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Psychosocial work environment during the COVID-19 pandemic

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Psychosocial work environment during the COVID-19 pandemic

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Editorial: Psychosocial work environment during the COVID-19 pandemic

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psychosocial, COVID-19, work, environment, risk

Editorial on the Research Topic
Psychosocial work environment during the COVID-19 pandemic

In our present Research Topic, "*Psychosocial Work Environment During the COVID-19 Pandemic*", the number of articles that were published was 16, with a total of 4,660 downloads to date. Our topic investigates the cross-sectoral and multidimensional impact of COVID-19-related work environment changes on employees' psychosocial wellbeing. Furthermore, it investigates the psychosocial mechanisms explaining these effects in several countries and across different service industries using a "voice of the employee" approach. It includes the investigation of both direct and indirect impacts of COVID-19 on employees' psychosocial wellbeing. All relevant research findings are documented by an in-depth analysis of all primary research data, aiming to investigate and isolate the main psychosocial cause-and-effect mechanisms explaining these effects.

We strongly believe that our current Research Topic will act as an added-value component in the international psychosocial risk management research platform for exchanging cross-sectoral and cross-country practical and scientific knowledge between scientists and practitioners. In addition to the above, both strategic HR managers and policymakers could take into consideration our Research Topic findings for the implementation of "evidence-based" and "employee-centric" management interventions and policymaking in the near future.

The effect of working environment conditions on the health and safety of workers has been the subject of several scientific studies (1–3). Psychosocial risks refer to factors that can potentially cause psychological or physical harm to workers. Such factors may concern aspects of the planning, organization, and management processes of work, a lack of supportive relationships, job insecurity, or even the culture of a company (4).

Psychosocial risks arise from the problematic planning, organization, and management of work, as well as from an unhealthy social context of work, and may lead to negative psychological, physical, and social outcomes such as work stress, burnout, or depression (5). In addition to mental health disorders, workers suffering from prolonged stress are at risk of experiencing serious physical health problems, such as cardiovascular diseases or musculoskeletal problems (6). At the organizational or business level, negative consequences can include poor overall work performance, increased absenteeism, and increased accident rates and injuries (7).

The outbreak of COVID-19 had a great impact on employees' daily work and psychology, and many frontline personnel sacrificed their own wellbeing (Jiang et al.). More specifically, the pandemic has placed an additional burden on already strained healthcare systems worldwide, intensifying the responsibility of healthcare workers. Before the COVID-19 pandemic, previous studies had shown that adverse workplace factors were associated with the likelihood of developing mental health disorders among healthcare workers.

A high prevalence of functional gastrointestinal disorder (FGID)-related symptoms was observed among healthcare workers without a history of FGID during the period when they were involved in the fight against COVID-19 (Zhang et al.). This study was one of the articles cited in the Research Topic "*Psychosocial Work Environment During the COVID-19 Pandemic*".

According to Muller et al. (8), individual, interpersonal, and organizational factors are recognized as workplace issues that have a negative influence on the mental health of health professionals, while workplace conflicts also have a negative influence. Workplace factors such as support in the workplace and health/safety in the workplace instead of coronavirus-related risks seem to be able to predict not only the present stress level but also the stress level over the long term. It was a really important finding that, during the COVID-19 pandemic period, in order to relieve the high stress of healthcare workers, organizational-level approaches should have been implemented, especially measures designed to enhance support and health/safety in the workplace, according to the Xiong et al..

Gu et al. proposed that policymakers and nursing administrators should pay close attention to the work stress of frontline nursing professionals because taking active and effective interventions and offering psychological support will help them to have a positive mindset. At the governmental level, occupational psychosocial risks should be included in the scope of OSH, including regulations, policies, and standards. At the organizational level, administrators are encouraged to work on preventing and controlling psychosocial risks and promoting mental health in workplaces. At the individual level, healthcare workers might increase awareness through universal training in psychosocial risk coping strategies.

In the context of the COVID-19 pandemic, employees were facing both the stress of their work commitments and the stress caused by the virus. Leaders communicating with employees about their physical and mental health was found to be of great importance as it could make employees feel that the organization is not only concerned about their work performance but also attaches importance to their health and safety (Xiong et al.), which promotes organization-based self-esteem and work engagement (9). One of the most cited articles on our topic is the article written by Tang et al., which suggests that managers should formulate policies and strategies to ensure and improve the interests and wellbeing of nurses and improve the practice environment to protect the sense of security of nurses, which is helpful to increase work engagement and reduce turnover intention. The safe communication of leaders makes employees feel that they are valued and useful in the organization, and they then tend to display more beneficial behaviors at work (10). It is crucial for leaders to provide timely psychological support to employees through communication (11, 12).

Author contributions

MM: Writing—review and editing. AK: Writing—original draft.

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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The mental health status of offshore oil platform workers during the COVID-19 pandemic

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Background: Previous studies indicated that offshore workers have a high level of work-related stress on an everyday basis. This study aims to assess the prevalence and determinants of mental health conditions in offshore oil platform workers during the COVID-19 pandemic.

Methods: Workers of three oil and gas platforms were assessed in this cross-sectional study. Their mental status was evaluated by the Posttraumatic Stress Disorder (PTSD-8) questionnaire, and Depression Anxiety, Stress Scales (DASS) questionnaires. Furthermore, we assessed satisfaction with life (SWL) with a single question. Finally, multivariate logistic regression was used to determine the association of demographic and work-related variables with mental health outcomes.

Results: Overall, 278 (Males:197, Females: 81) out of 315 invited workers with a mean age of 35.6 (SD: 7.2) years were included in this study using a random sampling method (participation rate: 88.2%). PTSD symptoms and Insomnia were observed in 9 (3.2%) and 138 (49.6%) of the participants, respectively. The prevalence of stress, anxiety, and depressive symptoms were 72 (25.9%), 70 (24.6%), and 85 (30.5%), respectively. Based on multivariable (adjusted) logistic regression analysis, women had significantly higher odds of stress and anxiety than men; those with an academic education were significantly more dissatisfied with their lives than those without an academic education.

Conclusion: Our findings revealed a high prevalence of anxiety, depressive symptoms, and stress among offshore oil platformers during the COVID-19 pandemic, especially in women. Indicating that women and those with a higher education level in the oil platform work settings are more susceptible to stressors.

KEYWORDS

platform workers, offshore, mental health, COVID-19, PTSD, stress, anxiety, depression

Background

The late COVID-19 has caused devastation worldwide in the past few years and has affected nearly all industries and working groups directly and indirectly (1, 2). The fear of exposure to the virus itself, economic and financial crises, and lifestyle changes are among the very few outcomes of the pandemic, with each one acting as a potential stressor affecting the population's mental status (1–4). Many studies evaluated the mental health of different occupations, especially health care workers (HCWs), who were under the most pressure and suffered the most adverse mental effect (4). Although other workers were far less exposed to the virus than HCWs, they suffered the effect of these many stressors to some extent (2, 5).

The oil and gas industry plays a crucial role in the economy and is one of the primary sources of employment in oil-producing countries (6). However, this occupation is affected by stressors from both the workplace and outside the workplace (7), which rests heavily on the workers' shoulders and affects their mental and physical health (7, 8). Previous studies indicate that offshore workers have a high level of work-related stress (8, 9). In addition, many studies have shown that the late COVID-19 pandemic resulted in massive adverse mental outcomes among the general population and different occupations (3–5, 8–11). In this regard, since the oil industry workers who are already affected by various stressors might be more susceptible to the adverse effects of the COVID-19 pandemic. However, no published studies assessed the mental status of these workers during the COVID-19 pandemic. This study aims to assess the prevalence and determinants of mental health conditions in offshore oil platform workers during the COVID-19 pandemic.

Materials and methods

Study design

This cross-sectional study was conducted between August and October 2021 among oil and gas platform workers in the Persian Gulf, Iran.

Sample size and sampling method

The sample size was calculated according to a previous Seafarers' mental health study (12). Considering a prevalence of depression of 25%, an alpha error of 5%, and an attrition rate of 10%, the needed sample was estimated to be 315 participants. Participants were selected using a stratified random sampling method. First, five platforms were randomly selected from the 20 existing oil platforms. Then, participants were randomly selected, proportional to the size of the participants in each platform.

Data collection

Data gathering was done through self-administrated online questionnaires. The original link was distributed among the workers through the platforms' headquarters. In addition, demographic variables and work-related characteristics (e.g., sex, age, marital status (single/married), work experience (in years), work status (day shift/night shift), and educational level (having an academic education/not having an academic education) were also gathered *via* online questionnaires.

Instruments

Mental health status was assessed using valid standardized Persian questionnaires, including the Depression, Anxiety and Stress Scale (DASS-21) (13, 14), Posttraumatic Stress Disorder (PTSD-8) (15), and Insomnia severity index (ISI) (16, 17).

DASS-21

DASS-21 is vastly used to measure depression, anxiety, and stress symptoms (13, 14). The reliability and validity of the Persian version of this questionnaire have been evaluated in studies with a satisfactory Cronbach's alpha of 0.94 for the total scales of the questionnaire (18). Each domain of anxiety, stress, and depression, consists of seven questions. In these questions, the answerer has four choices varying from zero ("It does not apply to me") to three ("It applies to me completely"). The sum of the scores in each domain indicates the existence and the severity of the aforementioned conditions (14). Scores above seven, nine and fourteen indicate a high probability of depression, anxiety and stress in each subdomain, respectively (14).

PTSD-8

PTSD is a short effective tool to evaluate the existence of the three conditions of intrusion, avoidance, and hyperarousal within PTSD. The PTSD-8 scale is comprised of eight questions. These questions are scored based on a four-point Likert scale (1 = not at all, 4 = very often) (15). Answering a question as "three" or "four" is considered the existence of the possible condition within the aforementioned domain and possible PTSD. This questionnaire was also validated in Persian with a satisfactory Cronbach's alpha of 0.86 (4).

ISI

ISI is a short seven items tool to evaluate insomnia severity during 2 weeks prior to the test (16, 17). Its questions are scored

based on a four-point Likert scale (0 = not at all, 4 = extreme). The total score, which is the sum of the scores of all items, falls within one of the domains of "no insomnia", "subthreshold insomnia" (8 to 14), "moderate clinical insomnia" (15 to 21), and "severe clinical insomnia" (22 to 28) (17). the Persian version of this questionnaire has been validated with an acceptable Cronbach's alpha of (0.87) (19).

Satisfaction with life (SWL) and perceived health

We assessed satisfaction with life and perceived health by using a single question regarding each variable. We asked the participants to rate their satisfaction with life (SWL) from one to 10 (1 = completely dissatisfied to 10 = completely satisfied), and rate their perception of their own health status from one to four (1 &2 = bad, 3 & 4 = good).

Statistical analysis

We used Statistical Package for the Social Sciences Software, version 20 (SPSS) for data analyses. The Kolmogorov-Smirnov test evaluated the normal distribution of continuous variables. We expressed categorical variables as frequency and percentage and continuous variables as mean and standard deviation (SD). The prevalence of mental symptoms are reported alongside their 95% confidence interval (CI).

Man-Whitney U and Fisher's exact test tests were used to compare continuous and categorical variables within DASS, and PTSD subscales. In addition, the correlations between PTSD, DASS subscales and quantitative demographic variables were assessed using Spearman's correlation coefficient.

Univariable (crude) and multivariable (adjusted for variables with a *P*-value <0.1 in the crude model) logistic regression analyses were performed, to determine the association between demographics and the aforementioned mental health conditions, and their results were reported as odds ratio (OR) and 95% CI. A *p*-value below 0.05 (two-tailed) was considered statistically significant.

Results

Of the *315* invited workers, *278* completed the online questionnaires (participation rate: 88.2%). The mean age of participants was 35.42 ± 7.52 years. *197* (*84.2%*) of the participants were male, *67* (*24.1%*) were night shift workers, *210* (*75.5%*) were married, and *243 (87.4%)* had an academic education. The mean work experience was 11.44 ± 6.79 years. Among the participants, *73* (*26.2%*) were dissatisfied with their lives (Mean total SWL score: 6.74 ± 2.56). PTSD symptoms were observed in *9* (*3.2%*) of participants (Mean total PTSD score: 4.01 ± 3.92). The prevalence of stress, anxiety, and depressive symptoms (DASS 21 subscales) among participants were *72* (*25.9%*), *70* (*24.6%*), and *85* (*30.5%*), respectively. Regarding ISI, *138* (*49.6%*) participants had experienced some degree of insomnia (Mean total ISI score: *7.83 ± 3.79*).

