98.3
Only child or not		
Yes	307	53.2
No	270	46.8
Homeland		
Wuhan	65	11.3
Outside Wuhan, Hubei	51	8.8
Outside Hubei	461	79.9
Coping style		7.58 ± 11.038
Social support		27.60 ± 5.121
Psychological resilience		65.08 ± 19.862

widely used for the measurement of psychological resilience in different populations and different situations (23–25). Chinese investigators translated the scale into a Chinese version with internal consistency reliability of 0.91 and Cronbach's α ranging between 0.60 and 0.88 (26). The CD-RISC contains 25 items with responses ranging from 5 points for all items as follows: not true at all (0), rarely true (1), sometimes true (2), usually true (3), and true almost all the time (4). This scale was rated based on how the participant has felt over the past month. The total score ranges from 0 to 100, with a higher score indicating more resilience (22).

Sociodemographic

Sociodemographic data included gender (male = 1, female = 2), age, marital status (married = 1, unmarried = 2), whether they were the only child (yes = 1, no = 2) and hometown (Wuhan = 1, outside Wuhan within Hubei province = 2, outside Hubei province = 3).

Data Analysis

Statistical analysis was performed using SPSS version 24. Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation (SD). Associations between variables were assessed using Pearson correlation analysis. The SPSS Process was used to test the effect of social support on coping style through psychological resilience (Model 4). The significance of the mediation effect was tested by Bootstrap and a 95% confidence interval (CI) for the mediation effect was calculated by sampling 5,000 times in the original data using repeated random sampling. If the 95%CI does not include 0, the path is significant. The conceptualized model was shown in **Figure 1**.

RESULT

Detailed descriptions of sociodemographic characteristics and main variables were given in **Table 1**. The main participants in this study were unmarried, with a similar proportion of males (49.4%) and females (50.6%). More than half of the participants were only child (53.2%), and most physicians' hometowns were outside Hubei Province (79.9%).

The results of correlation analysis (**Table 2**) showed that only age was positively correlated with coping style ($r = 0.102$, $P < 0.05$). There were positive relationships between social support, psychological resilience and coping style ($r = 0.474$, $P < 0.001$; $r = 0.473$, $P < 0.001$; $r = 0.353$, $P < 0.001$).

Results of mediation analysis were presented in **Table 3**. Social support had a significant effect on psychological resilience ($\beta = 1.385$, $P < 0.001$) and psychological resilience had a significant effect on coping style ($\beta = 0.192$, $P < 0.001$). Total effect (95% CI: 0.871, 1.182), direct effect (95% CI: 0.607, 0.916), and indirect effect of psychological resilience (95% CI: 0.168, 0.384) were all significant. And the indirect effect accounted for 25.84%.

DISCUSSION

The level of psychological resilience of medical residents in the present study was 65.08 ± 19.86, similar to the results of a study of Turkish nurses (64.28 ± 15.99) (27). This study explored the role of psychological resilience in the relationship between social support and coping style in medical residents. And the results showed that social support and psychological resilience were positively correlated with coping style. Psychological resilience played a part of the intermediary role in the relationship between the two. These results support our hypothesis.

Our findings showed that individuals with a high level of social support were more likely to prefer a positive coping style. Social support is widely recognized as a valuable resource, including tangible forms of assistance that individuals receive from family, friends, and others (28). On the one hand, a high level of social support often means that there are more available resources (28); on the other hand, emotional encouragement and understanding derived from family or friends help alleviate emotions (18, 29) and is the hope that people have positive psychological energy (30). During stressful events, including disasters, disasters, and disease outbreaks, social and peer support is an important protective factor for the overall mental health of medical staff themselves (5). Moreover, lack of support and

TABLE 2 | Correlation between sociodemographic data and main variables.

	1	2	3	4	5	6	7	8
1. Gender	1							
2. Age	0.011	1						
3. Marital status	0.002	−0.444***	1					
4. Only child or not	0.072	0.185***	−0.062	1				
5. Homeland	−0.054	−0.080	0.057	0.087*	1			
6. Coping style	−0.072	**0.102***	−0.035	−0.037	−0.032	1		
7. Social support	−0.020	0.048	−0.016	0.055	0.026	**0.474*****	1	
8. Psychological resilience	−0.066	0.030	−0.029	−0.024	−0.056	**0.473*****	**0.353*****	1

*$P < 0.05$, ***$P < 0.001$. Significant results between the main variables were shown in bold.*

TABLE 3 | Total, direct, and indirect effect of social support on coping style via psychological resilience.

	Coeff./Effect	*P*	95%CI	
			Lower	Upper
X→ M	1.385	<0.001	1.087	1.683
X→ Y	0.761	<0.001	0.607	0.916
M→ Y	0.192	<0.001	0.152	0.231
Total effect	1.027	<0.001	0.871	1.182
Direct effect	0.761	<0.001	0.607	0.916
Indirect effect	0.265		0.168	0.384
Proportion	25.84%			

X, social support; M, psychological resilience; Y, coping style.

understanding from family members and relatives, and lack of people's recognition of medical work can affect individuals' coping (8); Clinicians have begun to recognize the importance of social support in the form of family and friends for patients (28). The previous study has included more social support from mast cell patients in adaptive coping strategies, implying the impact of social support on coping (31). At the same time, patients' avoidance-type coping activities are associated with a low frequency of seeking social support (31). Social support was also considered to have a direct and buffering effect on patients' health and emotional adaptation (32) and was one of the effective strategies to improve the coping style and quality of life of cancer patients (32).

Social support has also been shown to influence coping style through psychological resilience. Social support can provide favorable external environmental conditions for the development of psychological resilience, for example, old adults who perceived higher support from social networks could prompt them to actively adapt to stressors resulting from migration and aging rather than avoid them (33). And the current study showed that social media use can enhance psychological resilience and increase the level of perceived social support to meet individuals' psychosocial needs in a fast-paced and rapidly changing world (18). Particularly, in crises, social media plays two important roles: it facilitates timely access to information from informal and official sources, and it also links people with their loved ones and the community who provide relief, help, and support (34). Thus, good social support can give people positive energy and support, promote them to view stress events optimistically, attenuate the negative effects caused by stress events, and improve hardiness. This was consistent with the findings of a study of caregivers of psychiatric patients (35). Providing social support to caregivers of patients with schizophrenia would improve their psychological resilience and may also help to improve their coping with these deficits (35). Studies in the nursing field have also shown that social support was a positive factor in the psychological resilience among midwife candidates, and as psychological resilience increased, self-confidence and problem-solving ability were also enhanced (36). In settings where epidemics are rampant nowadays, psychological resilience has still received continuous attention, suggesting its undeniable importance. Some investigators have recommended the development and implementation of strategies aimed at improving the psychological resilience of HCWs through evidence-based education and training to strengthen HCWs' defense against the various mental and psychological consequences of the pandemic (37, 38). Therefore, the focus of this study is of great significance.

This study has several limitations. First, a cross-sectional study was conducted at a single time point, and no conclusion on causality can be drawn. Second, this study collected data in one city, which may have introduced bias and limited the generalizability of the findings. Therefore, future studies with participants from different regions are warranted. Third, this study employed a self-report questionnaire, which may have contributed to reporting bias.

CONCLUSION

The study focused on medical residents' social support, psychological resilience, and coping style. The results of the study confirmed that there was a significant positive correlation among the three, and at the same time, a mediating effect of psychological resilience was found. Therefore, we believe that attention to the psychological status of medical residents should be strengthened, and attempts should be made to increase social support and psychological resilience to increase the enthusiasm for coping styles and ultimately improve their mental health status.

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 Wuhan Mental Health Center, Huazhong University of Science and Technology. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CX and JP: conceptualization, data curation, formal analysis, methodology, writing—original draft, writing—review and editing, validation, and visualization. YW: formal analysis, methodology, writing—original draft, writing—review and editing, validation, and visualization. ZW and BL: data curation, formal analysis, and writing—review and editing. CY, SZ, BC, and DZ: data curation, writing—review and editing, and validation. All authors contributed to the article and approved the submitted version.

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Improving Employee Mental Health: A Health Facility-Based Study in the United States

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Background: In the US, over 52.9 million (21%) adults lived with a mental health illness in 2020, with depression, being one of the commonest of these conditions. The World Health Organization ranks depression as the most important contributor to global disability. As frontline workers who are responsible for taking care of a myriad of patients daily, health workers are usually exposed to depressive situations which eventually result in the development of the condition among them. This study, therefore, developed an intervention to reduce depression among workers at the Outpatient Mental Health Clinic in Washington District of Columbia, United States.

Methods: A pre-intervention survey was conducted among 43 employees. The survey used the already validated Patient Health Questionnaire depression scale (PHQ-9) to determine the prevalence of depression. The WHO Healthy Workplace Model was adopted in designing an instrument for the workplace determinants of depression. An mHealth intervention was then developed and implemented among the workers. After this, a post-intervention survey was conducted among the cohort. Descriptive and inferential statistics were adopted in analyzing the data with STATA.

Results: The pre-intervention survey showed a depression prevalence of 30.2% among the employees. The post-intervention survey, however, showed that the prevalence of depression among the employees reduced to 12.6%. The surveys also showed that the majority of employees who felt exposed to workplace hazards including harmful chemicals, expressed feelings of depression (pre-intervention = 53.6%; post-intervention = 80%).

Conclusion: The intervention designed for this study was effective in reducing self-reported depression among employees. Improving employee mental health in health care facilities will require awareness raising among employees, mental health friendly policies, and regular follow up of employee mental health needs. Though this intervention was on a small scale, it shows promise for using cheap mhealth solutions in improving mental health at the work place.