The comparison of mental issues across demographic variables can be seen in Table 1. As shown no significant differences were seen in depression, anxiety, and PTSD subscales across age, work experience, marital status, and shift schedules. However, younger and less experienced participants endured significantly higher stress levels. Moreover, stress, anxiety and PTSD were significantly higher among women compared to men. Moreover, SWL and good health-perception was significantly higher in married participants and those with an academic education compared to the singles and those without an academic education.

The correlation coefficiencies (Table 2) show a strong negative correlation between SWL and DASS subscales (*p-value <0.05*). The same can be seen for SWL and PTSD subscales, and ISI scores as well (*p-value <0.05*). Furthermore, PTSD subscales and DASS subscales scores strongly correlate with one another.

The results of the logistic regression analysis are shown in Table 3. In the univariate (crude) logistic analysis, older age decreased the odds of anxiety by 5% [OR:0.95, 95%CI (0.91–0.99)], women compared to men had significantly higher odds of PTSD symptoms and stress by 637% [OR:7.37, 95%(1.89–28.66)] and 125% [OR:2.25, 95%CI (1.14–4.46)] respectively. Having more work experience decreased the odds of anxiety and stress by 5% [OR:0.95, 95%CI (0.91–0.99)] and 6%, (OR:0.94 95%CI (0.90–0.99)). Married participants had 125% higher odds of reporting having a bad self-health perception [OR:2.25, 95%CI (1.05–4.79)] and 135% higher odds of being dissatisfied with their lives [OR:2.35, 95%CI (1.29–4.29)] compared to single participants. Night shift workers had 126% higher odds of experiencing insomnia [OR:2.26, 95%CI (1.28–4.01)] compared to day shift workers. Those with an academic education had 130% higher odds of having a bad self-health perception [OR:2.30, 95%CI (1.02–5.17)] and 156% higher odds of being dissatisfied with their lives [OR:2.56, 95%CI (1.29–5.06)] compared to those without an academic education. In the multivariable (adjusted) logistic regression analysis, women had 229% higher odds of anxiety [OR:3.29, 95%CI (1.43–7.55)] and 180% higher odds of stress symptoms [OR:2.80, 95%CI (1.22–6.39)] compared to men. Night shift workers had 103% increased odds of experiencing insomnia [OR:2.03, *95%CI* (1.08–3.84)] compared to day shift workers. Those with an academic education had 293% higher odds of being dissatisfied with their lives [OR:3.93, 95%CI (1.57–9.86)].

Discussion

There have been many studies on the mental health outcomes of the COVID-19 pandemic in different populations

TABLE 1 Comparison of mental issues across demographic variables.

Variable		Age (Year)[a]	*P*-value[M]	Sex[b]		*P*-value[F]	Marital status[b]		*P*-value[F]	Shift[2]		*P*-value[F]	Education[b]		*P*-value[F]	Work EXP (Year) [1]	*P*-value[M]
				Male	Female		Single	Married		Day	Night		Academic	Non Academic			
Depression	No	35.6 ± 7.3	0.78	168 (84.8)	30 (15.2)	0.37	44 (22.7)	150 (77.3)	0.33	144 (77)	43 (23)	0.09	170 (85)	30 (15)	0.5	11.3 ± 6.7	0.81
	Yes	35.6 ± 6.6		66 (82.5)	14 (17.5)		21 (25.9)	60 (74.1)		51 (68)	24 (32)		73 (85.9)	12 (14.1)		11.4 ± 6.3	
Stress	No	36 ± 7.1	0.04*	183 (87.1)	27 (12.9)	0.02*	44 (21.2)	164 (78.8)	0.06	151 (76.3)	47 (23.7)	0.15	184 (86.4)	29 (13.6)	0.23	11.8 ± 6.6	0.02*
	Yes	34.6 ± 7		51 (75)	17 (25)		21 (31.3)	46 (68.7)		44 (68.8)	20 (31.3)		59 (81.9)	13 (18.1)		9.7 ± 6.3	
Anxiety	No	36.3 ± 7.4	0.04*	183 (87.6)	26 (12.4)	0.008*	50 (24.2)	157 (75.8)	0.43	152 (77.2)	45 (22.8)	0.06	181 (84.2)	34 (15.8)	0.24	11.8 ± 6.8	0.06
	Yes	33.7 ± 6		51 (73.9)	18 (26.1)		15 (22.1)	83 (77.9)		43 (66.2)	22 (33.8)		62 (88.6)	8 (11.4)		9.9 ± 5.8	
PTSD	No	35.6 ± 7.1	0.92	230 (85.5)	39 (14.5)	0.006*	63 (23.7)	203 (76.3)	0.64	187 (73.6)	67 (26.4)	0.09	235 (85.1)	41 (14.9)	0.61	10.5 ± 6.6	0.85
	Yes	35.2 ± 7.1		4 (44.4)	5 (55.6)		2 (22.2)	7 (77.8)		8 (100)	0		8 (88.9)	1 (11.1)		10.5 ± 6.4	
SWL	No	35.4 ± 8.5	0.15	60 (88.2)	8 (11.8)	0.19	25 (36.2)	44 (63.8)	0.004*	44 (67.7)	21 (32.3)	0.1	55 (75.3)	18 (24.7)	0.006*	10.4 ± 7.2	0.08
	Yes	35.7 ± 6.6		174 (82.9)	36 (17.1)		40 (19.4)	166 (80.6)		151 (76.6)	46 (23.4)		188 (88.7)	24 (11.3)		10.7 ± 6.4	
Perceived	Bad	34.15 ± 7.9	0.2	28 (80)	7 (20)	0.3	13 (38.2)	21 (61.8)	0.03*	21 (63.6)	12 (36.4)	0.1	29 (74.4)	10 (25.6)	0.04*	9.9 ± 5.5	0.23
health status	Good	35.8 ± 7		206 (84.8)	37 (15.2)		52 (21.6)	189 (78.4)		174 (76)	55 (24)		214 (87)	32 (13)		11.5 ± 6.7	
ISI	Normal	36.4 ± 7.5	0.44	127 (87)	19 (13)	0.12	32 (22.1)	113 (77.9)	0.31	112 (81.8)	25 (18.2)	0.003*	125 (85)	22 (15)	0.52	11.9 ± 6.8	0.08
	Insomnia	34.7 ± 6.6		107 (81.1)	25 (18.9)		33 (25.4)	97 (74.6)		83 (66.4)	42 (33.6)		118 (85.5)	20 (14.5)		10.6 ± 6.3	

[a]Are Reported As Mean (SD); b[2]Are Reported As N (%); [M]Based On Mann-Whitney U Test; [F]Based On Fisher's Exact test. Exp: Experience; SWL, Satisfaction With Life; ISI, Insomnia Severity Index; PTSD, Post-Traumatic Stress Disorder; *Statistically Significant (P-value <0.05).

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TABLE 2 Spearman's correlation.

Variable	Age	Work. Exp	SWL	DASS stress	DASS Anxiety	DASS depression	ISI score	PTSD score
Age	1.000	0.897**	0.025	−0.081	−0.118	−0.071	−0.079	0.045
Work.Exp	0.897**	1.000	0.032	−0.101	−0.095	−0.067	−0.127*	0.079
SWL	0.025	0.032	1.000	−0.514**	−0.410**	−0.580**	−0.369**	−0.265**
DASS Stress	−0.081	−0.101	−0.0514**	1.000	0.720**	0.802**	0.570**	0.569**
DASS Anxiety	−0.118	−0.095	−0.410**	0.720**	1.000	0.666**	0.488**	0.573**
DASS Depression	−0.071	−0.067	−0.580**	0.802**	0.666**	1.000	0.581**	0.533**
ISI Score	−0.079	−0.127*	−0.369**	0.570**	0.488**	0.581**	1.000	0.386**
PTSD Score	0.045	0.079	−0.265**	0.569**	0.573**	0.533**	0.386**	1.000

**Statistically significant (P–value < 0.01); Exp, experience; SWL, Satisfaction With Life; DASS, the Depression Anxiety Stress Scale; ISI, Insomnia severity index; PTSD, Post–traumatic stress disorder.

such as the general population (10), healthcare workers (3, 20), and seafarers (5). However, offshore oil platformers have not been well studied. Based on our findings, the prevalence of anxiety, depressive, and stress symptoms were 24.8, 28.8, and 24.4%, respectively. The prevalence of the aforementioned mental health problems among platform workers is very high compared to other occupations such as seafarers (5), health care workers, and other settings (4, 17). This can be due to other potential stressors that indirectly resulted from the pandemic (economic and financial difficulties, the induced fear of infection, etc.) alongside the work's nature itself. It should be noted that the prevalence of anxiety and depression among 1,747 offshore workers just prior to the beginning of the pandemic were 15 and 18 percent, respectively (21). Thus in the same field of work, the prevalence of these symptoms have increased about 10%. Although this difference in the prevalence of mental symptoms can be due to the difference in the countries in which these studies were conducted, one cannot deny the pandemic's effects on the increased prevalence of these adverse mental symptoms. Thus, the authors of the current study believe that individual strategies parallel with companies' mental health promotion policies should be developed in order to support workers in similar health emergencies in the future. Within these strategies, those who are at higher risk of being affected by stressors (such as women and those with a higher educational level) should be prioritized

Despite the high prevalence of stress among platformers workers, only 2.2% of them showed signs of PTSD. This prevalence is lower than the reported prevalence of PTSD symptoms among seafarers (37.3%) (22). Such a difference between our findings and seafarers might be due to the difference in the nature of the jobs (e.g., long time of social isolation among seafarers compared to platform workers) as well as the work setting itself (e.g., moving nature of the ships and related stressors compare to the fixed platforms).

Furthermore, our results indicate no significant relationship between marital status, shift schedule, and mental health after adjustment for confounding variables.

Nonetheless, those with a higher educational level had higher SWLs. This finding could be attributed to, higher income, and lower work-life conflicts (23).

Furthermore, the prevalence of stress and anxiety were significantly higher among females compared to the males in our study; this finding is in line with similar studies on male-dominated occupations (24). This difference of stress and anxiety among sexes can attributed to the different roles, responsibilities, concerns and stressors that female workers have (24, 25). In this regard it is suggested that in occupations dominated by one sex, additional psychological support is needed for the opposite sex. However, the low number of female participants in the current study might have adversely affected our findings. In order to evaluate the effect of such parameters on the mental health of the participants, we suggest a more extensive population-based study with a normal distribution of sex and marital status. Furthermore, conducting qualitative research to explore predictors and patterns of underlying processes of offshore workers' mental health status is recommended. It is well known that during this pandemic, the prevalence of mental disorders has risen; therefore, it is suggested that some psychosocial counseling interventions can be helpful (3, 4, 22, 26–28); and in times of global devastation, many workers will endure some degrees of mental distress, especially in occupations with high levels of stress. Hence, in dire times, psychological support should be prioritized for occupations with the most stress levels.

Limitations and strengths of the study

Few studies have assessed offshore oil platform workers' stress and mental health status. Thus, due to the point

TABLE 3 Association of demographic and work-related variables with psychiatric symptoms and perceived health status in logistic regression analysis among seafarers.

Variable		PTSD (yes/no)		Anxiety (yes/no)		Stress (yes/no)		Depression (yes/no)	
		Model I	Model II	Model I	Model II	Model I	Model II	Model I	Model II
Age (year)		0.99 (0.91–1.08)	1.08 (0.85–1.38)	0.95 (0.91–0.99)*	0.90 (0.80–1.01)	0.96 (0.93–1.00)	1.03 (0.93–1.14)	0.99 (0.96–1.03)	1.00 (0.91–1.11)
Sex (female/male)	Male	1	1	1	1	1	1	1	1
	Female	7.37 (1.89–28.66)*	14.08 (2.59–76.52)	2.48 (1.26–4.88)	3.29 (1.43–7.55)*	2.25 (1.14–4.46)*	2.80 (1.22–6.39)*	1.18 (0.59–2.38)	1.77 (0.78–4.02)
Work Exp (year)	0.97 (0.88–1.08)	0.98 (0.77–1.24)	0.95 (0.91–0.99)*	1.04 (0.92–1.17)	0.94 (0.90–0.99)*	0.92 (0.82–1.03)	0.99 (0.96–1.03)	0.99 (0.89–1.10)	
Marital status	Single	1	1	1	1	1	1	1	1
	Married	1.08 (0.22–5.36)	1.61 (0.15–16.32)	1.12 (0.58–2.16)	1.89 (0.83–4.31)	0.58 (0.31–1.08)	0.71 (0.33–1.53)	1.03 (0.49–2.18)	0.96 (0.45–2.03)
Work status	Day	1	1	1	1	1	1	1	1
	Shift	N.A	N.A	1.72 (0.93–3.18)	1.30 (0.62–2.71)	1.46 (0.78–2.71)	1.44 (0.69-2.99)	1.62 (0.82-3.20)	0.61 (0.31-1.21)
Education	No	1	1	1	1	1	1	1	1
	Yes	1.39 (0.17–11.45)	N.A	1.45 (0.64–3.31)	0.70 (0.25–1.89)	0.71 (0.34–1.46)	0.49 (0.18–1.29)	0.96 (1.01–0.38)	1.01 (0.38–2.70)

Variable		Health status (bad/good)		SWL (dissatisfied/satisfied)		ISI (normal/insomnia)	
		Model I	Model II	Model I	Model II	Model I	Model II
Age (year)		1.03 (0.98–1.08)	1.11 (0.96–1.29)	1.01 (0.97–1.05)	0.94 (0.84–1.04)	0.98 (0.95–1.01)	0.98 (0.89–1.07)
Sex (female/male)	Male	1	1	1	1	1	1
	Female	0.71 (0.29–1.76)	0.60 (0.20–1.77)	1.55 (0.68–3.52)	1.75 (0.61–5.04)	1.56 (0.81–2.99)	2.01 (0.91–4.45)
Work Exp (year)		1.04 (0.98–1.10)	0.90 (0.77–1.05)	1.03 (0.98–1.07)	1.07 (0.96–1.20)	0.96 (0.93–1.00)	1.00 (0.91–1.10)
Marital status	Single	1	1	1	1	1	1
	Married	2.25 (1.05–4.79)*	1.97 (0.78–4.79)	2.35 (1.29–4.29)*	2.07 (0.97–4.24)	0.83 (0.47–1.45)	0.94 (0.47–1.86)
Shift status (day/night)	Day	1	1	1	1	1	1
	Night	0.55 (0.25–1.19)	0.58 (0.23–1.44)	1.19 (0.42–3.33)	0.56 (0.27–1.15)	2.26 (1.28–4.01)*	2.03 (1.08–3.84)*
Education	No	1	1	1	1	1	1
	Yes	2.30 (1.02–5.17)*	2.32 (0.72–7.47)	2.56 (1.29–5.06)*	3.93 (1.57–9.86)*	1.03 (0.53–2.00)	0.85 (0.36–2.00)

Model I, Crude Mode; Model II, Adjusted for variables which had P-Value <0.1 in the crude model values are reported as odds ratio (95% Confidence Interval); *Statistically significant (P-value < 0.05).
Exp, experience; SWL, Satisfaction With Life; ISI, Insomnia severity index; ISI, scores from 8 and above were considered as having insomnia.

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above and the cross-sectional nature of the study, it was not possible to determine whether the found conditions were the pandemic's results or the workload. Furthermore, the self-report measurement might have affected the results. The participants were mostly male, this limitation might also affect the results of current study. Nonetheless, one strong point is that this study is one of the very few studies to evaluate the mental health status of offshore oil platform workers during the pandemic. The high response rate is due to the great follow up system and cooperation of the platforms' headquarters was another strong point.

Conclusion

Our findings revealed a high prevalence of anxiety, depressive symptoms, and stress among offshore oil platformers during the COVID-19 pandemic. We urge all researchers to do more studies on these workers in order to cover all aspects of mental health status during COVID-19. Furthermore, the relevant authorities of the oil industry are encouraged to take proper action regarding workers' mental health issues in this setting.

Data availability statement

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

Ethics statement

The study involving human participants was reviewed and approved by National Institute for Medical Research Development (NIMAD). The patients/participants provided their written informed consent to participate in this study.

Author contributions

MQ and FB conceived the study, participated in study design, data collection, interpretation of the result, and revised the manuscript critically. NM participated in data collection, interpretation of the result, and wrote the first draft of the manuscript. HA and ES participated in data collection and drafting the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Post-traumatic growth experience of first-line emergency nurses infected with COVID-19 during the epidemic period—A qualitative study in Shanghai, China

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Background: In March 2022, Shanghai, China, was hit by a severe wave of SARS-CoV-2 transmission caused by the Omicron variant strain. The medical staff was greatly infected during this period, which posed a traumatic event for them. Meanwhile, they also experience post-traumatic growth under introspection and positive change. However, the psychological coping and growth after infection with COVID-19 among medical staff have rarely been investigated.

Objectives: To explore the process and influencing factors of post-traumatic growth among emergency nurses infected with coronavirus disease (COVID-19) so as to provide a new perspective and theoretical basis for psychological rehabilitation or intervention for medical staff who experienced traumatic events.

Methods: The study used a qualitative design based on the phenomenological approach. A purposive sampling method was used to explore the subjective feelings and post-traumatic growth among 13 first-line emergency nurses infected with COVID-19 in Shanghai, China. Semi-structured face-to-face interviews were conducted in June 2022. A Seven-step Colaizzi process was used for data analysis.

Results: Themes were described and extracted from the experience and insights at different stages during the fight against the virus. Three main themes, i.e., stress period, adjustment period, and growth period, as well as several sub-themes, were identified.

Conclusion: First-line emergency nurses infected with COVID-19 are a sensitive group that should be given more attention. Investigating how they achieve psychological adjustment and growth in the case of severe trauma can provide valuable references for nursing management and education in the

future. Society, hospital and nursing managers should pay more attention to the PTG of nurses and establish supportive PTG strategies, which will benefit the retention rate and career development of nurses.

KEYWORDS

post-traumatic growth, emergency nurses, COVID-19, psychological experience, qualitative study

Introduction

The World Health Organization (WHO) proclaimed the outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that caused the 2019 coronavirus disease (COVID-19) as the Public Health Emergency of International Concern (PHEIC), characterizing it as a pandemic (1). The virus spreads mainly through saliva droplets, nose droplets from an infected person who coughs or sneezes, or airborne aerosols (2). On November 9, 2021, a novel Coronavirus B.1.1.529 variant was first detected from case samples in South Africa. Within just 2 weeks, the mutant strain has become the absolute dominant strain in Gauteng Province, South Africa, with rapid growth of COVID-19 cases. On November 26, 2021, it was defined as the fifth Variant of Concern (VOC) and was named Omicron by WHO (3). Omicron continued to mutate, and recently SARS-CoV-2 Omicron Subvariants BA.4 and BA.5 have been identified (4). Since March 2022, Shanghai, China has experienced a severe wave of SARS-CoV-2 transmission caused by the Omicron variant strain. During the time period between March 1, 2022 and June 31, 2022, a novel coronavirus infected nearly 6,50,000 people in Shanghai, with more than 58,000 confirmed local cases and 5,91,000 asymptomatic infections, including many medical staff (5).

Chinese and Shanghai governments took the spread of COVID-19 very seriously, as they did at the beginning of the outbreak in Wuhan. The government had mobilized massive medical resources to set up fever clinics, special isolation wards, hospitals for severe patients and temporary shelter hospitals (mobile cabin hospitals). More than 100 designated hospitals and mobile cabin hospitals have been added to accommodate all types of infected patients and asymptomatic infected patients (6). Tens of thousands of medical staff had been involved in treating those diagnosed with the virus (7). During the epidemic period, the treatment activities of first-line emergency medical staff included close contact with sources of infection, heavy treatment tasks, and strict protection. The occupational risks they faced were also characterized by high infection rates (8). Globally, around 14% of COVID-19 cases reported to WHO were health workers, while in some countries, this rate was as high as 35% (9). In China, the education level of nurses is mainly from junior college to undergraduate, and the study of infectious disease prevention is essential. The government attached great importance to protecting healthcare workers from infection. However, under strict protection, there were still staff members who were unfortunately infected. For those infected with COVID-19, this presented a traumatic experience. In addition to dealing with compromised physical health, psychological trauma should not be ignored.

Trauma refers to the acute damage caused by the external environment to the body tissues and organs and the patient's psychology. The most common factors include mechanical trauma, chemical trauma and psychological trauma. In psychiatry, psychological trauma is defined as "events beyond the ordinary experience," i.e., the occurrence of traumatic events is sudden and irresistible, which makes people's psychological state deviate from the normal everyday state (10). The experience of trauma actually leads to deep psychological injury at an unconscious level that entails loss of control, language, power, and self. Trauma is a wound that "cries out," a silent wound that is articulated through re-enactments. As a result, traumatized individuals are vulnerable to repeating past traumas and remain in a crisis without being able to regain control over their current lives (11). More than 70% of the global adult population experienced at least one traumatic event in their lifetime, while 31% experienced four or more (12). Emergency nurses are at high risk of trauma due to the serious condition of patients, high work intensity, interpersonal pressure, violence and other work related risks. Global public health events such as COVID-19 pose huge occupational risks to nurses, especially those working on the first line, who are at great risk of infection. Even in society, infected people will be stigmatized by some media and the public, they will feel ostracized and ashamed, and medical staff are no exception (13). Having experienced working during the COVID-19 pandemic, many front-line personnel had sacrificed their own wellbeing, which could be even more traumatic and cause increasing psychological distress when they were infected with the novel coronavirus (14).

Generally, mild psychological trauma can be self-healing, while the trauma of a larger degree may cause anxiety, depression, and in severe cases, even Post-Traumatic Stress Disorder (PTSD), thus putting these individuals at a high risk of Secondary Traumatic Stress (STS) and bringing more severe challenges to their mental health (15). Previous studies

have found that the incidence of depressive symptoms among people diagnosed with COVID-19 is as high as 29.2%, which is significantly higher than in the general public (16). According to Missouridou's research, nurses who have experienced traumatic events were more prone to develop compassion fatigue during the COVID-19 pandemic (17). The inability to cope with the impact of trauma may limit nurses' ability to interact in a meaningful and safe way with patients and their families (11). Yet, in recent years, some scholars have tried to understand people's subjective feelings other than STS from a positive perspective. Positive psychological changes that occur after an individual experiences traumatic events are known as Post-Traumatic Growth (PTG) (18), i.e., one has the ability to grow as a result of trauma (19). After working on the first line, infected nurses may experience some positive changes due to the COVID-19 awareness and coping experience gained on the job. PTG helps them reflect on their experience, which is beneficial to their career growth and general satisfaction with life (20).

The medical staff is an important force in the fight against COVID-19. First-line emergency nurses have direct contact with confirmed patients in their work, participate in emergency treatment, complete nursing work and take care of their lives. Yet, even under strict protection, they are highly likely to be infected. Some previous studies have focused on the PTG of emergency nurses, but the research on their psychological coping and growth after being infected with COVID-19 need to be further explored. It is of interest and significance to understand how this representative group of nurses obtain PTG experience. Therefore, they were chosen as study subjects in the present study, and the phenomenological research method for qualitative research was applied to explore their experience and process of PTG so as to provide a new perspective and theoretical basis for psychological rehabilitation or intervention for medical staff who experienced traumatic events.

Methods

Study design

Phenomenological qualitative study and individual semi-structured interviews were used to explore the subjective feelings and experience of PTG of first-line emergency nurses infected with COVID-19, and to understand the positive factors affecting PTG. In simple terms, phenomenology seeks to describe the essence of a phenomenon by exploring it from the perspective of those who have experienced it. The goal of phenomenology is to describe the meaning of this experience—both in terms of what was experienced and how it was experienced (21). This method provides an in-depth perspective on the experiences of the participants (22), focuses on describing common experiences shared across a population (23).