Keywords: depression, facility-based study, mental health, mHealth intervention, United States

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INTRODUCTION

Mental health disorders continue to increase globally each year (1) with over 450 million people experiencing these conditions each year (2). They are characterized by a combination of abnormal thoughts, emotions, perceptions, behavior, and relations with other conditions which include autism, bipolar disorder, dementia, schizophrenia, and depression and are responsible for 1 out of 5 years lived with disability worldwide (2). Of the 450 million people who experience mental disorders, about 264 million are due to depression alone. In the US, over 52.9 (21%) million adults lived with a mental health illness in 2020, with depression, being one of the commonest of these conditions (3).

The WHO (4) ranks depression as the most important contributor to global disability. Depression can be recurrent or long-lasting and inhibit people's ability to perform at school or the workplace as well as negatively affect overall daily life. At its peak, depression results in suicide (1, 5) with about 800,000 people committing suicide annually (6). The risk factors of depression entail multifaceted interactions between biological, social, and psychological determinants. Also, life events such as unemployment, loss, and childhood misfortune impact and may facilitate the development of depression (7).

In the United States, depression has been on the ascendency over the past two decades. The National Health Interview Survey posits that in 2019, 18.5% of adults experienced depressive symptoms that were either severe, moderate, or mild for at least 2 weeks (8). Specifically, 11.5% had mild depressive symptoms, 4.2% had moderate symptoms, and 2.8% had severe symptoms. Exacerbated by the emergence of the novel coronavirus (COVID-19) global pandemic, the prevalence of depression in the US has become over three times greater during COVID-19 than before the pandemic (9). Despite these statistics, mental health conditions including depression receive less attention compared to other health conditions in the US (10). This is because patients suffering from these conditions rarely seek help, face stigma in obtaining health care, or simply do not consider themselves to be sick (11, 12).

At the workplace, many mental health conditions, most especially depression, go undiagnosed (13). Meanwhile, prevalent undiagnosed depression can be a cause of low productivity (14). A study by Bond et al. (15) for the US Department of Health and Human Services (DHHS) indicated that depression constitutes a major leading cause of work absenteeism and responsible for high work disability insurance claims filling in both public and private sectors. The CDC reports that depression interferes with a person's ability to complete physical job tasks about 20% of the time and reduces cognitive performance about 35% of the time. Even after taking other health risks (e.g., obesity and smoking) into account, employees at elevated risk of depression had the highest healthcare costs during the 3 years after an initial health risk assessment.

Depression can be effectively managed, and people can fully recover if treatment interventions are initiated early (15). Early work-based invention is crucial because it helps mitigate devastating effects of depression and improve work performance (15). Besides, early intervention saves employees' employment and prevents consequences of unemployment including alcohol abuse, hopelessness, isolation, decreased self-esteem, increased depression and suicide and long sick leave will reduce employee's likelihood for returning to the same job (15). Active Labor Market Programmes (ALMPs), which form important components of employment support policies around the world, have also been found by the literature, to enhance mental health and wellbeing of individuals. Active Labor Market Programmes (ALMPs), which form important components of employment support policies around the world, have also been found by the literature, to enhance mental health and wellbeing of individuals (16, 17).

Short Messaging Service (SMS) and email messaging are efficient and personal forms of electronic communication, making them ideal for delivering health interventions (18). Also known as mHealth interventions, these strategies have the potential to impact mental health because cell phones and SMS/email messages are widely used around the world. mHealth interventions effectively support health behaviors and have advantages over other types of computerized interventions. Program features that improve user engagement and persuasiveness are suggested to mitigate the effect of SMS intervention (18). Our study, therefore, sought to develop an mHealth intervention to reduce the prevalence of depression among health workers. Our study is essential in that addressing depression would also mean addressing other associated health challenges that employees experience daily at work. It could, therefore, contribute effectively to the design and implementation of interventions toward addressing mental health conditions in the US.

MATERIALS AND METHODS

Theoretical Issues

Introduction

The theoretical framework which guided this project was the WHO Healthy Workplace Model (19). A healthy workplace was defined as "one in which workers and managers collaborate to use a continual improvement process to protect and promote the health, safety and well-being of workers and the sustainability of the workplace by considering the following, based on identified needs: health and safety concerns in the physical work environment; health, safety and well-being concerns in the psychosocial work environment including organization of work and workplace culture; personal health resources in the workplace; and ways of participating in the community to improve the health of workers, their families and other members of the community" (19).

Tenets of the Theory

The key tenets are grouped into four large "avenues of influence." These are the physical work environment, the psychosocial work environment, the personal health resources in the workplace, and enterprise community involvement. These avenues are not mutually exclusive entities. Rather, they overlap and influence one another (**Figure 1**).

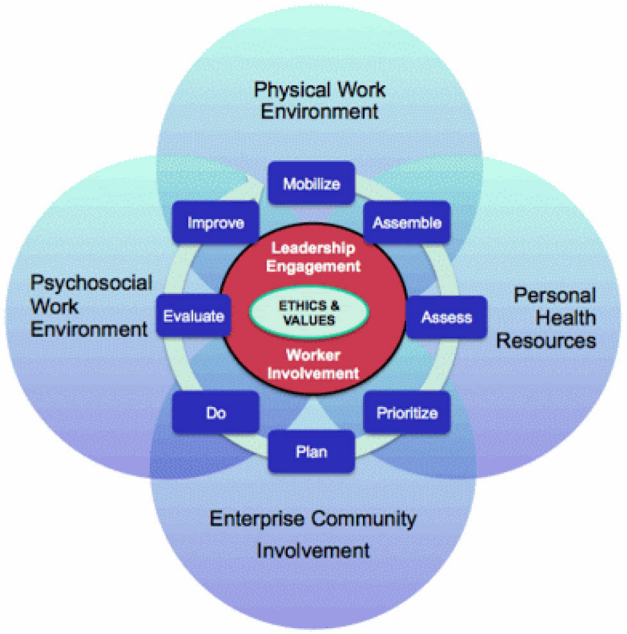

FIGURE 1 | WHO Healthy Workplace Model. Source: Burton and WHO (19).

The physical work environment content of the model, for instance relates to the part of the workplace facility which includes air, structure, chemicals, furniture, machines, and processes and materials present or that can happen (sometimes introducing hazards) at the workplace, and which can affect mental health including depression. The organization culture and psychosocial work environment includes practices, beliefs, values, and attitudes exhibited at work daily and which have the propensity to affect the mental health of employees leading to depression (19). Similarly, the personal health resources in the workplace (including a support environment, health services, information, and opportunities) and enterprise community involvement (including activities, expertise, and other resources a health entity engages in or provides to the environment within which it operates) could have implications for the development of depression by the employees depending on their levels of engagement in these activities/exposures. The model then offers the opportunity to integrate an intervention needed to address the identified challenges as a step toward reducing the depression levels among employees.

Rugulies (20) described a broadened perspective on the psychosocial work environment to include aspects of the job and work environment such as organizational climate or culture, work roles, interpersonal relationships at work, and the design and content of tasks (variety, meaning, scope, repetitiveness, etc.). The concept of psychosocial factors extends also to the extra-organizational environment, such as domestic demands and aspects of the individual such as personality and attitudes, which may influence the development of stress at work. Frequently, the expressions work organization or organizational factors are used interchangeably with psychosocial factors in reference to working conditions which may lead to stress (20).

Conclusion

The WHO Healthy Workplace Model was adopted as the conceptual framework for this study due to its relevance in outlining the essential workplace determinants of employee mental health. The model is thus, best positioned to provide the basis for the development of the factors influencing depression among health professionals in the current study. By adopting the healthy workplace model, the current study was guided in efficiently identifying the various work-related determinants of mental health and consequently the development of depression by employees.

Study Setting

Our study was conducted at the Outpatient Mental Health Clinic in Washington District of Columbia, US. The Outpatient Mental Health Clinic in Washington District provides services to approximately 4,000 patients. The services offered include psychiatric rehabilitative services, substance abuse and assertive community therapy programs. This project sought to create awareness of employee mental health problems and develop an intervention effective in improving the mental health of all employees at the facility and beyond.

Study Design

Pre-intervention (Baseline) Survey

A baseline survey using the already validated Patient Health Questionnaire depression scale (PHQ-9) developed by Kroenke et al. (21) was carried out to examine the prevalence of depression in the workplace. To ascertain the workplace determinants of depression at the workplace, the WHO Healthy Workplace Model developed by Burton and WHO (19) was adopted. Together with the PHQ-9 and background characteristics, a questionnaire (see **Appendix 1**) was created and administered in the form of Google Forms among the study participants.

Development and Implementation of Intervention

After the baseline survey was conducted, an intervention was developed based on the findings. Specifically, already validated depression-related messages were adapted from Hartnett et al. (22) and Agyapong et al. (23) to constitute the intervention. The intervention had 8 statements as presented in **Table 1**.

Specifically, statements 1, 2, 3, 6, and 7 were adapted from Agyapong et al. (23), while statement 4, 5, and 8 were adapted from Hartnett et al. (22). The intervention was implemented over a 1-month period (October 2021). Using text and email messaging systems, the messages were sent to the employees twice weekly. Thus, one message was sent on Tuesday and the other one was sent on Saturday. The adaptation of these messages was informed by their relative effectiveness upon implementation. The study by Hartnett et al. was a protocol for the one by Agyapong et al. In their study, Agyapong et al. carried out a single-rater-blinded randomized trial involving 73 patients with major depressive disorder. Patients in the intervention group received supportive text messages for 6 months instead

TABLE 1 | Intervention statements for employees.