Participants and ethical considerations

First-line nurses in the emergency department of a third-level class-A hospital in Shanghai who participated in the treatment of COVID-19 patients and were infected with Omicron virus in April 2022 were included in the study. The method of purposeful sampling was used to select participants, which is used to identify and select informative cases related to the phenomenon of interest (24). The inclusion criteria were the following: (1) participated in the first-line emergency treatment of COVID-19 patients; (2) nucleic acid test positive for novel coronavirus infection; (3) informed consent and willingness to participate in this study; (4) qualified in verbal communication skills. Potential participants were contacted by email. Ethical approval was obtained from the Institutional Review Committee of Shanghai Tenth People's Hospital. The researchers explained the purpose and process of the study and ensured the confidentiality of the data. Personal interviews were scheduled with the consent of the participants. All the nurses participating in the study gave their written informed consent, and informed that they had the right to withdraw from the study at any time, without reason. To secure the participants' privacy and the confidentiality of their data, in place of their real names, code names were used throughout the text. Finally, 13 first-line emergency nurses with COVID-19 diagnosis were interviewed, all of whom volunteered to participate in the study and no one dropped out. General characteristics of participants are shown in Table 1.

Data collection

Semi-structured in-depth interviews were conducted in June 2022 through face-to-face communication. A semi-structured interview guide was created to guide actual interviewers in gathering data. Table 2 shows the interview questions included in the guide, which were constructed on the basis of previous research (25–27). The guide would start the interview with encouraging questions. Participants shared their traumatic experiences and coping process, and these were explored until full understanding of emerging themes was achieved (28). If necessary, the interviewer would ask follow-up questions that were more in-depth and specific. All researchers had past experience in qualitative interview. Before the study began, the participants had no relationship with the researchers, i.e., they did not know each other from before. In addition, prior to data collection, two emergency nurses were pre-interviewed to ensure the clarity and identification of any potential problems. The pre-interview was considered as a test and was not included in the analysis. Although there is no established principle regarding the sample size in qualitative studies, data collection is considered finished when satisfactory data are gathered, no new information emerges anymore and when the same data

TABLE 1 General characteristics of participants.

Characteristics	*N* (%) or mean (SD)
Sex	
Male	3 (23.08)
Female	10 (76.92)
Age	26.33 (3.75)
Length of employment	3.92 (4.06)
Education level	
Diploma	2 (15.39)
Baccalaureate degree	11 (84.61)
Marital status	
Married	2 (15.39)
Single	11 (84.61)
Place of birth	
Jiangsu province	2 (15.39)
Anhui province	4 (30.78)
Jilin province	1 (7.69)
Gansu province	1 (7.69)
Henan province	1 (7.69)
Hunan province	1 (7.69)
Sichuan province	1 (7.69)
Chongqing city	1 (7.69)
Shanghai city	1 (7.69)

TABLE 2 The interview guideline: open questions.

No.	Questions
1	What were your experiences and feelings after being infected with COVID-19?
2	How did you cope with the difficulties and stress during this period?
3	What positive changes have you made?
4	After this infection, what do you think is the biggest change in yourself?
5	What other insights do you have?

TABLE 3 Colaizzi's seven-step process for qualitative data analysis.

No.	Data analysis step
1	All interviews were recorded and transcribed. Each transcript is carefully read several times.
2	Re-read, highlight, and extract meaningful statements directly related to the perspectives and experiences of first-line emergency nurses in PTG.
3	Formulate meanings from all significant statements.
4	Identify and organize the formulated meanings into theme clusters.
5	Describe the investigated phenomenon of PTG in the first-line emergency nurses exhaustively.
6	Recognize similar subthemes, identify the basic structure, and get the main themes.
7	Return to the participants to confirm the findings. The authors discussed their disagreements until a consensus was reached.

start to appear (29). In following this norm, the sample size and domain size were estimated at the point of saturation (13 participants). With permission from all participants, interviews were recorded by the investigators. Each interview lasted 40–60 min and was conducted by two researchers and two research assistants. In addition to the interview, participants' responses were recorded, including non-verbal cues and body language during the interview. These were later transcribed verbatim and analyzed concurrently.

Data analysis

The audio recordings were transcribed verbatim and checked for accuracy by repeated listening within 24 h of the interviews. Data analysis was independently performed by two experienced researchers immediately after each interview. The Colaizzi's phenomenological seven-step method (30) was used for data analysis and to complete the extraction of themes and sub-themes. In this study, the seven-step process is illustrated in Table 3. If there were differences in opinion between researchers, they were discussed until a consensus was reached. The final transcribed data and extracted topics and subtopics were sent to the participants, all of whom agreed to be contacted again. Through feedback communication, it was ensured that the research results reflected the actual views of participants, and the results were not biased due to the subjective perception of the researchers.

Study rigor

To ensure the dependability of the study, the methods and the analyses used were described in detail. Credibility was ensured by a "blinded" approach to the materials by each researcher. Validity was ensured by continuous triangulation among researchers with regard to discordant texts. Peer information was used for verification. In addition, the data were re-evaluated by an expert in qualitative studies, who was not included in the study. Lastly, for transferability of the data, the sample and the data were described in detail.

Results

A total of 13 participants including 3 men and 10 women were included in the study. They were originally from nine different provinces or municipalities in China. Their average age was 26.33 years old and they had an average of 3.92 years of work

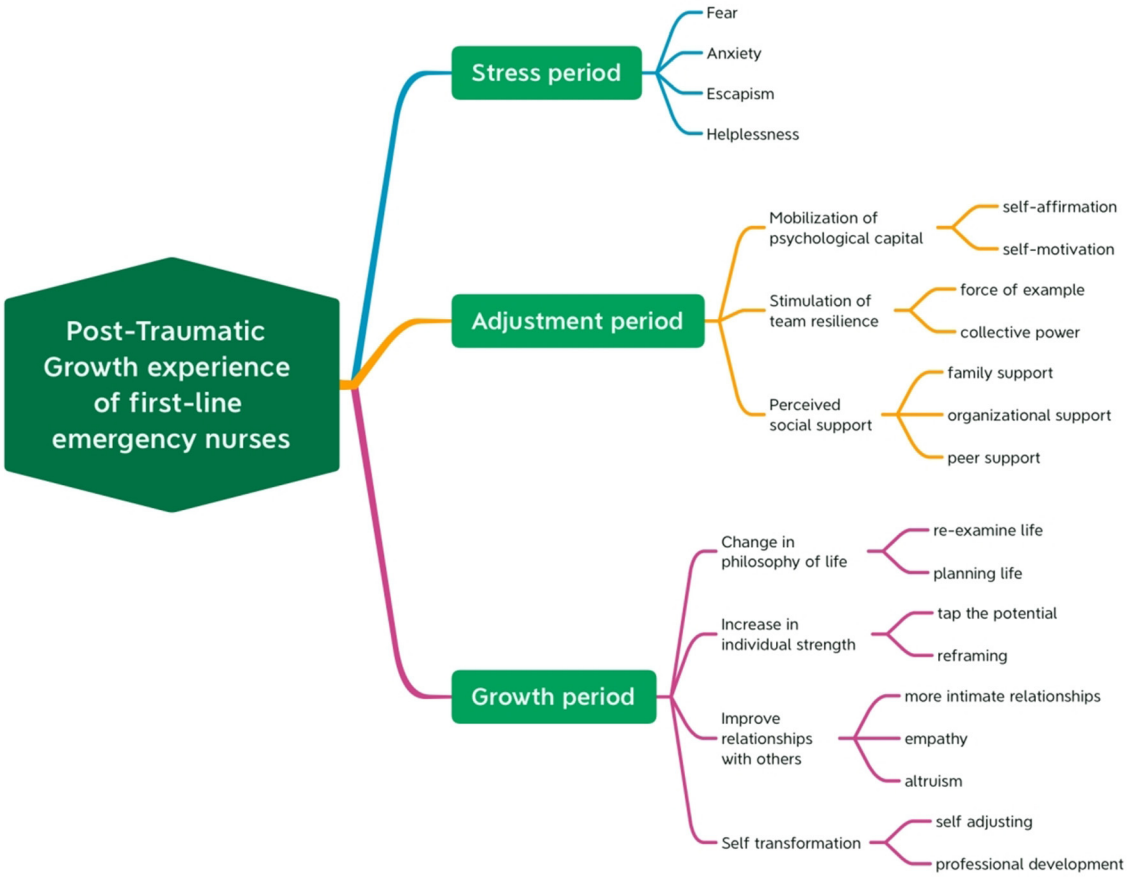

FIGURE 1
Themes and sub-themes categorized from data.

experience. Their education level ranged from diplomas ($n = 2$) to baccalaureate degrees ($n = 11$). Most of the participants were unmarried ($n = 11$). All of them were infected with COVID-19 ($n = 13$). By using Colaizzi's methodology, three main themes and several sub-themes were identified. Themes were described and extracted from the experiences and insights of emergency nurses infected with COVID-19 at different stages during the fight against the virus. Three main themes were: (1) stress period; (2) adjustment period; (3) growth period. Themes and sub-themes categorized from the data are presented in Figure 1.

Stress period

Fear

All participants expressed the fear of receiving a positive nucleic acid test notification. They expressed fear of COVID-19 symptoms, after effects, risk of transmission, and imminent isolation. "*I received a call from the hospital to inform me that I was infected. I suddenly felt overwhelmed, felt tightness in my chest and even felt that the air would be frozen...*" (Participant 6). "*I was sent to the makeshift hospital in the middle of the night. I cannot describe the kind of fear I experienced... (shake)*" (Participant 2). With the onset of COVID-19 symptoms, physical pain and the presence of the virus in the body were felt, causing nurses to experience unprecedented fear. "*Fever, cough, muscle aches, and lack of energy. I was worried about developing pneumonia, and I was even more afraid of going to the makeshift hospital, because there are so many infected patients*" (Participant 10). "*My first symptoms included fever, cough, pain in my eyes, a laceration of my throat, up to the manubrium sternum, and chest tightness. I was particularly worried that I would have after-effects from the novel Coronavirus infection. I am still so young. I don't want any health-related issues...*" (Participant 13).

Anxiety

While undergoing isolation and treatment, most participants were deeply worried and disturbed. One participant experienced these emotions as she was missing her family

members. "*My hometown in Anhui, my parents have been urging me to go back. My family took this matter very seriously, and I had to show them all my meals at the isolation area by WeChat so that they could rest assured. They were so nervous that I could hardly hold back my tears when I would see them (choking). Their sad appearance made me more anxious and I missed them deeply*" (Participant 4). As symptoms change, nucleic acid test results have become a great matter of concern among these nurses. If the situation did not improve, they would fall into deeper anxiety, some of them even unable to rest normally. "*I had a cough for a month, accompanied by a low fever, and was extremely agitated. Colleagues who got infected around the same time as I did have already returned to work, but I still have not recovered, and I was worried about whether I had pneumonia and whether it would develop into tuberculosis (frowns). I have fallen into excessive restlessness and have to use sleeping pills to fall asleep*" (Participant 11). "*Colleagues infected around the same time got negative nucleic acid test results, while I was still positive. I was every day in a state of fear waiting to check the nucleic acid report on the phone*" (Participant 7).

Escapism

Most participants adopted escapism behavior toward possibility of being infected with COVID-19, which was unacceptable to them, while some felt stigmatized. "*I didn't want anyone to know I was infected, including my family, as I did not want them worrying about me*" (Participant 1). Stigma was often associated with social stereotypes, prejudice and discrimination, all of which have a negative impact on patients' social recovery. One participant thought that COVID-19 patients were loathed by society (31). "*I don't want to be labeled as COVID-19 patient*" (Participant 8). They did not even want to recall the experience. "*It would be nice to have the ability to erase that experience the way you format a computer file*" (Participant 2).

Helplessness

Some participants expressed feelings of helplessness about what they were going through. "*One day, a neighbor in our community was infected, and an ambulance came to take her to the isolation area. Someone took a video of her being picked up and posted the video in a group chat with the caption "The sheep (refers to patients diagnosed with COVID-19) has finally been picked up!" I was very sad at that moment; worrying about what kind of ridicule would I have to face in the future?*" (Participant 9). One participant described the disappointment of living in makeshift hospital caused by a sudden change of circumstances and restricted freedom. "*In the makeshift hospital, although you were given three meals a day, I can only move in the makeshift hospital, I really did not know what to do, I feel like every day there was wasted (sigh)*" (Participant 3).

Adjustment period

Mobilization of psychological capital

Positive psychological capital is known to have an important role in improving employee's job performance (32). In the field of nursing, studies have shown that individuals with better psychological capital can face difficulties at work with confidence and optimism (33). Most nurses reported experiences of self-affirmation and self-motivation. "*I accepted the negative energy of the negative emotions and told myself that I can do it. Although some problems still exist, my soul is invigorated*" (Participant 5). "*Dr. Julie Noram, an American psychiatrist, once said, "There are people who tend to be pessimistic in their behavior, but still achieve remarkable results." I think I might be a defensive pessimist (chuckle)*" (Participant 1).

Stimulation of team resilience

Team resilience is an important protective factor of individual resilience reorganization (34). Participants described comfort and encouragement among individuals in the same organization that helped them grow. "*Our infected colleagues who went to the isolation area together set up a WeChat group. Every day, we tracked improvement of symptoms and nucleic acid status of members in the group and comforted each other*" (Participant 6). "*Several of our infected colleagues huddled together for warmth and felt less terrible*" (Participant 2).

Perceived social support

External support from social, colleagues, and families can effectively help nurses improve their ability to adapt to stress and psychological adjustment. The supportive relationship's encouragement and care can help individuals maintain good psychological states during trauma recovery (35). All respondents expressed warm social support, including family support, organizational support and peer support. "*My mom and dad talk to me on video every day about my condition. I felt I needed to get better soon*" (Participant 7). Good social relations and social resources help individuals to obtain external support in adversity and reduce stress response. The support of team leaders helps build confidence in individuals, and their support is of guiding value. "*I clearly remember that when I went to the isolation area, the head nurse prepared a lot of materials for me, such as disinfection supplies, protective supplies, food, daily necessities, and a brand new trolley box. She asked about my symptoms every day, which was very touching*" (Participant 4). Support and care from first-line team members are very motivating and heartfelt, which also reflects team cohesion. "*When I was released, two colleagues who were just off their night shift helped me carry things to the hotel. I really appreciated it, as it helped me to feel lonely wandering alone in Shanghai*" (Participant 3).

Growth period

Change in the philosophy of life

All participants mentioned a new understanding of life and the future after experiencing trauma. They would reexamine the meaning of life and re-plan their lives for the future. "*Nothing is better than a healthy life, and nothing is important as health*" (Participant 3). "*I will get better for myself and my family; I will spend more time with them, cherish every day, and enjoy the fun of life. After all, there are many meaningful things I still need to do*" (Participant 13).

Increase in individual strength

Resilience is the ability of individuals to make positive choices and rationally deal with stress. It is beneficial for lead individuals to reframe the non-adaptive state and activate their potential to defend against crisis so as to resolve difficulties (36). Most of the participants expressed their experience of exploring their strengths and reframing. "*Just like the principle of a pressure cooker, if I keep pressuring myself, I may lose control or my negativity may eventually erupt. Although it is hard, I believe I can deal with these problems better*" (Participant 1). "*I cannot turn back the time, and I still have a long way ahead of me. I will try to accept the reality, and continue on my way, as one can still grow in the face of adversities*" (Participant 9).

Improve relationships with others

All participants reported improved relationships with others, including closer relationships with family and friends. They are more empathetic and altruistic in PTG. "*When I saw my son at the gate of the community after I came back from isolation, I burst into tears and held him tightly in my arms*" (Participant 10). "*I felt closer to my best friend, who encouraged me to go share my feelings with him as we could go through them together*" (Participant 12). Traumatic experiences of nurses can potentially affect how they treat patients, and empathy can improve relationships with patients. "*When I had the opportunity to experience the same type of pain my patients' experience, I could really feel and understand them better*" (Participant 4). Volunteering to help others can make one feel good and enhance the sense of worth. This triggers the release of endorphins, which help to reduce anxiety and contribute to good health (37). "*I'm more willing to help patients at work. It's really hard to be sick. Being a patient is a painful role*" (Participant 1).

Self-transformation

After traumatic events, most people tend to adjust to adversity and gradually recover to a state of health. People have abilities for self-healing and resilience, which tend to vary from person to person (38). All the nurses who participated expressed the process of self-transformation. "*I adjusted my mind and rose above myself in adversity (smile)*" (Participant 11). In addition to the psychological, one participant described an experience in which he took positive action to improve himself. "*I signed up for an online training course for emergency specialist nurses of Shanghai Nursing Association to keep myself busy and continue to work on myself (laughing)*" (Participant 9).

Discussion

This study, carried out to reveal the process and influencing factors of post-traumatic growth among emergency nurses infected with COVID-19 was completed with 13 nurses. Emergency nurses experienced psychological changes before and after being infected with COVID-19, and these emotions were universal rather than special. Various internal and external factors continued to contribute to their recovery from traumatic events. Overall, participants described this process as a transition from negative to positive. The process and causes of PTG in this study agree with those presented in the literature (26, 39, 40).

Previous studies have focused on the psychological response of nurses to negative events, mostly in view of the anxiety, depression and other negative aspects (41, 42). In the research results, nurses experienced negative emotions as the main aspect. However, some recent studies suggested that PTG was common in nurses, so it was necessary to discuss the psychological process of nurses experiencing stress from the perspective of positive psychology. Most of the existing studies on PTG among nurses were completed by quantitative investigation, where traumatic events included war, earthquake disasters, secondary exposure to violence in hospital work, exposure to workplace violence, traumatic childbirth, caring for a terminally ill patient or experiencing the death of a patient (43–46), while qualitative research has a significant effect on the profound exploration of personal inner feelings, especially for such a serious stress event as COVID-19 infection. According to the results of this study, all first-line emergency nurses involved in the study experienced PTG after being infected with COVID-19. PTG did not immediately occur at first, but it resulted from effective adaptation and improvement. Individuals, groups and society came into play as different factors in this process.

The concept of post-traumatic growth, which was first proposed by Americans scholar Tedeschi and Calhoun (18), is interpreted by some researchers as finding benefits, psychological thriving, adversary growth, perceived benefits, stress-related growth, and similar. It refers to the positive change experienced by an individual after struggling with a challenging life crisis, which makes the individual grow and surpass the original level at least in one aspect (18). The initial research subjects used in the PTG studies were college students with traumatic experience, and later the research

focus shifted to acute traumatic events. Patients with chronic and severe diseases such as cancer, AIDS and leukemia have become the main research subjects in the past decade (47). Meanwhile, related studies have begun to focus on the PTG experience of caregivers of diseased patients (48). Studying the PTG of individuals in public health emergencies is an innovative approach. Different identities, traumatic events and cultures may lead to different fields and specific connotations of individuals' PTG. The nurses we interviewed here were not only caregivers of COVID-19 patients, but also infected patients, a very special group.

Previous studies have shown that PTG often coexists with significant psychological distress (43, 45). The results of this study showed that at the early stage of COVID-19 infection, emergency nurses were in a strongly negative psychological state, which researchers named "Stress period." Fear, helplessness, anxiety and escapism were the most common psychological manifestations of the stress period. Clinical nurses were the main force in disaster relief, facing many pressure sources. The unpredictability of the SARS-CoV-2 Omicron Subvariants, side effects and sequelae of infection, and the fear of receiving isolation treatment were all factors that usually cause great psychological stress in the infected person. Experienced nurses were more calm and less affected by stressful events, and traumatic experiences could have existed in their previous careers (49–51). Among the interviewees, many emergency nurses were young nurses without adequate disaster relief experience, which might imply that their psychological quality was relatively weak, and further influence their attitudes toward work and their perceptions of careers. In addition, infected nurses with high self-esteem did not want to be cared and treated by their families or society as COVID-19 patients (52). In traditional Chinese culture, some people interpret having an unfortunate illness as a form of stigma, so they prefer not to share their condition with anyone. Stigma is often associated with social stereotypes, prejudice and discrimination, which negatively impact patients' social recovery (31). When someone has a condition that might be interpreted as shameful and unpleasant, people tend to reject and "mark" them, thus increasing stigma. Accordingly, society as a whole should make more efforts to eliminate the public's discrimination and prejudice against COVID-19 patients.

After a period of strong stress, the infected emergency nurses gradually adapted to their status and the role of patients and entered the "adjustment period." Some positive factors helped them make a positive change, manifested as an improvement in resilience. Resilience implies the ability to bounce back or easily recover when confronted by adversity, trauma, misfortune, or change (53). The key point of resilience is adapting to various environments. Researchers defined resilience in nursing as a measure of a nurse's ability to cope with stressors and mental health threats, where resilient people are emotionally calmer while dealing with catastrophic situations (54). For nurses, resilience is one factor that helps reduce their stress levels and increase endurance. Nurses mobilize psychological capital through self-affirmation and self-motivation. Positive psychological strength and excellent psychological qualities improve adaptability (38). In addition, Chinese culture emphasizes the importance of tenacious character. People with tenacious character tend to have a strong will; they are fearless and able to bear hardships. These characteristics help individuals stick to endure and actively seek ways to overcome difficulties. Positive and effective coping strategies enable individuals to show higher self-efficacy when encountering setbacks or difficulties and mobilize available resources to solve problems, which is an important factor for realizing PTG (55). In the emergency medical teams, colleagues having to cope with the same types of accident encourage and support each other, thus forming a strong organizational cohesion, which is important for improving team resilience. High personal and team resilience are positive factors associated with improved career development. Social support refers to the social resources provided by formal or informal support groups that are perceived subjectively and/or received objectively by individuals (56). External support comes from society, organization, colleagues and family. In our study, nurses appreciated receiving material or spiritual support and help under adverse circumstances. Other studies have reported that for medical staff, social support has a direct positive predictive effect on PTG, and can also indirectly promote PTG through psychological resilience (57).

The "growth period" theme extracted from the interviews refers to a change in philosophy of life, increase in individual strength, improved relationships with others, and self-transformation, all of which reflect several aspects of post-traumatic growth of nurses after COVID-19 infection. According, Self-determination Theory (SDT), when certain needs are destroyed after a traumatic event, individuals still take action to restore themselves to a state of wellbeing (58). The traumatic event of being infected with COVID-19 leads individuals to reframe in a non-adaptive state, revealing their previously unexposed potential (59), such as dealing with problems, learning from the environment, and adjust mindset. Nurses get well and subsequently acquire a new concept of life, which is regarded as growth. They have more experience and a better mentality to review and face the traumatic events that may occur later on in their future life. Nurses diagnosed with COVID-19 received meticulous and professional care from their nursing colleagues as patients, which allowed them to gain a deeper understanding of the profession and recognize the significance of nursing work. They were also under greater expectations to attain professional advancement through efforts. The experience of being helped and cared for strengthened their bonds with family, friends and colleagues. Moreover, due to the role transformation, nurses infected with COVID-19 gained the ability to more deeply understand the helplessness of patients

and the importance of humanistic care. Their empathy and altruism were enhanced, thus guiding them to think and solve problems from the perspective of patients and providing warm, humanistic care for patients.

Traumatic events were detrimental to nurses' physical and mental health and professional development. Studies have shown that clinical nurses' turnover intention has a significant internal relationship with the traumatic events they have experienced (60). As it is not possible to avoid traumatic events, nursing managers should consider how to help nurses cope with traumatic events and achieve PTG, which is related to the construction of the nursing team and the quality of clinical nursing. Self-disclosure is the act of revealing private information to others (61). The PTG theory holds that self-disclosure can promote an individual's ability to achieve PTG (62). Therefore, after traumatic events, nursing managers should pay more attention to the psychological state of nurses in their daily work, actively communicate with them, and encourage them to express emotions. A positive, purposeful rumination should be cultivated. Deliberate rumination refers to the adaptive cognitive process of paying attention to the negative emotions or experiences caused by traumatic events, and actively, consciously, and purposefully explaining traumatic events, seeking meaning, and exploring inner feelings (63), which is beneficial for new nurses in improving their resilience and post-traumatic growth (64). Ongoing education and guidance may protect infected nurses from absorbing or internalizing unmanageable emotions which may lead to compassion fatigue and also help them to gain a deeper understanding of their communication and interactions with patients (17, 65). For example, mindfulness, workshops, situational simulation exercise, peer support and other methods can be used to train nurses to better deal with traumatic events (66). We further encourage medical institutions to set up support organizations, specifically for the mental health of medical staff, form the trauma informed culture as, which could greatly facilitate developing and implementing team PTG intervention strategies.