No	Statements
1.	What lies behind you and what lies before you are tiny matters compared to what lies within you. Have faith in yourself and success can be yours at the work place.
2.	Letting go of resentment at the workplace is a gift you give yourself, and it will ease your professional journey immeasurably. Make peace with everyone at the work place and happiness will be yours.
3.	Pay attention to activities that have a positive impact on your mood especially at work. Note these activities and refer to them when you hit a low point to improve your mood at work.
4.	For today, focus on only what is happening now. Do not entertain negative words, thoughts or actions including those you experience at the workplace.
5.	By taking care of our physical health, our past hurts, and our present-day stresses, we can overcome low mood especially at the workplace.
6.	There are 2 days in the week we should not worry about, yesterday and tomorrow. That leaves today, live for today.
7.	Stumbling blocks can become steppingstones to a better life. You can turn adversities into opportunities.
8.	Your thoughts affect how you feel. Thoughts are not facts. Notice them and watch them come and go.

of 1 month for the current study. The authors concluded by stating, "Our findings suggest that supportive text messages are a potentially useful psychological intervention for depression.…"

Post-intervention (End-Line) Survey

Immediately after the rollout of the intervention (November 2021), a post-intervention survey was carried out to ascertain any changes in the prevalence and determinants of depression among employees. The approach adopted for the baseline survey was repeated and the initial cohort included in the survey was recruited again as part of the end-line survey. Four of the initial participants could, however, not participate in the end-line survey. As such, while the baseline survey had 43 participants, the end-line had 39 participants. The study size was informed by the small number of employees of the surveyed institution (50). As such, a census was conducted and the 43 participants were those who responded to our surveys and also took part in the intervention rollout.

Measurements

To measure the impact of the intervention, findings from the baseline and end-line surveys were compared. Findings from the end-line survey are useful in informing amendments/improvements to the developed intervention. Depression was categorized using a PHQ-9 score of ≥10. Socio-demographic characteristics of the participants in the pre-and post-intervention surveys were also compared. The frequency distribution of major depression and other depression by standard PHQ-9 severity intervals (0–4, 5–9, 10–14, 15–19, & 20–24) as well as the commonly used a cut-off point of ≥10. The scale was measured as Depression Severity: 0–4 none, 5–9 mild, 10–14 moderate, 15–19 moderately severe, 20–27 severe. A dichotomous variable of 0 = depressed, and 1 = Not depressed was then developed as the outcome variable.

TABLE 2 | Background characteristics of employees in the pre- and post-intervention surveys.

Background Characteristics	Pre-intervention (*N* = 43) *n* (%)	Post-intervention (*N* = 39) *n* (%)
Age		
<30	6 (13.95)	8 (20.51)
30–39	22 (51.16)	19 (48.72)
40–49	12 (27.91)	10 (25.64)
50+	3 (6.98)	2 (5.13)
Sex		
Male	19 (44.19)	21 (53.85)
Female	24 (55.81)	18 (46.15)
Marital status		
Never Married	16 (37.21)	17 (43.59)
Married	23 (53.49)	21 (53.85)
Divorced	3 (6.98)	1 (2.56)
Widowed	1 (2.33)	
Educational level		
No education	1 (2.33)	1 (2.56)
Postsecondary/higher education	38 (88.37)	26 (66.67)
Secondary	4 (9.30)	12 (30.77)
Religion		
Christianity	42 (97.67)	28 (97.44)
Islamic	1 (2.33)	1 (2.56)
Occupation		
Psychiatrists	6 (13.95)	9 (23.08)
Psychiatric Nurses	10 (23.26)	7 (17.95)
Community support workers	10 (23.26)	6 (15.38)
IT personnel	4 (9.30)	5 (12.82)
Other occupations	13 (30.23)	12 (30.77)
Duration of practice (In years)		
< 1	6 (13.95)	6 (15.38)
1–5	19 (44.19)	18 (46.15)
6–10	14 (32.56)	10 (25.64)
11+	4 (9.30)	5 (12.82)
Duration at facility (In years)		
< 1	10 (23.26)	10 (25.64)
1–5	22 (51.16)	16 (41.03)
6–10	10 (23.26)	10 (25.64)
11+	1 (2.33)	3 (7.69)
Total	**43 (100.00)**	**39 (100.00)**

The depression instrument, background characteristics, and workplace determinants were all put into a questionnaire which was then administered during the pre- and post-intervention surveys (**Appendix 1**).

Data Analysis

Quantitative data collected from the participants were entered and cleaned using Epi data software. The data were then

transported into STATA software for analysis. Data collected from the PHQ-9, socio-demographic characteristics and workplace determinants of depression were analyzed using frequency, percentage, bar charts, and chi-square analysis. Statistical significance in the chi-square analysis was determined at $p < 0.05$.

RESULTS

Background Characteristics of Employees

Table 2 presents results of the background characteristics of employees included in the pre-intervention (baseline) and post-intervention (end-line) surveys. Majority of the employees in both surveys were in their 30s. Female workers constituted 55.8% in the baseline while males formed 53.9% in the end-line survey. Most of them (Pre-intervention [Baseline]: 88.4%; Post-Intervention [End-line]: 66.67%) had postsecondary/higher level of education. The majority (97 %) were Christians. The respondents were psychiatric Nurses, community support workers, and psychiatrists. The comparative majority had worked for 1–5 years in their respective professions as well as in the facility, for 1–5 years.

Prevalence of Reported Feelings of Depression Among Employees

Depression was measured using the Personal Health Questionnaire Depression Scale (PHQ-9). **Figure 2** presents results of the levels of depression in the pre-intervention and post-intervention surveys. Prior to the intervention, the prevalence of reported feelings of depression among the employees was 30.2%. This, however, declined to just 12.6% post-intervention.

Workplace Determinants Depression Among Employees

Table 3 presents a bivariable analysis for the relationship between workplace determinants and depression among employees. In the pre-intervention survey, about 54% of workers who disagreed to the statement that they were always motivated to come to work were those who verbalized feelings of depression. Similarly, about 62% of employees who reported not being comfortable to share their mental health needs with management of their workplace also reported being feelings of depression. The majority (80%) of the employees who had healthy interpersonal relationships with their co-workers and strong and positive support environment at the workplace did not report any feelings of depression.

In the post-intervention survey, there was no significant association between work-related determinants and depression. However, it was noted about 60.0% of workers who disagreed with the statement that access to information is easy at your workplace reported feelings of depression. The majority (85.3%) of the employees who had healthy interpersonal relationships with their co-workers at the workplace did not report any feelings of depression. Similarly, most employees (82.4%) who agreed that work-related values at the workplace were appropriate and promote their mental health did not report feelings of depression.

DISCUSSION

Depression is a serious mental health challenge in the US. It is a result of a complex interaction of biological, psycho-social, and psychological factors. People who have gone through unfavorable life events including unpleasant working environments have high probabilities of developing depression (24). Depression, in turn, leads to stress and dysfunction and aggravates the affected

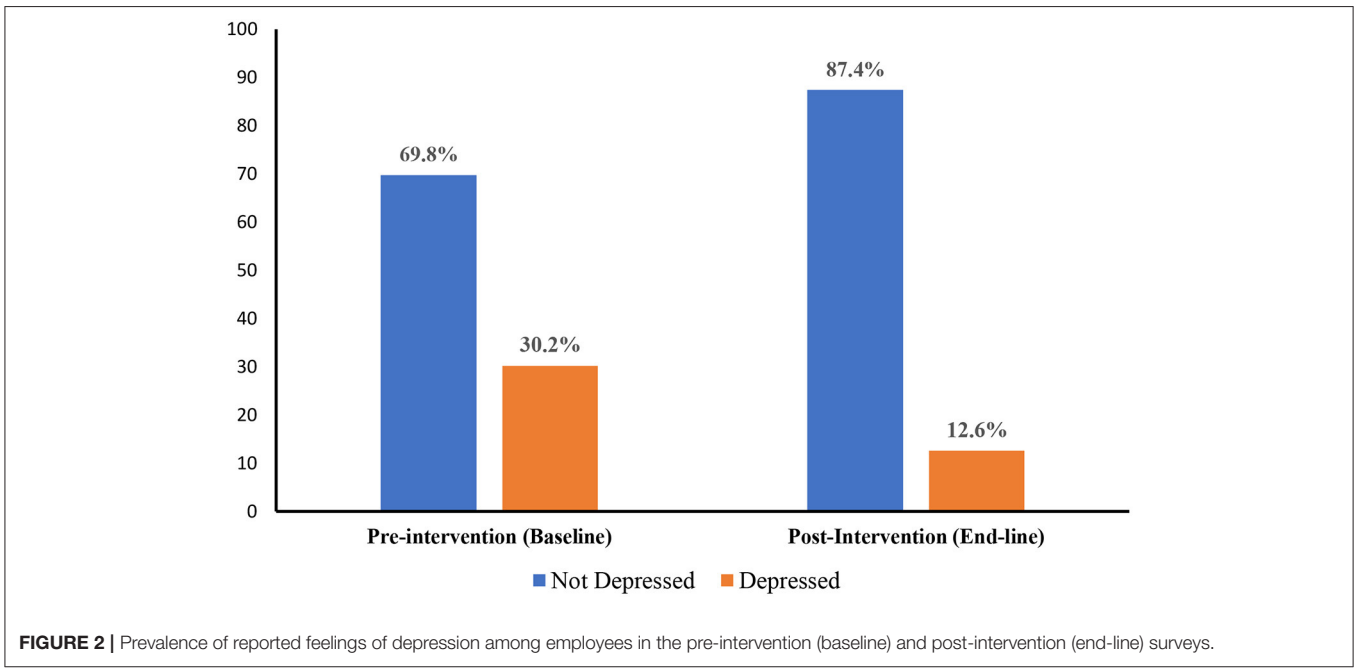

FIGURE 2 | Prevalence of reported feelings of depression among employees in the pre-intervention (baseline) and post-intervention (end-line) surveys.