Limitations

This study did not consider certain factors that could affect an individual's ability of PTG, such as gender, religious beliefs and any previous personal experiences with traumatic events. Moreover, because this was a qualitative study, the results were not replicable, as the subjects, experiences and contexts were all unique. Lastly, the study was performed in a single clinical setting, which further hindered the generalization of the results. Replication of this study in different clinical settings, with larger samples, and with samples from different cultures could help to generate more diverse findings. If the study had included focus group interviews, this could provide more in-depth themes in nurses' experience.

Conclusion

First-line emergency nurses infected with COVID-19 are a special group that should be paid more attention to. Investigating how they achieve their psychological adjustment and growth in the case of severe trauma can provide valuable references for nursing management and future education. Different aspects of a traumatic event are associated with significant changes in the mind and behavior of affected individuals. Individuals, organizations, and societies contribute to their PTG. However, there are many aspects that can be improved to achieve PTG. As suggested in this study, society, hospital and nursing managers should pay more attention to the PTG of nurses and establish supportive PTG strategies to make up for the lack of individual coping ability, which will benefit the retention rate and career development of nurses.

Data availability statement

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

Author contributions

JJ and PH: conception, design, and revising the article critically for intellectual content. JJ, PH, XH, YL, and HS: acquisition of data. JJ, PH, LZ, and XD: analysis, interpretation of data, and drafting the article. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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Workplace factors can predict the stress levels of healthcare workers during the COVID-19 pandemic: First interim results of a multicenter follow-up study

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Background: Research is lacking on the long-term influence of workplace factors on the mental health of health care workers during the COVID-19 pandemic.

Methods: We distributed two online surveys to health care workers between May and October 2020 (T1) and between February and April 2021 (T2). Perceived stress, coronavirus-related risks, and workplace factors were measured *via* self-report questionnaires at both time points. We conducted hierarchical linear regression to investigate the predictive factors for high stress.

Results: A total of 2,110 participants from seven countries and 4,240 participants from nine countries were enrolled at T1 and T2, respectively. Among them, 612 participated in both surveys. We called this cohort T1 + T2. High stress was reported in 53.8 and 61.6% of participants at T1 and T2, respectively. In cohort T1 + T2, compared with the baseline, the level of stress rose significantly (6.0 ± 2.9 vs. 6.4 ± 3.1), as did health/safety in the workplace (3.9 ± 0.8 vs. 4.2 ± 0.7). Unfortunately, we did not detect any significant difference concerning support in the workplace. Among all factors at baseline, being older than 35 [β (95% CI) = −0.92 (−1.45, −0.40)], support [−0.80 (−1.29, −0.32)], and health/safety in the workplace [−0.33 (−0.65, −0.01)] were independent protective factors, while a positive history of mental disorders [0.81 (0.26, 1.37)] and rejection in private life [0.86 (0.48, 1.25)] were risk factors for high stress at T2.

Conclusion: To relieve the high stress of health care workers, organizational-level approaches should be implemented, especially measures designed to enhance support, health/safety in the workplace, and to reduce the rejection of the public.

KEYWORDS

health care workers, mental health, organizational factors, stress, workplace factors

Introduction

According to the World Health Organization (WHO), as of 30 November 2021, the coronavirus disease 2019 (COVID-19) pandemic has resulted in 261,435,768 confirmed cases globally, including 5,207,634 deaths. It has posed an unprecedented threat to the entire world (1).

Given the human-to-human transmission of the coronavirus, frontline health care workers (HCWs) have been at high risk of becoming infected through close contact with COVID-19 patients. In addition, when the number of patients exploded and medical resources were insufficient, HCWs were under tremendous stress, both physically and psychologically (2). The relative shortage of personal protective equipment (PPE) in the very early stages of the pandemic, overwork, frustration, discrimination, isolation, and worrying about family members made the challenge more difficult (3). Therefore, the mental health of HCWs has been negatively affected. A meta-analysis showed that the pooled prevalence rates of moderate to severe post-traumatic stress symptoms, anxiety, depression, and sleep disturbances among HCWs in China were as high as 27, 17, 15, and 15%, respectively during the COVID-19 pandemic. Among them, frontline HCWs, women, nurses, and those working in Wuhan, China reported more severe degrees of mental health symptoms (4). In addition, a high prevalence of professional burnout was detected (5–7).

To mitigate the mental health problems and stress of HCWs, multifaceted interventions have been proposed and adopted. On the individual level, psychological support has been provided through a variety of methods to help heavily burdened HCWs, including hotline services, psychological counseling, online platforms with psychological self-help information, and support groups (8, 9). At the organizational level, harmful workplace factors have been identified and improved to prevent the deterioration of the mental health and wellbeing of HCWs. Some work-related risk factors have been investigated and discussed more frequently, including high COVID-19 exposure and heavy workload (10). Therefore, adequate PPE, shorter work shifts, and convenient accommodations and diet have been recommended to buffer against the negative impact of stress (5, 11, 12). However, other workplace factors—such as support and cohesion in the workplace and rejection or discrimination toward HCWs due to the risk of contagion—have been far less discussed. Based on previous experiences, if handled improperly, these factors can lead to poor communication, impaired trust, and weakened teamwork. Hence, teams that were newly formed in the course of coronavirus-related restructuring or that have come into conflict situations due to stress overload should pay special attention to these factors. Moreover, most studies concerning COVID-19 have been cross-sectional, and the long-term effect of workplace factors remains unknown.

In sum, to provide evidence for governments and policy-makers, the association between workplace factors and the stress of HCWs during the COVID-19 pandemic needs to be investigated in a large-scale sample over the long term. Thus, as part of the Cope-Corona project, we aimed to evaluate the level of stress, coronavirus-related risks (the frequency of contact with COVID-19 patients and self-perceived risk), and workplace factors (support in the workplace, health/safety in the workplace, and rejection in private life due to work) of HCWs from multiple countries and how they have changed during the COVID-19 pandemic, as well as to identify predictive factors of a high level of stress.

Materials and methods

Study design

This study was part of the Cope-Corona project, which aims to investigate how medical staff have handled the coronavirus pandemic, and to examine their resources and coping strategies. In addition to the variables reported here, further scales measuring individual resources and psychological reactions to the pandemic will be reported and analyzed in subsequent papers.

The working group was founded based on the European Association for Psychosomatic Medicine (EAPM), along with Paracelsus Medical University, Nuremberg General Hospital, and Catholic University Eichstätt-Ingolstadt, led by C. Waller serving as the principal investigator. All members of EAPM were informed about the research initiative and asked to participate. The whole project was designed to be carried out at three points in time: T1 between June and October 2020, during the

first phase of the pandemic; T2 between February and April 2021, during a possible second peak; and T3 in Spring 2022. This process resulted in a group of partners situated in Ireland, Andorra, Spain, Germany, Italy, Romania, and Iran for T1. At T2, partners in Poland and China joined the working group.

We designed the study as an online survey using the Qualtrics survey tool (https://www.qualtrics.com). The survey was made available in German, English, Spanish, Catalan, Italian, Romanian, and Farsi. Additional versions in Polish and Chinese were available at T2. The Qualtrics tool reads the language settings from the user's browser and presents the adequate language accordingly.

The survey was fully anonymized. We did not gather any IP addresses or geographic data. Subjects were asked to give a self-generated identification code to match subjects at the different assessment points in time.

We obtained ethical approval from the Institutional Review Board of Paracelsus Medical University, General Hospital Nuremberg (No. IRB-2020-017) and from each study center. All participants received full disclosure and provided informed consent.

Participants

All adult (≥18 years old) employees of the hospitals and their subcontractors—including medical doctors, nurses, medical-technical personnel, psychologists, medical students, administrative workers, and researchers—were asked to participate in the survey. Otherwise, there were no exclusion criteria. To ensure the validity of the responses, the inclusion criterion was a response to at least 50% of the questions. This means that we excluded participants from the analysis who answered less than 50% of the questions. The 50% rule was agreed upon at the beginning of the survey by the members of the research group as a heuristic approach to exclude unfinished surveys. All questions were weighted the same. At both measurement time points, all employees were invited to participate in the survey, regardless of their previous participation.

Instruments

We measured the constructs in the questionnaire using established, validated psychometric scales or with *ad hoc* instruments where appropriate tools were not available. We analyzed all *ad hoc* scales using confirmatory factor analysis (CFA) and tests for internal consistency with satisfying results (for details, see Muller et al., under publication).

Perceived stress. We gauged perceived psychological stress using the Perceived Stress Scale (PSS-4) (13), a self-report tool to evaluate the degree to which individuals feel about controllability and confidence in handling stressful situations in the previous month. The PSS-4 consists of 4 items, with the answers being rated on a 5-point scale (0 = "never", 1 = "almost never", 2 = "sometimes", 3 = "fairly often", and 4 = "very often"). The psychometric properties of the PSS-4 are acceptable across cultures and countries (14, 15).

Contact with COVID-19 patients. Respondents were asked whether they dealt directly with coronavirus-infected patients or suspected cases in their work. Answers were scaled from 1 = "not at all", 2 = "rarely", 3 = "sometimes", and 4 = "very much".

Risk perception. At T1, personal risk concerning the coronavirus was measured with three items on 5-point scales, specifying the probability of becoming infected ("extremely improbable" to "extremely probable"), the danger of becoming infected themselves ("completely harmless" to "extremely dangerous"), and concern about infecting people in their personal lives ("very little" to "very much"). At T2, the question about the probability of becoming infected was rated on a 6-point scale, with an additional option of "I have been infected already".

Health/safety in the workplace. We measured health/safety in the workplace using two items: one was about the availability of PPE, and the second, more general item was "I am confident that I can stay healthy at work". Both were rated on 5-point scales (1 = "strongly agree", 2 = "agree", 3 = "undecided", 4 = "disagree", and 5 = "strongly disagree").

Support in the workplace. We gauged support in the workplace with five items using statements representing the quality of within-team collaboration, cross-team communication, trust in supervisors, recognition from supervisors, and information provided by the hospital. All items used 4-point scales ranging from 1 = "strongly disagree", 2 = "disagree", 3 = "agree", and 4 = "strongly agree".

Rejection in private life. We measured rejection in private life concerning one's job at the hospital using two items: one clarifying rejection or hostility experienced in private life, and the other involving support for one's job in private life. Both were measured on 4-point scales (1 = "strongly disagree", 2 = "disagree", 3 = "agree", and 4 = "strongly agree").

Demographic and occupational variables. We measured job experience in three categories (less than 3 years, 3 to 6 years, and more than 6 years). In addition we examined sex, age, job position at the hospital, and the previous history of mental illnesses.

Definition of a high level of stress

The stress level was reflected by the sum score of the PSS-4, which ranged from 0 to 16. Higher scores indicate higher levels of stress. However, in previous literature, no cut-off values were established for a high level of stress. In previous studies on the association between perceived stress and cardiovascular

disease (16) or peripheral artery disease (17), a score of 6 has been adopted based on its distribution within the populations studied. In our study, the 25th, 50th, and 75th percentiles of the PSS-4 scores in both the T1 and T2 samples were 4, 6, and 8, respectively. Hence, we employed a PSS-4 score of 6 to categorize participants with high levels of self-perceived stress.

Statistical methods

As reported in the instrument section, we provided an additional option of "I have been infected already" for the question on the probability of becoming infected at T2, which should have been coded as "6". As a result, 359 (8.5%) participants chose this option. However, at T1, the question was assessed using a 5-point scale ranging from "1" to "5". Hence, at T2, a sum score of this construct could lead to a higher estimation of the level of risk perception. To solve this problem, when establishing risk perception at T2, we recoded the option of "I have been infected already" as an invalid value, and excluded participants who chose this option from the analysis. The missing values of other variables were less than 1% and replaced by the linear interpolation method.

For continuous variables, we used an independent samples *t*-test to determine the difference between participants who did and did not have high levels of stress, and the paired samples *t*-test to compare measurements at the two time points. To estimate the effect size, we computed Cohen's d accordingly. The $\chi 2$ test was used for categorical variables, and the Bonferroni method was adopted for multiple comparisons. A p value of less than 0.05 (two-tailed) was considered significant. We performed hierarchical linear regression analysis to investigate the predictive factors of high stress levels. We entered coronavirus-related risks (both the frequency of contact with COVID-19 patients and self-perceived risk), workplace factors (support in the workplace, health/safety in the workplace, and rejection in private life due to work), and demographic variables that showed a univariate relationship with high levels of stress into the model. We adopted the stepwise method, with a p value of less than 0.05 to enter and less than 0.10 required to stay in the model. Statistical analyses were performed with IBM SPSS Statistics, version 24.0.

Results

Demographic and occupational characteristics

As presented in Figure 1, 2,110 and 4,240 participants were enrolled at T1 and T2, respectively. Of these HCWs, 612 participated in the cohort T1+T2.

The detailed demographic and occupational characteristics are shown in Table 1. At both T1 and T2, the percentages of female and middle-aged HCWs, nurses and doctors, and HCWs with more than 6 years of experience were higher. At T1, most HCWs were from Nuremberg, Germany (63.4%), while at T2, most of them were from three centers in Spain (31.3%) and Nuremberg (27.0%), Germany and two centers in China (12.9%) and Wroclaw in Poland (12.9%), respectively. Besides, 14.6 and 15.5% health professionals reported a positive history of mental disorders in T1 and T2, respectively.

With a score of 6 or higher in PSS-4 indicating a high level of stress, we categorized the HCWs into two subgroups. A high stress level was reported in 53.8% (1,136/2,110) and 61.6% (2,610/4,240) of the HCWs at T1 and T2, respectively.

Compared with their non-highly stressed counterparts, highly stressed HCWs had higher rates of positive history of mental disorders, were younger, and had less job experience; more were female but fewer were doctors. In addition, the shares of highly stressed HCWs differed significantly among different centers, as did the change in proportions in the two surveys. For example, at T1, the proportions of HCWs with high stress were significantly higher in Chieti, Italy (69.1%) and Tehran, Iran (67.6%) than in Barcelona and Dexeus, Spain (36.2%) and Andorra (48.4%). At T2, the shares of heavily stressed HCWs increased the most in Spain and Nuremberg, Germany, and the percentages rose to as high as 76.7% in Chieti, Italy. A large number of HCWs from new centers in T2, i.e., Poland and China, were also under high stress.

Stress, coronavirus-related risks, and workplace factors

At T1, 36.6% of HCWs reported having much or quite a lot of contact with patients with confirmed or suspected COVID-19. At T2, this amount increased to 47.1%. In addition, 359 (8.5%) HCWs reported that they had already been infected with COVID-19.

As presented in Table 2, compared with not-highly stressed participants, those with high stress perceived significantly higher risks associated with the coronavirus at both time points. However, at T1, we did not find any difference between them regarding the frequency of contact with patients with COVID-19, and we noted only a marginal difference at T2. Concerning workplace factors, HCWs with a high level of stress experienced significantly lower support, less health/safety in the workplace, as well as significantly higher rejection in private life due to work at both T1 and T2.

The distribution of the sum scores of PSS-4 was normal at both surveys. Thus, we performed hierarchical linear regression analysis to explore the independent predictive factors of the sum scores. We selected potential related factors based on the results of univariate analysis. As shown in Table 3, in the first step, we utilized potential demographic and personal characteristics (gender, age, job position, job experience, and history of mental illnesses). Only being older than 35 was an

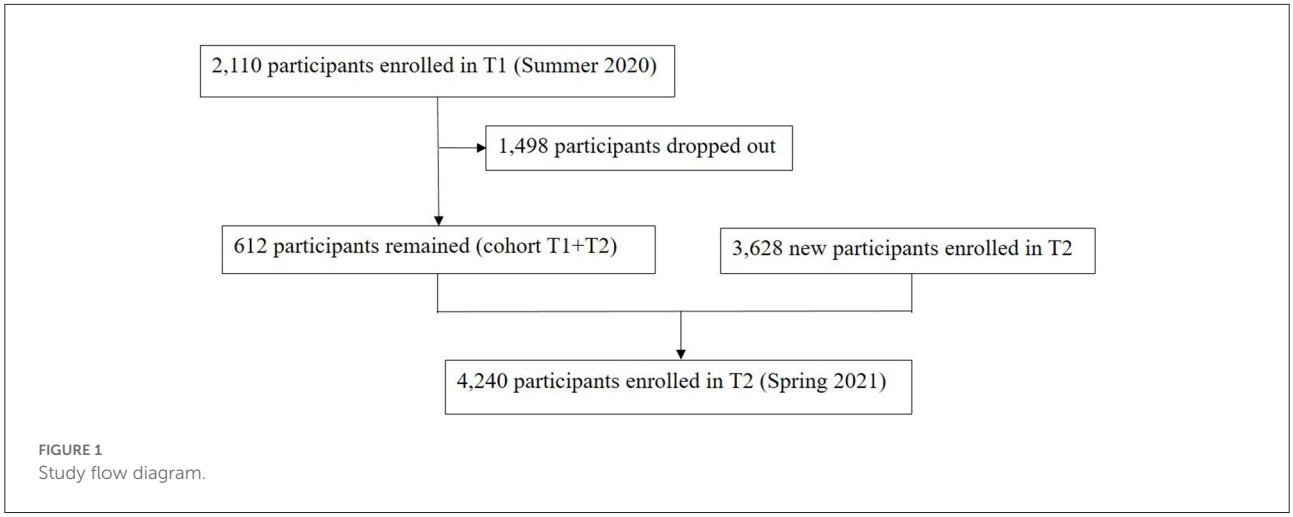

FIGURE 1
Study flow diagram.

independent protective factor, while being female, and with a positive history of mental disorders were the risk factors for high stress at T1. In the second step, we included risk perception and workplace factors, and all of them remained in the model. Finally, we entered and tested all significant independent predictors from the above steps. As a result, at T1, being older, health/safety in the workplace, and support in the workplace were independent protective factors against high levels of stress, while being female, with a positive history of mental disorders, perceived high risk involved in work, and high rejection due to work were risk factors. The fitting of this model was significant, with 20.9% of the total variance explained. Factors remaining in the hierarchical linear model were the same at T2, with the regression coefficients differing slightly.

In T2, 12.9% (548/4,240) participants were from Chinese centers. To further clarify the potential influence of different health care systems and cultural backgrounds on workplace factors, comparisons between HCWs from Western and Chinese centers were carried out concerning the stress, coronavirus-related risks and workplace factors. According to the results (see Supplementary Table 1), even though the perceived stress level was similar between Chinese and Western subjects, the percentage of Chinese HCWs who had frequent contact with patients with COVID-19 was significantly lower. In consistent with this, their risk perception was significantly lower, and the perceived health and safety in the workplace was significantly higher. However, Chinese HCWs reported a significantly lower level of support in the workplace and a higher level of rejection in private life. In a next step, the associated factors of high stress level in T2 were explored within the Chinese subsample. According to the results, only health/safety in the workplace, and rejection in private life due to work could predict a high stress level.

Changes in stress and predictive factors

A total of 612 out of 2,110 (29.0%) HCWs in T1 completed T2; they constituted cohort T1 + T2. Among all participants at T1, the level of perceived stress (6.0 ± 2.9 vs. 6.0 ± 3.0) did not differ between those in cohort T1+T2 and those not in cohort T1 + T2.

In cohort T1 + T2, compared with the baseline at T1, both the stress level and frequency of contact with COVID-19 patients rose significantly after more than half a year at T2 (see Table 4). Fortunately, health/safety in the workplace increased as well, with a moderate effect size. However, we did not observe a significant difference concerning perceived support in the workplace and rejection in private life due to working in hospitals.

In cohort T1 + T2, correlation analysis showed that among all demographic, occupational, and work-related factors at baseline, a positive history of mental disorders ($r = 0.127$, $p < 0.001$), age ($r = -0.161$, $p < 0.001$), job experience ($r = -0.127$, $p = 0.001$), risk perception ($r = 0.114$, $p = 0.003$), support in the workplace ($r = -0.206$, $p < 0.001$), health/safety in the workplace ($r = -0.192$, $p < 0.001$), and rejection in private life ($r = 0.219$, $p < 0.001$) were significantly correlated with a high level of perceived stress at T2. Entered into the multivariate linear regression model, similar to the above model at T1 and T2, age (>35 years old) [β (95% CI) = −0.95 (−1.45, −0.41)], support in the workplace [−0.92 (−1.42, −0.43)], and health/safety in the workplace [−0.46 (−0.79, −0.14)] at baseline were protective factors, while a positive history of mental disorders [0.81 (0.26, 1.37)], and rejection in private life at baseline [0.43 (0.11, 0.72)] were risk factors for a high stress level at T2. The model was significant, with 11.3% of the total variance explained.

TABLE 1 Demographic and occupational characteristics of HCWs at T1 (n = 2,110) and T2 (n = 4,240).

Variables	Percentages in T1*					Percentages in T2*				
	Total (n = 2110)	Highly stressed (n = 1136)	Not-highly stressed (n = 974)	χ^2	p	Total (n = 4240)	Highly stressed (n = 2610)	Not-highly stressed (n = 1630)	χ^2	p
Female	73.5;	77.2;	69.1;	17.7	**<0.001**	77.8;	80.0;	74.3;	18.9	**<0.001**
	100	56.6	43.4			100	63.4	36.6		
Age groups				22.7	**<0.001**				53.3	**<0.001**
<26 years old	12.3;	15.0;	9.2;			13.0;	15.0;	9.8;		
	100	65.4[1]	34.6			100	71.1[1]	28.9		
26–35 years old	22.5;	23.9;	20.8;			27.9;	29.8;	24.9;		
	100	57.3[1,2]	42.7			100	65.7[1, 2]	34.3		
36–45 years old	21.9;	20.8;	23.2;			21.7;	21.2;	22.5;		
	100	51.1[2]	48.9			100	60.2[2,3]	39.8		
46–55 years old	26.0;	24.5;	27.8;			22.7;	21.0;	25.5;		
	100	50.6[2]	49.4			100	56.8[3]	43.2		
>56 years old	17.3;	15.8;	18.9;			14.6;	13.0;	17.3;		
	100	49.5[2]	50.5			100	54.5[3]	45.5		
Position				17.4	**0.002**				11.6	**0.021**
Doctor	19.4;	16.3;	23.0;			19.3;	18.1;	21.2;		
	100	45.2[2]	54.8			100	57.8[2]	42.2		
Nurse	31.9;	33.5;	30.1;			37.9;	39.7;	35.0;		
	100	56.5[1]	43.5			100	64.4[1]	35.6		
Technician	10.6;	11.6;	9.4;			9.1;	9.2;	9.1;		
	100	58.9[1]	41.1			100	61.8[1,2]	38.2		
Administration	18.5;	19.3;	17.5;			15.8;	15.6;	16.1;		
	100	56.2[1]	43.8			100	60.9[1,2]	39.1		
Others	19.6;	19.3;	19.9;			17.9;	17.4;	18.6;		
	100	53.0[1,2]	47.0			100	60.0[1,2]	40.0		
Job experience				20.1	**<0.001**				24.1	**<0.001**
<3 years	17.4;	20.3;	14.1;			18.2;	19.8;	15.5;		
	100	62.8[1]	37.2			100	67.3[1]	32.7		
3–6 years	11.4;	12.5;	10.1;			14.8;	15.9;	13.1;		
	100	59.2[1]	40.8			100	66.1[1]	33.9		
>6 years	71.2;	67.2;	75.9;			67.0;	64.2;	71.5;		
	100	50. 8[2]	49.2			100	59.0[2]	41.0		
Center				45.4	**<0.001**				137.7	**<0.001**
Andorra	11.7;	10.6;	12.9;			7.5;	4.9;	11.7;		
	100	48.8[3,4]	51.2			100	39.9[3]	60.1		
Barcelona/Dexeus/Val d'Hebron (only	5.5;	3.7;	7.6;			31.3;	28.0;	36.6;		
T2)	100	36.2[4]	63.8			100	55.1[2]	44.9		
Chieti	6.4;	8.3;	4.3;			2.1;	2.6;	1.3;		
	100	69.1[1]	30.9			100	76.7[1]	23.3		
Cluj	2.5;	2.4;	2.7;			0.6;	0.6;	0.6;		
	100	50.9[1,2,3,4]	49.1			100	60.0[1,2,3]	40.0		
Ireland	5.3;	6.4;	3.9;			3.3;	3.4;	3.1;		
	100	65.8[1,2,3]	34.2			100	63.8[1,2]	36.2		
Nuremberg	63.4;	62.1;	64.9;			27.0;	28.7;	24.3;		
	100	52.7[2,3]	47.3			100	65.4[1]	34.6		

(Continued)

TABLE 1 (Continued)

Variables	Percentages in T1*					Percentages in T2*				
	Total ($n = 2110$)	Highly stressed ($n = 1136$)	Not-highly stressed ($n = 974$)	χ^2	p	Total ($n = 4240$)	Highly stressed ($n = 2610$)	Not-highly stressed ($n = 1630$)	χ^2	p
Tehran	5.3;	6.6;	3.7;			2.9;	3.1;	2.6;		
	100	$67.6^{1,2}$	32.4			100	$65.3^{1,2}$	34.7		
Wroclaw (only T2)	-					12.3;	14.5;	8.8;		
						100	72.4^{1}	27.6		
Beijing/Mianyang (both only T2)	-					12.9;	14.2;	10.9;		
						100	67.5^{1}	32.5		
Positive history of mental illnesses	17.4;	19.8;	14.6;	9.2	**0.002**	19.2;	21.5;	15.5;	23.1	**<0.001**
	100	61.0	39.0			100	68.9	31.1		

*To make the comparisons between two subgroups clear, the column percentages are presented in the first line, and then row percentages are presented in the second line. The Bonferroni method was adopted for multiple comparisons: Values with [1] were significantly higher than values with [2,3] and [4], and only values with different superscripts were significantly different from each other. *P* values in bold type indicate significant differences.