TABLE 3 | Bivariable relationship between workplace determinants and depression.

Workplace determinants	Pre-intervention survey ($N = 43$)				Post-intervention survey ($N = 39$)			
	Not depressed *n* (%)	Depressed *n* (%)	Chi-Square	*p*-value	Not depressed *n* (%)	Depressed *n* (%)	Chi-Square	*p*-value
Always motivated to come to work			2.95	0.086			0.3123	0.576
Disagree	8 (26.67)	7 (53.85)			11 (32.35)	1 (20.00)		
Agree	22 (73.33)	6 (46.15)			23 (67.65)	4 (80.00)		
Air quality at the workplace is appropriate for you			0.60	0.439			0.1907	0.662
Disagree	8 (26.67)	5 (38.46)			10 (29.41)	1 (20.00)		
Agree	22 (73.33)	8 (61.54)			24 (70.59)	4 (80.00)		
Exposed to harmful chemicals and other environmental hazards at the workplace			0.03	0.864			1.0479	0.306
Disagree	13 (43.33)	6 (46.15)			15 (44.12)	1 (20.00)		
Agree	17 (56.67)	7 (53.85)			19 (55.88)	4 (80.00)		
The furniture you work with is appropriate for your health and posture			1.95	0.163			0.0025	0.960
Disagree	11 (36.67)	2 (15.38)			14 (41.18)	2 (40.00)		
Agree	19 (63.33)	11 (84.62)			20 (58.82)	3 (60.00)		
The attitudes of your co-workers are positive toward you			3.02	0.082			0.8434	0.358
Disagree	6 (20.00)	0 (0.00)			5 (14.71)	0 (0.00)		
Agree	24 (80.00)	13 (100.00)			29 (85.29)	5 (100)		
The attitude of management is positive toward you and promotes the effective discharge of your duties			0.60	0.439			0.1907	0.662
Disagree	8 (26.67)	5 (38.46)			10 (29.41)	1 (20.00)		
Agree	22 (73.33)	8 (61.54)			24 (70.59)	4 (80.00)		
Work-related values at the workplace are appropriate and promote your mental health			0.061	0.804			1.3358	0.248
Disagree	8 (26.67)	3 (23.08)			6 (17.65)	2 (40.00)		
Agree	22 (73.33)	10 (76.92)			28 (82.35)	3 (60.00)		
Strong and positive support environment at the workplace			0.60	0.443			0.0009	0.976
Disagree	6 (20.00)	4 (30.77)			7 (20.59)	1 (20.00)		
Agree	24 (80.00)	9 (69.23)			27 (79.41)	4 (80.00)		
Access to information is easy at your workplace			0.45	0.501			3.5511	0.060
Disagree	10 (33.33)	3 (23.08)			7 (20.59)	3 (60.00)		
Agree	20 (66.67)	10 (76.92)			27 (79.41)	2 (40.00)		
Access to opportunities for personal development abound at the workplace			0.22	0.642			0.0025	0.960
Disagree	9 (30.00)	3 (23.08)			14 (41.18)	2 (40.00)		
Agree	21 (70.00)	10 (76.92)			20 (58.82)	3 (60.00)		
Interpersonal relationships (with co-workers) at the workplace are healthy			0.13	0.721			0.6202	0.431
Disagree	6 (20.00)	2 (15.38)			8 (23.53)	2 (40.00)		
Agree	24 (80.00)	11 (84.62)			26 (76.47)	3 (60.00)		
Trust your co-workers when it comes to sharing your mental health needs with them?			0.34	0.559			0.4424	0.506
Disagree	11 (36.67)	6 (46.15)			19 (55.88)	2 (20.00)		
Agree	19 (63.33)	7 (53.85)			15 (44.12)	3 (60.00)		

(Continued)

TABLE 3 | Continued

Workplace determinants	Pre-intervention survey ($N = 43$)				Post-intervention survey ($N = 39$)			
	Not depressed *n* (%)	Depressed *n* (%)	Chi-Square	*p*-value	Not depressed *n* (%)	Depressed *n* (%)	Chi-Square	*p*-value
The design and content of tasks are friendly at your workplace			0.28	0.596			0.1907	0.662
Disagree	4 (13.33)	1 (7.69)			10 (29.41)	1 (20.00)		
Agree	26 (86.67)	12 (92.31)			24 (70.59)	4 (80.00)		
Feeling that the organization takes into consideration your mental health			1.04	0.307			0.0057	0.940
Disagree	9 (30.00)	6 (46.15)			13 (38.24)	2 (40.00)		
Agree	21 (70.00)	7 (53.85)			21 (38.24)	3 (60.00)		
Always comfortable to share your mental health needs with management of your workplace			0.46	0.486			0.6281	0.428
Disagree	15 (50.00)	8 (61.54)			20 (58.82)	2 (40.00)		
Agree	15 (50.00)	5 (38.46)			14 (41.18)	3 (60.00)		
Availability and access to personal health resources at the workplace			0.003	0.960			0.0057	0.940
Disagree	9 (30.0 = 0)	4 (30.77)			13 (38.24)	2 (40.00)		
Agree	21 (70.00)	9 (69.23)			21 (61.76)	3 (60.00)		

person's life. As frontline workers who are responsible for taking care of a myriad of patients daily, health workers are usually exposed to depressive situations which eventually results in them developing the mental health condition. Once that happens, interventions are required to reduce the prevalence and toll of the depressive symptoms among them. The purpose of the current project was to develop an intervention which helps to improve employee mental health in healthcare settings with focus on depression and examine workplace factors which influence depression among employees. Using the already validated Patient Health Questionnaire depression scale (PHQ-9) developed by Kroenke et al. (21) and adopting the WHO Healthy Workplace Model developed by Burton and WHO (19), a pre-intervention survey was conducted among employees of the Outpatient Mental Health Clinic in Washington District of Columbia.

Our study showed a reported feelings of depression prevalence of 30.2% among the employees. This prevalence was far more than the average depression levels in the USA as reported by the WHO (4). The survey also showed that while the work environment was generally supportive toward achieving desired mental health state, the employees felt they were exposed to workplace hazards. To address the high level of reported feelings of depression observed in the baseline survey, we designed an mHealth intervention was developed in the form of already validated depression-related messages adapted from Hartnett et al. (22) and Agyapong et al. (23). Using text messaging and email platforms, the messages were sent to employees over a one-month period within regular intervals.

Immediately after the intervention, a post-intervention (end-line) survey was carried out to assess its impact in reducing the levels of depression among the employees. The employees included in the baseline survey were the participants in the end-line survey as well. The post-intervention survey showed that the prevalence of depression among the employees had reduced to 12.6%. Chi-square analyses conducted, however, showed no statistically significant relationship between depression and the workplace determinants. Further tests of the intervention over longer durations and pre- and post-intervention surveys among higher numbers could, however, improve these associations.

The intervention demonstrated perceived improvements in mental health status through a decline in reported feelings of depression among the employees surveyed. The overall percentage change in the prevalence of between the pre- and post-intervention surveys was 17.6% which is quite significant considering the short duration within which it was carried out. Employee perception of the supportiveness of the work environment also increased, though marginally, in the post-intervention survey. This is a further indication of the effectiveness of the intervention. The study by Hartnett et al. (22) and Agyapong et al. (23) was carried out for a longer period compared to this study. They deployed supportive messages for 6 months and suggested that the text messages were a potential psychological intervention for depression in underserved population. The findings from this project following the deployment of messages for a period of 1 month showed a decrease in reported feelings of depression from 30.2% to 12.6%. This means that if the project was to expand for a period of 6 months, the results could have been more positive.

There were some limitations of the study which are worth noting. First of all, the small sample sizes used affected the significance of statistical analyses conducted. All the workplace determinants, therefore, had no statistically significant relationship with the outcome variable (depression). The intervention was carried out within one month. This to the duration of just one month between the pre- and post-intervention surveys. Given that the duration of the intervention

were about three months for instance, the level of depression experienced in the post-survey could have gone further down as sustainable change usually takes time to happen. Four participants in the pre-intervention survey were lost during the follow-up survey. This could have affected the quality of comparison done in the results. While we acknowledge that the WHO healthy workplace model is appropriate in this study, there are more comprehensive literature on job quaity and mental health and which contains more workplace characteristics that are important for mental health. Our results should, therefore, be interpreted with these limitations in mind.

CONCLUSION

The intervention designed for this project was effective in reducing reported feelings of depression of among employees. Following the pre-intervention and post-intervention survey, we realized that the prevalence of depression among employees declined from 30.2% to just 12.6%. Given that there is a paucity of empirical literature on workplace depression among employees in hospital settings in the US, the project has been instrumental in contributing immensely to the available literature on employee mental health.

For all health professionals in other facilities across the US, the intervention if implemented in such settings, will hopefully improve the levels of workplace related feelings of depression among them, and elevating their perceived supportiveness of the work environment. The overarching implication of this is a major contribution toward efforts at achieving the SDG 3.4 target of promoting mental health and wellbeing of all by the year 2030. The organization where the project was carried out has been experiencing a decrease in productivity. The initiation of this project was timely and caught the attention of the organization's administrators. The findings from this project were presented to the administrators including the Chief Executive Officer (CEO) of the organization.

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

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

GCG conceived the study. GCG, HA, and LEB conducted the analysis and wrote the initial draft of the manuscript. All authors read the final manuscript and approved it.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.895048/full#supplementary-material

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Leave Me Alone With Your Symptoms! Social Exclusion at the Workplace Mediates the Relationship of Employee's Mental Illness and Sick Leave

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Although a substantial part of employees suffers from a mental illness, the work situation of this population still is understudied. Previous research suggests that people with a mental illness experience discrimination in the workplace, which is known to have detrimental effects on health. Building on the stereotype content model and allostatic load theory, the present study investigated whether employees with a mental illness become socially excluded at the workplace and therefore show more days of sick leave. Overall, 86 employees diagnosed with a mental disorder were interviewed and completed online-surveys. Path analyses supported the hypotheses, yielding a serial mediation: The interview-rated severity of the mental disorder had an indirect effect on the days of sick leave, mediated by the symptomatic burden and the social exclusion at the workplace. In the light of the costs associated with absenteeism the present paper highlights the harmfulness of discrimination. Organizations and especially supervisors need to be attentive for signs of exclusion within their teams and try to counteract as early as possible.

Keywords: workplace, mental illness, social exclusion, sick leave, discrimination, stereotype content model

INTRODUCTION

Mental illnesses are one of the main causes of disability worldwide (1, 2). Estimates indicate that more than one in six people across the European countries (17.3%) experienced mental health problems in 2016 (3). Besides severe cognitive, emotional, and behavioral impairments for the affected individuals (4–6), mental health problems pose a substantial economic burden on health care systems (7, 8). Since a substantial part of the working population suffers from mental disorders (9, 10), mental illnesses furthermore interfere with the functioning of employees and organizations

as well: Several studies provide evidence for a significant relationship between employees' mental health status and their performance (11–13). Thus, mental disorders contribute to a substantial amount of indirect costs organizations spend, arising from reduced productivity or increased absenteeism of their employees with a mental illness (14, 15).

Despite these consequences of mental disorders on the well-being of employees and organizations, the work situation of employees with a mental illness (EMI) still is understudied (16). Investigations suggest that EMI are faced with various barriers at their jobs (17, 18), which in turn could worsen their health status (19). Stigmatization and discrimination of people with a mental illness for instance are not only common in the general public (20, 21), but also appear in organizations, for instance in form of the exclusion from work-related events or the denial of conversation in general (22–24). Discriminative actions as this social exclusion are known to be detrimental for health (25–29) and thus social exclusion might result in increased absenteeism (30). However, to the best of our knowledge, the influence of the mental illness on social exclusion and absenteeism has not been investigated jointly yet. This study is intended to close this research gap and thereby to contribute to a better understanding of the negative effects mental disorders and social exclusion have on employees and organizations, hoping to provide starting points for their mitigation.

In a recent review, Follmer and Jones (16) not only highlight the existence of negative stereotypes about EMI among supervisors and employees, but also the discrimination they experience in the workplace. An explanation why and how such negative stereotypes about people with a mental disorder end up in discriminative behavior provides the stereotype content model (SCM) (31) and its extension, the behaviors from intergroup affect and stereotypes (BIAS) map (32). The SCM proposes that two dimensions are central for the emergence of different group stereotypes: *warmth*, defined as the perception whether the intent of a certain group toward one self or one's ingroup is either beneficial or malevolent and *competence*, defined as the perceived capability of the group to pursue and enact those intentions (31, 33). Groups are classified on both dimensions, yielding either thoroughly positive stereotypes (i.e.„ classified as warm and competent) as e.g., the middle class, thoroughly negative stereotypes (i.e., cold and incompetent) as e.g., poor people, or ambivalent stereotypes (i.e., warm and incompetent or cold and competent) as e.g., elderly or rich people (32, 33). Each of those stereotype-combinations elicits specific emotional reactions toward the classified group (31, 33): Warm and competent groups are admired, cold and incompetent groups elicit contempt, warm but incompetent groups induce pity, and cold but competent groups envy. Those emotional reactions finally end up in specific behavioral tendencies toward the classified group, mediating the effect of the stereotype on the behavior as the BIAS map proposes (32, 33): While admired groups induce active and passive facilitation, the opposite is true for resented groups (i.e., incompetent and cold) which provoke active and passive harm. Envied or pitied groups evoke mixed behavioral patterns (passive facilitation and active harm or active facilitation and passive harm, respectively). A multiplicity of studies investigated the SCM and the BIAS map and found support for their assumptions, also across various nations, including Germany [e.g., (31, 32, 34–36)].

Hence, according to the SCM, emotional reactions and behavioral tendencies toward people with a mental illness depend on the perception whether (a) they want to help or harm oneself and whether (b) they are able to do so. In a systematic literature review, Parcesepe and Cabassa (21) sum up that people with a mental illness are often perceived as being e.g., incompetent, dangerous and criminal, indicating a rather low evaluation on the two dimensions warmth and competence. In a more proximal study on the SCM, Sadler et al. (37) asked participants to rate the warmth and competence of people with a mental disorder as seen by Americans in general: Results confirmed the indirect evidence, showing that people with a mental illness are perceived as equally incompetent and cold as poor people. Accordingly, people tend to react with active harm, e.g., segregation (38, 39), or passive harm, e.g., social distance (20, 21, 38), toward them, as predicted by the SCM.

Although research on employees with a mental illness in general still is scarce [see Follmer and Jones (16) for a recent review], the existing literature indicates that likewise discriminatory behaviors toward people with a mental illness also exist in the workplace [e.g., (17, 18, 22, 24, 40, 41)]. Follmer et al. (23) for instance found that lower ratings of warmth and competence of EMI predict a higher desire to socially distance oneself from a fictious coworker with a mental illness. This confirms investigations on the experiences of EMI, reporting that people at work avoid them due to their mental health problems (24). Thus, people with a mental illness do not only experience discriminatory behavior as social exclusion in the general public, but also in their workplaces.

The evaluation that a specific colleague has a mental health problem and the subsequent exclusion of this colleague by the coworkers however, do not appear out of the blue: First, the coworkers have to notice corresponding peculiar behavior (or in other words: symptoms) that marks the colleague accordingly. Only if the colleague acts strangely (i.e., displays symptoms), an appraisal as being (more or less) mentally ill on the part of the coworkers is possible—followed by the above mentioned perception that the colleague is cold and incompetent [c.f. (37)] and the corresponding behavioral reactions (e.g., social exclusion) toward her/him [c.f. (33)]. Thus, EMI with a higher symptomatic burden (i.e., more and/or stronger symptoms) should be perceived as being more mentally ill—and thus experience more social exclusion at the workplace.

The symptomatic burden on the other hand is inevitably linked to the severity of the mental illness itself: The level of disability and distress patients experience in various life domains, including occupation, increases as the mental health status gets more severe (42, 43). More depressed people for instance spend less time in groups, use more negative emotion words, and feel lonely more often than their less depressed counterparts (44, 45). Thus, an increasing severity of the mental illness should go along with more and/or stronger symptoms—or in other words a higher symptomatic burden. This in turn will be noticed by the coworkers, leading to social exclusion of the EMI.

Based on this line of thought we therefore test the following hypotheses:

Hypothesis 1: The severity of the mental disorder leads to a higher symptomatic burden.
Hypothesis 2: The severity of the mental disorder leads to an increase of experienced social exclusion at the workplace via a higher symptomatic burden.

Social stressors as social exclusion are not only uncomfortable to endure but unfortunately also could have detrimental effects on human body and thus health according to the allostatic load model (46–49). The allostatic load model assumes that physiological reactions mediate the effect of (job) stressors on health outcomes (48, 50). According to the model, different physiological systems in the human body initiate an adaptive response if exposed to a stressor, that is the physiological markers increase (48, 49). This response persists until the stressor vanishes (49). Now the physiological response is stopped and the markers decrease – thus recovery takes place (48, 49). This process of adjustment in order to cope with a stressor fulfilled by different physiological systems is defined as *allostasis* (50, 51).

The described switching on and off of the physiological response is an adaptive and beneficial mechanism—however it can become overstrained with potential detrimental effects on the human body in the long run, a status called *allostatic load* (46–49). The allostatic system for instance may have difficulties to habituate to the same stressor (i.e., the physiological response to the stressor is always equally high) or problems to end the response adequately (i.e., it continues even after the stressor disappears)—both resulting in a hyperactivation of the system (48, 49). McEwen (49) calls these subtypes of allostatic load "lack of adaption" and "prolonged response" and further postulates that the effects of a chronic hyperarousal add up over time and finally result in diseases (47–49).

Unfortunately, social stressors are designated to cause those subtypes of allostatic load: Various psychophysiological studies indicate that even when people are exposed to the same social stressor for several times, the sympathetic response does not significantly change, suggesting poor habituation of the associated system to the stressor [e.g., (52–55)]—or (in the sense of allostatic load theory) a "lack of adaption." Furthermore, employees tend to ruminate in their leisure time when they are confronted with social stressors at work (56–58). Such pondering about a stressor can lead to an extended physiological reaction, as experimental laboratory studies suggest (59)—or in other words can cause a "prolonged response" in the sense of allostatic load theory. Thus, if people are exposed to the same social stressor over and over again—as it can be the case for employees confronted with social exclusion at the workplace—both mentioned subtypes of allostatic load might occur and finally end up in sickness.

The proposed impact of social exclusion on human health was supported by research from various fields, indicating that isolation in general affects the functioning of the immune system and even mortality rates (27–29). But there also is according evidence in the work environment since socially excluded employees have a higher risk for a long-term sick leave spell (30), just as victims of workplace bullying do [for a recent review and meta-analysis see (60)]. Thus, it is possible that the influence of the mental illness goes beyond the symptoms a patient suffers from and the social exclusion (s)he experiences thereof at the workplace: The isolation could furthermore lead to an increase of days EMI are sick leaving, yielding a serial mediation of the severity of the mental illness on sick leave via the symptomatic burden and social exclusion at the workplace. While the debarment of EMI as well as the impact of social exclusion on absenteeism has already been under examination (23, 24, 30), no study has ever combined those research lines and investigated the influence of the mental illness on sick leave via social exclusion.

Based on this line of thought we therefore test the following hypothesis:

Hypothesis 3: The severity of the mental disorder leads to an increase of sick leave, sequentially via a higher symptomatic burden and more social exclusion at the workplace.

MATERIALS AND METHODS

Design and Procedure

The data of the present study originate from the COMPARE-consortium (61) standing for "children of mentally ill parents at risk evaluation." The consortium investigates why children of parents with a mental illness are at higher risk of developing mental illnesses themselves and whether a preventive intervention may interrupt this malicious transmission of the parental mental state to the child (61). It consists of a clinical study "COMPARE family" [see (62)] as well as four subprojects named "COMPARE emotion," "COMPARE interaction," "COMPARE work" and "COMPARE school" [see (61)]. In the following we only report the aspects of the COMPARE-consortium which are relevant for the paper at hand. For more details on the consortium and the subprojects we refer to Christiansen et al. (61) and for more information on the clinical study to Stracke et al. (62)[1].

The recruitment for the used partial data set took place from January 2018 to May 2020 in different university outpatient clinics throughout Germany. The clinical study was advertised with e.g., flyers, newspaper articles and information meetings for professionals (e.g., physicians). Persons contacting the clinics asking for psychotherapeutic help were screened for eligibility and interest in participating in the clinical study [c.f. (62)]. After deciding to participate, they signed the informed consent and fulfilled the first assessment, from which the data used in this paper originate.

Every assessment was split in multiple occasions: First, structured interviews were conducted in two sessions on site by trained study personal. After the second interview session, patients received a sheet with a link to the online

[1]In the present paper we used data from the clinical study "COMPARE family" [see (62)] and the subproject "COMPARE work" [see (61)]. Since the acquisition of participants in the clinical study is still ongoing, two partial data sets were provided in May 2020 and in February 2021 with the aim to facilitate in advance analysis. The partial data sets contain final, not changeable and completely refined data. In this present paper we used data from the first partial data set provided in May 2020.

questionnaire assessed by "COMPARE family" and were asked to answer it at home [c.f. (62)]. If participants also agreed to take part in "COMPARE work" (or one of the other subprojects) they furthermore received links to the corresponding online questionnaires.

Different criteria had to be met for patients to participate in the clinical study: (1) they had to search for outpatient psychotherapeutic care, (2) they had to fulfill the diagnostic criteria for a DSM-5 disorder (63), and (3) they had to care for at least one child aged between 1.5 and 16 years [c.f. (62)]. Patients were not included in the clinical study if (1) the patient already had been in psychotherapeutic treatment at the present time, (2) the patient needed an acute inpatient treatment, (3) all children fulfilled the criteria for a severe mental illness and furthermore were in need of an immediate treatment, (4) the patient used benzodiazepines regularly (an intermittent use less than once every 2 weeks was allowed) or (5) the family had insufficient German language skills [c.f. (62)]. For the present paper we furthermore excluded patients without a current (self-employment) as well as patients being on a sick leave for longer than 6 weeks since any item with regard to the current work situation could presumably not have been reasonably answered.

Measures

All data used in this paper have been collected and managed with REDCap (64), standing for "research electronic data capture". As already mentioned, the data—although belonging to one assessment—were partly measured at different events. Thus, in addition to describing the variables used in the present paper we also mention the occasion they were collected in.

Variables Assessed in Interview Sessions

Severity of Mental Illness

The Diagnostic Interview for Mental Disorders (DIPS) (65, 66) was conducted with the patients in the first interview session. Trained study personnel executed the DIPS [c.f. (62)] taking between 60 and 120 min [c.f. (65)]. The structured interviews of the DIPS-family are a reliable and valid method for diagnosing mental disorders across the lifespan (65). At the end of the interview, the assessor rates the severity of the main diagnosis on a scale from 0 to 8 with digits between 0 and 3 standing for a subclinical diagnosis and digits between 4 and 8 for a clinical diagnosis [c.f. (65, 66)]. This rating was used as an indicator for the severity of the patients' mental illness in the present study. Since subclinical diagnoses were not sufficient for being enrolled into the clinical study, the rating only varied between 4 and 8 in the present paper.

Variables Assessed in the Questionnaire of "COMPARE Family"

Symptomatic Burden

The Brief Symptom Inventory (67) was used to assess the symptomatic burden of the patient. The inventory is a short form of the Symptom Check-List-90-R (68) and measures the subjective impairment caused by the symptoms of the patient (67). Various studies indicate the reliability and validity of the inventory, especially if the psychopathology is under study (67, 69). The 53 items ask the participant how much (s)he suffered from different symptoms within the last seven days as, for example, the symptom of "feeling no interest in things" (Cronbach's $\alpha = 0.96$). Answers ranged from 0 (*not at all*) to 4 (*very much*) on a Likert-scale with labeled intermediate steps.

Variables Assessed in the Questionnaire of "COMPARE Work"

Social Exclusion

We measured social exclusion with the corresponding scale from Zapf and Holz (70) which is an adaption and further development of Frese's and Zapf (71) scale and has proven to be reliable and valid (71, 72). It consists of four items as "you are being ignored and excluded" (Cronbach's $\alpha = 0.82$). Answers ranged from 1 (*does not apply at all*) to 6 (*completely applies*) on a Likert scale with labeled intermediate steps.

Sick Leave

Patients indicated the number of days they were on sick leave by answering the following question: "On how many days have you been absent from work for health reasons in the last 4 weeks (without taking into account the days on which you were missing due to an illness of your child / children)?"

Statistics

To test hypothesis one and two—which stated that patients with a more severe mental illness suffer from more and/or stronger symptoms (H1), and as a result become socially excluded at work more often, yielding an indirect effect (H2)—we conducted a path analysis using the PROCESS macro version 3.4.1 (73) in IBM SPSS Statistics 26 executing Model 4 (simple mediation): First, we regressed the symptomatic burden on the severity of mental illness. Second, we regressed social exclusion on the severity of mental illness and the symptomatic burden simultaneously. Third, we calculated the indirect effect of the severity of the mental illness on social exclusion via the symptomatic burden. Lastly, we regressed social exclusion solely on the severity of mental illness to test for the total effect of the predictor.

To test whether the social exclusion of the patients at work finally results in an increase of absenteeism—yielding a serial mediation with two mediators (H3)—we further conducted a path analysis using Model 6 (serial mediation, two mediators) of the Process macro (73): After rehearsing the first two steps just described we further regressed sick leave on the severity of mental illness, the symptomatic burden and social exclusion simultaneously. Then, we calculated the indirect effect of the severity of mental illness on sick leave via the symptomatic burden and social exclusion. Finally, we regressed sick leave on the severity of mental illness alone to again obtain the total effect model. The significance level (α) was 0.05 for every hypothesis.

As recommended by Hayes (73) the confidence intervals of any indirect effect presented in this paper are percentile bootstrap confidence intervals calculated on the basis of 10,000 bootstrap-samples. We do not report *p*-values of indirect effects since the normal theory approach used for their calculation has different statistical drawbacks and therefore cannot be recommended [e.g., (73)].

TABLE 1 | Sample details.

Variable	*M*	*SD*	%
Gender			
Female			77.90
Male			22.10
Age (years)	39.42	6.90	
Working hours per week	29.77	11.15	
Tenure (years)	7.45	7.31	
Contract			
Permanent			84.50
Fixed-term			15.50
Education			
Qualification for university entrance			40.50
Qualification for university of applied science entrance			21.40
General Certificate of Secondary Education			31.00
Certificate of Secondary Education			6.00
Other			1.20
Primary diagnosis			
Affective disorders			46.51
Neurotic, stress-related and somatoform disorders			46.51
Schizophrenia, schizotypal and delusional disorders			2.33
Disorders of adult personality and behavior			2.33
Behavioral syndromes associated with physiological disturbances and physical factors			1.16
Behavioral and emotional disorders with onset usually occurring in childhood and adolescence			1.16
Additional comorbid diagnoses			63.10

Primary diagnosis refers to the German version of the ICD 10 (74). n = 84–86.

TABLE 2 | Means, standard deviations, and correlations between investigated constructs.

Variable	*M*	*SD*	1	2	3	4
1. Severity of mental illness	5.98	0.97	–			
2. Symptomatic burden	0.83	0.55	0.32** [0.11, 0.50]	–		
3. Social exclusion	1.43	0.77	−0.02 [−0.23, 0.20]	0.39*** [0.19, 0.56]	–	
4. Sick leave	2.49	6.05	−0.02 [−0.23, 0.19]	0.04 [−0.18, 0.26]	0.29** [0.09, 0.48]	–

Pearson correlation coefficient with 95%-confidence interval in square brackets. Two-sided testing of significance. n = 82–86.
***p < 0. 01, ***p < 0.001.*

RESULTS

Overall, $N = 86$ patients met the inclusion criteria and answered the questionnaires from "COMPARE work" and "COMPARE family." Details of the sample can be found in **Table 1**.

Preliminary Analysis

Means, standard deviations and correlations between the investigated variables are presented in **Table 2**. As expected, the severity of mental illness had a positive relation with the symptomatic burden of the patient, which in turn correlated positively with social exclusion. Furthermore, sick leave was positively correlated with social exclusion. Thus, the bivariate relations showed the expected pattern.

Test of Hypotheses

The results of our first path analysis which tested the simple mediation model are presented in **Figure 1**: Patients with a more severe mental illness suffered from more and/or stronger symptoms ($b = 0.186$, $p = 0.003$, 95% CI [0.064, 0.307]) supporting hypothesis 1. Furthermore, employees with a stronger symptomatic burden reported more experienced social exclusion ($b = 0.628$, $p < 0.001$, 95% CI [0.321, 0.935]). There was no direct effect of the severity of the mental illness on social exclusion – neither with ($b = -0.117$, $p = 0.191$, 95% CI [−0.294, 0.060]) nor without ($b = -0.001$, $p = 0.995$, 95% CI [−0.184, 0.182]) controlling for the symptomatic burden. However, there was an indirect effect: Patients with a more severe mental disorder suffered from a stronger symptomatic burden

and in turn reported more experienced social exclusion at work ($b = 0.117$, 95% CI [0.028, 0.251]), supporting hypothesis 2.

Figure 2 presents the results of the second path analysis which tested the serial mediation model. In addition to **Figure 1**, it shows that patients who reported more experienced social exclusion were absent from work more often ($b = 2.652$, $p = 0.006$, 95% CI [0.800, 4.504]). Neither the symptomatic burden ($b = -1.034$, $p = 0.464$, 95% CI [−3.829, 1.761]) nor the degree of the mental illness (no matter whether directly ($b = 0.048$, $p = 0.948$, 95% CI [−1.431, 1.528]) or in total ($b = -0.145$, $p = 0.842$, 95% CI [−1.584, 1.294])) were associated with the amount of days a patient was sick leaving at work. Instead, as can be seen in **Table 3**, the severity of the mental illness had an indirect effect on sick leave: Patients with a more severe mental disorder suffered from a stronger symptomatic burden and reported in turn more experienced social exclusion at work which went along with an increase of days a patient was sick leaving ($b = 0.309$, 95% CI [.022, 0.777]), supporting hypothesis 3. The indirect effects of the severity of the mental illness on absenteeism via the symptomatic burden or social exclusion reclusively were both statistically negligible (see **Table 3**).

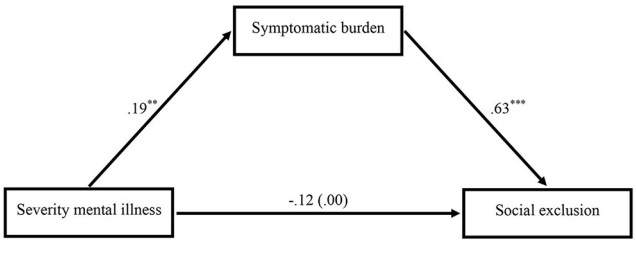

FIGURE 1 | Mediation model showing the impact of the severity of the mental illness on social exclusion via the symptomatic burden ($n = 82$). The total effect of the severity of the mental illness on social exclusion without controlling for the symptomatic burden is shown in parentheses. Unstandardized regression coefficients. Two-sided testing of significance. $^{**}p < 0.01$, $^{***}p < 0.001$.

Additional Analysis

Since the acquisition of patients for the present paper lasted until May 2020, a part of the participants undertook their assessment during the beginning of the COVID-19 pandemic in Germany. To rule out the possibility that the far-reaching influences of the pandemic on the society did affect the presented results we excluded any patient having participated in the year 2020 and reran the analyses, yielding similar results (c.f. Appendix A of the **Supplementary Material**).

Furthermore, some patients completed the questionnaire of "COMPARE work" (i.e., the questions regarding social exclusion and sick leave) before answering the questionnaire of "COMPARE family" (i.e., the questions regarding the symptomatic burden) resulting in a mixed temporal precedence. Thus, we excluded every participant who answered to "COMPARE work" one or more days before answering to "COMPARE family", which resulted in patients completing the questionnaire of "COMPARE work" 12 days after the questionnaire of "COMPARE family", on average. Afterwards we reran the analyses and obtained similar results (c.f. Appendix B of the **Supplementary Material**).

DISCUSSION

The goal of the present study was to contribute to the scarce literature on employees with a mental illness (EMI) by investigating the impact of the mental illness on sick leave. More specifically, we hypothesized and tested whether the severity of the mental illness has an indirect effect on the days of sick leave sequentially via the symptomatic burden and social exclusion at the workplace. Regression and path analysis supported our hypothesis, indicating that patients with a more severe mental disorder suffer from a stronger symptomatic burden. This in turn increases their experienced exclusion at the workplace, yielding an indirect effect of the severity of the mental illness on social exclusion. Finally, the isolation EMI experience at the workplace leads to an increase of absenteeism, resulting in the hypothesized serial mediation.

Although stigmatization and discrimination of people with a mental illness in general has been the scope of several

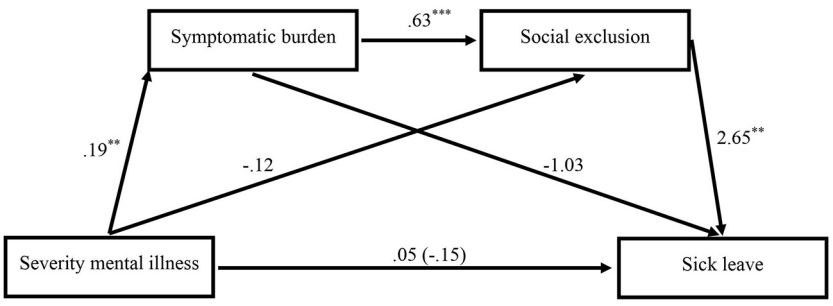

FIGURE 2 | Mediation model showing the impact of the severity of the mental illness on sick leave via the symptomatic burden and social exclusion ($n = 82$). The total effect of the severity of the mental illness on sick leave without controlling for the symptomatic burden and social exclusion is shown in parentheses. Unstandardized regression coefficients. Two-sided testing of significance. $^{**}p < 0.01$, $^{***}p < 0.001$.

TABLE 3 | Indirect effects of the severity of the mental illness on sick leave.

Effects	*b*	SE_b	95% CI
SMI → SB → SL	−0.192	0.268	[−0.735, 0.361]
SMI → SX → SL	−0.311	0.268	[−0.967, 0.064]
SMI → SB → SX → SL	0.309	0.199	[0.022, 0.777]

Confidence intervals and standard errors are based on 10,000 bootstrap-samples (percentile bootstrap confidence intervals). n = 82. SMI, severity of the mental illness; SB, symptomatic burden; SX, social exclusion; SL, sick leave; SE_b, standard error of the regression coefficient of the indirect effect; CI, confidence interval. Unstandardized regression coefficients.

investigations [for reviews on the topic see e.g., (21, 75, 76)], the work situation of EMI still is understudied (16). Previous investigations indicate that social distancing from people with a mental illness exists – not only in the general public but also in the work context [e.g., (21, 24)]. The resulting isolation is known to have detrimental effects on health [e.g., (27–29)] and thus, social exclusion can contribute to sick leave (30). The present study is the first that connects those findings, demonstrating that EMI show higher rates of absenteeism due to the social exclusion they experience at the workplace. It therefore adds to a better understanding of the experiences people with a mental illness make at the workplace and the consequences evoked thereof.

Deeper insights on the work situation of EMI are necessary since many of the published investigations on this population are descriptive in nature, limiting the possible conclusions drawn from those findings [c.f. (16)]. Thus, the current paper contributes to the scarce literature by applying inferential statistics, allowing more reliable conclusions about the specific work environment of EMI.

The study's findings underline the harmfulness of discrimination in general and social exclusion in particular. Various studies indicate the deleterious effects isolation can have on human health (27–29)—thus it is not surprising that socially excluded employees have a higher risk for a long-term sick leave spell (30). The present study replicates those findings in the population of employees with a mental illness, indicating that the social exclusion of EMI increases the days they are sick leaving. Besides the detrimental effects on the health of the discriminated individual, those results also imply negative consequences for organizations and the society as a whole given the amount of costs employers and states across the European Union spend in relation to absenteeism (77).

Although discriminative actions as social distancing toward EMI have been the scope of investigations before [e.g., (23)], this study is the first to portend that the symptomatic burden caused by the mental illness is crucial for the degree of exclusion EMI experience at their workplaces. Seen through the lens of the stereotype content model (SCM) (31) this finding makes sense: The model and its extension, the BIAS Map (32), propose that groups who are evaluated as being cold and incompetent as e.g., people with a mental illness (37), elicit active and passive harm (e.g., exclusion) (31–33). Thus, employees who are perceived as having more mental health problems should experience more social exclusion. However, to evaluate that a certain coworker has a mental health problem, the colleagues first have to notice corresponding peculiar behavior, that is, symptoms of a mental disorder. The more symptoms the colleagues notice (or the stronger they are), the higher the attributed mental health problems of the coworker and hence the elicited behavioral reaction will be. Thus, EMI suffering from a high symptomatic burden will be perceived as being more mentally ill by their coworkers in comparison to EMI with a low symptomatic burden, and thus experience more social exclusion. Experimental evidence supports the suggested importance of the symptomatic burden: Muschalla et al. (78) were able to show that the announced willingness of a fictious coworker with a mental illness to work on her mental health problems led to a lower desire for social distance toward that fictious coworker. Thus, even the anticipation of lower symptoms seems to mitigate the desire to socially distance oneself from the EMI.

Limitations

The present paper has several limitations. First of all, cross-sectional data assessed at one point of time cannot be interpreted causally, since the temporal precedence remains unclear [c.f. (79)]. In the present study however, this concern can partly be thwarted: Although the variables belong to the same assessment, they have not all been measured at the same time. The predictor (severity of the mental disorder) has been rated by trained study personnel in the first interview session which always took part before the online-questionnaires were dispensed [c.f. (62)]. Furthermore, we found similar results when we reanalyzed the data without participants who answered to the questionnaire of "COMPARE work" one or more days before answering the questionnaire of "COMPARE family," yielding an average of 12 days between the assessment of the first mediator (the symptomatic burden) and the second mediator/the outcome (social exclusion and sick leave). Thus, temporal precedence could at least partly be established.

Despite these efforts to ensure temporal precedence, the results still have to be interpreted with caution: Different investigations suggest that experienced exclusion is not only a consequence of a mental illness but also may contribute to its development [c.f. (80, 81)], making a reversed causation of the presented results possible. Furthermore, mental illnesses go along with an increased risk for physical disorders (82, 83). Thus, it is possible that comorbid physical impairments might have contributed to social exclusion and sick leave as well, confounding the results of the present study. Therefore, future replications applying a cross-lagged panel design and incorporating possible confounders are recommended to gain

more certainty about the direction and validity of the presented effects [c.f. for instance (84)].

As in other clinical trials (85–87) recruitment of patients was difficult, yielding a small sample size in the present paper which bears the risk of a non-representative sample [c.f. for instance (84)]. In the German population, the most prevalent groups of mental disorders are anxiety disorders followed by affective disorders (88, 89). Similar results are found in non-German representative studies on mental illnesses in the working population, showing that simple phobia is the most prevalent mental disorder among the workforce followed by depression [c.f. (10)]. Although the present sample also mostly consists of patients with affective or anxiety disorders, the former are clearly dominating (40 diagnoses of affective disorders vs. 20 diagnoses of anxiety disorders). Thus, our sample is not an optimal representation of the population of employees with a mental illness. Future investigations applying a net online-questionnaire, including online screening instruments instead of on-site clinical interviews, could be able to establish a better representation of EMI by lowering the effort for participation.

Besides restrictions in the representativeness, the small sample size also constitutes a problem for the conducted analyses: Complex path models often require more participants than investigated in the present paper [c.f. (90)]. Unfortunately, although recruitment maintained for 17 months, it was not possible to acquire a larger sample—a problem different clinical trials are confronted with [c.f. (85–87)]. Since previous literature already provided support for the individual paths of the mediation model, indicating that a higher severity of the mental illness is associated with a higher symptomatic burden (42–45), that mental illnesses go along with social exclusion [e.g., (20, 21, 24, 38)] and that social exclusion in turn increases the risk for sick leave (30), we are confident that the depicted mediation model represents not merely a chance finding. However, future investigations should try to replicate our results within a larger sample.

Multiple sources of common method biases can operate in any given study and limit the trustworthiness of the results [c.f. (91)]. In the present paper we tried to confine this problem by several ways: First of all, we were able to draw on different assessment-methods (interviews and questionnaires), which might delimitate the risk of a common method bias to some degree [c.f. (91)]. Furthermore, the problem could partly be mitigated by the different contexts some of the variables were assessed in (more specifically, the different questionnaires of "COMPARE family" and "COMPARE work") [c.f. (91)]. At last, the response format used to assess sick leave has been different from the response formats of its predictors which might reduce the risk of common method bias as well (91).

Besides actually being ill, employees may also call in sick for other non-health related reasons, as for instance caring for their ill children. To assure that we only measure the time employees were sick leaving because of their ill health, we explicitly asked for the days they were absent from work due to health reasons and appealed to exclude any days they were missing due to an illness of their children.

Lastly, the majority of the participants were female (77.9%). This can be explained by the applied inclusion criteria, only allowing people to participate if they fulfilled the criteria for a mental disorder [c.f. (62)]. In Germany, however, common mental illnesses as affective disorders or anxiety disorders have a higher prevalence in women than in men [c.f. (88, 89)]. Thus, the reason for the predominantly female composition of the sample probably lies in the applied inclusion criteria and mirrors the gender differences in the prevalence of common mental illnesses in Germany.

Practical Implications and Future Research

The results of the present study indicate that the social exclusion of EMI can increase the days they are sick leaving. Thus, not only active forms of discrimination, which are [according to the extension of the SCM (31, 32)] executed with the blatant aim to affect the target group (e.g., bullying), have detrimental effects on the individual [e.g., (60, 92)], but also more passive forms that are marked by less directed effort as e.g., neglecting, ignoring or excluding [c.f. (32)], can affect individuals health and therefore also the organization they work in, e.g., due to indirect costs associated with absenteeism (15). While active forms of discrimination might at first view seem to be more threatening for the organizational health and probably—due to their more directed effort (32)—attract more attention in organizations, it is hence also necessary that supervisors pay attention whether the more passive forms of discrimination take place in their teams and, if so, try to counteract them.

One possibility to mitigate the social exclusion of EMI could be the appliance of workplace interventions. The Mental Health First Aid training (93, 94) for instance can increase the intentions to provide help to a person with mental health problems in general and might also reduce the desire for social distance, as a recent meta-analysis across several settings indicates (95). Although not specifically developed for the workplace (94), a recent randomized controlled trial shows that the training may also increase the willingness to help a fictious coworker with a mental illness among public servants (96). Future randomized controlled trials might investigate whether the training is able to prevent the detrimental process described in this paper, e.g., by reducing the social exclusion EMI experience in the workplace.

Practitioners, responsible for occupational health policies in their organization, should furthermore focus on reducing stigma toward EMI, since the stereotype, that people suffering from a mental illness are cold and incompetent, is responsible for their exclusion, as the SCM proposes [c.f. (31–33)]. According to a recent meta-analysis, the most promising approach to reduce stigma toward people with a severe mental disorder is establish contact and education [c.f. (97)]. Thus, practitioners can implement existing workplace programs as "The Working Mind" (98), which entails elements of education and contact (98, 99) and has proven to reduce mental health stigma (99), in order to counteract social exclusion of EMI at the workplace.

While the group "people with a mental illness" as a whole is perceived as being cold and incompetent in the sense

of the SCM, research indicates that the perception on the two SCM-dimensions warmth and competence varies across different psychological disorders (23, 37). Follmer and Jones (23) for instance let participants rate how warm and competent different disorders are perceived in the workplace by society and found that individuals suffering from an anxiety disorder are perceived as being warmer and more competent than people with a depression or a bipolar disorder. As a result, the evoked behavioral response toward people with a mental illness might differ, depending on the disorder [c.f. (32)]: Employers for instance would rather dismiss an employee developing a schizophrenia than an employee developing a depression (17). Thus, it would be interesting to explore whether the presented results vary across different mental illnesses, more specifically, whether the type of disorder (for instance depression vs. anxiety disorder) moderates the effect of the symptomatic burden on social exclusion in the demonstrated process. Yet, when we checked our data, we were not able to find a significant interaction (c.f. Appendix C of the **Supplementary Material**), which might be caused by the small sample size. However, a better understanding of which subgroups of people with a mental illness are at special risk for social exclusion and the subsequent absenteeism at the workplace would help, e.g.,, for constructing more precise interventions, which is why we encourage further investigations in this regard.

CONCLUSION

In 2016, about every sixth person in the European Union suffered from mental health problems. Besides the detrimental effects that go along with the disorder itself, people with a mental illness also face various hindrances imposed by society, that are known to worsen the overall health status. The present paper demonstrated that those effects also take place within the workforce. Employers therefore need to implement an integrative climate where employees with a mental illness can feel as safe and valued as every other employee – for the sake of their staff's but also their organization's well-being.

DATA AVAILABILITY STATEMENT

Data share of all primary data of the COMPARE-consortium is planed after the completion of the projects [see (61)]. Participants were also assured that data would not be shared until the projects were completed. Therefore, since assessments and projects are not yet completed, the data cannot yet be made available.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee at the department of psychology at the Philipps-University Marburg. The patients/participants provided their written informed consent to participate in this study.

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AUTHOR CONTRIBUTIONS

BF, CT, KO, and NB generated the idea for the present paper. BF and CT performed the statistical analysis. BF wrote the first draft of the manuscript. CT contributed to sections of the manuscript. CR, CS, HC, KO, LW, MK, and RS designed the COMPARE-Consortium from which the used data originate and thus substantially contributed to the design of the present study. BF and NB were responsible for managing the project COMPARE work. The COMPARE-family research group was responsible for managing the project COMPARE family, for the clinical study

monitoring as well as the data acquisition and data management of both projects. All authors revised the manuscript and approved the submitted version.

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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.2022.892174/full#supplementary-material

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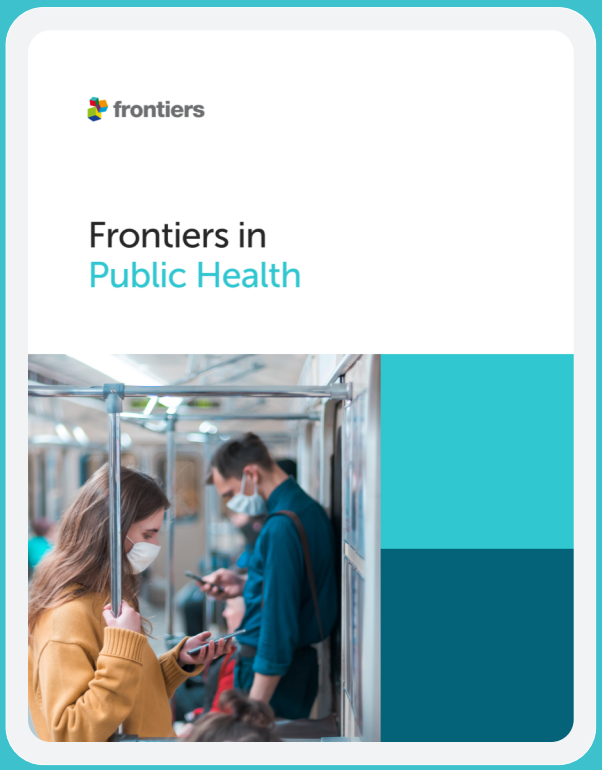

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