Discussion

As the first interim result of the Cope-Corona project, a high level of stress was reported in more than half of the HCWs; this proportion continued to rise in the follow-up study. With longitudinal data, we expanded upon past research by demonstrating that workplace factors (support in the workplace, health/safety in the workplace, and rejection in private life due to work)—instead of coronavirus-related risks—can predict not only the present stress level, but also the stress level after more than half a year during the COVID-19 pandemic.

Similar to our results, previous evidence worldwide has shown that mental problems became pronounced in HCWs during the COVID-19 pandemic, as well as in other viral epidemics. According to a systematic review on the psychological impact of HCWs during large-scale viral outbreaks, the pooled prevalence for acute stress disorder was 40%, followed by anxiety (30%), burnout (28%), depression (24%), and post-traumatic stress disorder (PTSD) (13%) (18). In addition, younger age, being female, and lower levels of specialized training and job experience were associated with those problems. A survey in England included 106 HCWs and found that the median stress (PSS-4) score of the overall cohort was 7 (19). In this survey, the stress level was significantly higher in respondents with pre-existing depression and anxiety. Similarly, a higher level of stress was observed in younger, female HCWs, and HCWs with a previous history of mental disorders, and less job experience and from several study centers in this study. Being younger than 35 years old was also the independent risk factor for a high stress level according to the longitudinal data. The possible explanation could be that younger medical staff were generally less experienced, and were more likely to be sent as the front-line workers. In addition, older medical staff probably have already experienced other viral epidemics occurred in the past 20 years, such as the severe acute respiratory syndrome (SARS) in 2003, the A/H1N1 influenza pandemic in 2009, Middle East respiratory syndrome (MERS) in 2012, and Ebola virus disease in 2014, and thus were better prepared for the outbreak.

However, unlike other studies, the COVID-19-related risks did not seem to play an important role in the elevated stress level in our study. According to our results, the stress level was not associated with the frequency of contact with COVID-19 patients. Even though perceived risk involved in work was associated with a high level of stress, it could not predict the stress level after more than half a year. According to studies about the mental health of HCWs in previous viral epidemic outbreaks, feeling unsafe and a lack of specialized training were adverse factors psychological wellbeing (18). Therefore, a possible explanation for such a phenomenon is that during late phase of the COVID-19, basic organization-wide approaches were already provided by most hospitals, like sufficient protective measures and specialized skills training, and have helped to mitigate the harm of coronavirus-related risks.

Besides, baseline support and health/safety in the workplace have been proved to be protective factors against high stress, while rejection in private life at baseline was a risk factor for a high stress level in our study. In line with our findings, a cross-sectional study in the US indicated that organizational risk factors for adverse psychological effects in HCWs were limited PPE and negative feelings toward one's workplace, e.g., not believing in the values and actions of one's organization and feeling unable to refuse specific organizational demands (20). Another cross-sectional study with 2,527 responses from 41 countries demonstrated that depressive symptoms have been associated with perceived poor workplace support during the

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TABLE 2 Stress, coronavirus-related risks, and workplace factors of HCWs at T1 ($n = 2,110$) and T2 ($n = 4,240$).

Variables	T1						T2					
	Total ($n = 2,110$)	Highly stressed ($n = 1,136$)	Not-highly stressed ($n = 974$)	χ2/ t	*p*	Cohen"s d	Total ($n = 4,240$)	Highly stressed ($n = 2,610$)	Not-highly stressed ($n = 1,630$)	χ2/ t	*p*	Cohen's d
Perceived stress	6.0 ± 3.0	8.3 ± 2.1	3.5 ± 1.4	−62.7	<0.001	2.69	6.4 ± 3.0	8.3 ± 2.0	3.2 ± 1.5	−91.6	<0.001	2.88
Corona contact (%)				1.4	0.245	-				3.9	0.049	-
Hardly any	63.4	62.2	64.7				52.9	51.72	54.8			
Much	36.6	37.8	35.3				47.1	48.31	45.2			
Risk perception*	3.2 ± 0.7	3.4 ± 0.8	3.1 ± 0.7	−8.9	<0.001	0.40	3.4 ± 0.8	3.4 ± 0.8	3.2 ± 0.8	−7.0	<0.001	0.25
Support in the workplace	2.8 ± 0.6	2.7 ± 0.6	3.0 ± 0.5	11.4	<0.001	0.54	2.7 ± 0.7	2.6 ± 0.6	2.9 ± 0.7	14.9	<0.001	0.46
Health and safety in the workplace	3.8 ± 0.9	3.6 ± 0.9	4.0 ± 0.8	10.2	<0.001	0.47	3.9 ± 0.8	3.7 ± 0.8	4.1 ± 0.8	10.2	<0.001	0.50
Rejection in private life	1.8 ± 0.6	2.0 ± 0.7	1.7 ± 0.6	−9.8	<0.001	0.46	1.9 ± 0.6	2.0 ± 0.6	1.7 ± 0.6	−15.8	<0.001	0.50

*At T2, a total of 3,745 participants were included in the analysis of this variable, since 359 participants selected the option of "being infected already" and were counted as invalid values; another 136 were missing values. The numbers of participants in the two subgroups were 2,307 and 1,438, respectively.

COVID-19 pandemic (21). In addition, 3 months after COVID-19 was declared a pandemic, a large sample study in Singapore showed that the burnout threshold was met by more than three quarters of respondents, and that psychological pathology was associated with a lack of safe work environments (5). Therefore, coordinated actions between workers, health teams and health institutions were recommended to be included as part of a comprehensive community care to protect the mental health emergency generated by COVID-19 (22).

Before the COVID-19 pandemic, previous researches have already showed that adverse workplace factors were associated with the likelihood of developing mental health problems among HCWs. For example, based on a structured interview, workplace conflicts that have a negative influence on the mental health of health professionals were classified under three key themes: individual, interpersonal, and organizational factors (23). According to this framework, the sources of organizational conflict predominantly include ambiguity in professional roles or workflows and poor work environments. Organizational-level approaches like regularly reviewing workplace policies and protocols on how to support employees after an occupational traumatic event, ensuring that practice is consistent with established best practice, and offering task-focused skills training have been recommended to protect the mental wellbeing of individuals at high-risk occupations (24).

However, to date, most interventions implemented to relieve the mental health problems of HCWs during the COVID-19 pandemic focused mainly on individual symptoms, but rather the organizational or interpersonal levels (25). For example, the most common intervention was providing individual mental health services, such as psychological counseling (8). Notwithstanding, these interventions might hinder efforts to explore the impact of organizational or systemic factors on adverse mental health outcomes (25). In addition, interventions at the individual level often met with the problem of low acceptance or low interest, as Chen et al. (26) pointed out. In this study, even though medical staff showed signs of psychological distress, they denied having problems and refused psychological help. Workplace-based interventions, such as providing more places to rest and guaranteeing food and daily living supplies, were welcomed (26). In another study in China, a series of workplace-based interventions were provided, including a mandatory 2-week quarantine in the hospital after work shifts in the fever clinic to avoid infecting family members; reasonable adjustments of working hours; the provision of convenient accommodations, diet, and adequate PPE; the help of a labor union; and help for family members when needed (27). Organizational interventions also include clear communication with staff (28) and the implementation of training programmes (29). To solve the problem of workplace violence against health professionals during the coronavirus pandemic, researchers have also recommended hospitals and governments to help to promote the transference of information to patients, to

TABLE 3 Predictive variables of the sum scores of PSS-4 in the hierarchical linear regression model at T1 (n = 2,110) and T2 (n = 3,745).

	T1					T2				
Positive variables selected	**Unstandardized β (95% CI)**	**Standardized β**	***p***	**F (d.f.)**	**R–square**	**Unstandardized β (95% CI)**	**Standardized β**	***p***	**F (d.f.)**	**R–square**
First step				21.7 (3)	0.031				59.2 (3)	0.040
Positive history of mental illnesses	0.91 (0.57, 1.25)	0.12	<0.001			0.86 (0.64, 1.09)	0.11	<0.001		
Age	−0.66 (−0.93, −0.39)	−0.11	<0.001			−0.37 (−0.44, −0.30)	−0.15	<0.001		
Gender	0.57 (0.28, 0.86)	0.09	<0.001			0.44 (0.22, 0.65)	0.06	<0.001		
Second step				125.6 (4)	0.193				142.1 (4)	0.133
Risk perception	0.14 (0.10, 0.18)	0.14	<0.001			0.31 (0.19, 0.44)	0.08	<0.001		
Support in the workplace	−0.30 (−0.36, −0.24)	−0.23	<0.001			−0.52 (−0.67, −0.37)	−0.12	<0.001		
Health/ safety in the workplace	−0.09 (−0.13, −0.05)	−0.10	<0.001			−0.61 (−0.73, −0.48)	−0.16	<0.001		
Rejection in private life	0.23 (0.18, 0.28)	0.19	<0.001			0.97 (0.82, 1.12)	0.21	<0.001		
Third step				75.7 (7)	0.209				98.7 (7)	0.156
Positive history of mental illnesses	0.77 (0.47, 1.08)	0.10	<0.001			0.75 (0.52, 0.97)	0.10	<0.001		
Age	−0.32 (−0.56, −0.07)	−0.05	0.009			−0.26 (−0.33, −0.19)	−0.11	<0.001		
Gender	0.59 (0.33, 0.85)	0.09	<0.001			0.33 (0.12, 0.55)	0.05	0.002		
Risk perception	0.59 (0.42, 0.76)	0.14	<0.001			0.31 (0.19, 0.44)	0.08	<0.001		
Support in the workplace	−1.20 (−1.43, −0.97)	−0.23	<0.001			−0.49 (−0.64, −0.35)	−0.10	<0.001		
Health/ safety in the workplace	−0.29 (−0.46, −0.13)	−0.09	<0.001			−0.57 (−0.69, −0.44)	−0.15	<0.001		
Rejection in private life	0.84 (0.65, 1.03)	0.18	<0.001			0.92 (0.77, 1.07)	0.20	<0.001		

β, partial regression coefficient. Definition of variables: age group: 1 = equal to or younger than 35, 2 = older than 35; gender: 1 = female, 2 = male.

implement appropriate sanctions on the convicts, to promote interpersonal support in professional groups, and to raise public awareness (30). Unfortunately, as our results show, even after more than half a year during the pandemic, support in the workplace did not increase and remained at a low level.

Moreover, the last factor that needs to be discussed is the stigmatization of people working in high-risk environments. Consistent with our findings, a recent study in an Italian hospital showed that stigma was positively correlated with an increased risk of burnout and fatigue in HCWs (31). However, regretfully, we also found that discrimination against HCWs did not decline during the previous year. Hence, efforts to decrease the discrimination and rejection of the public toward not only HCWs, but also patients with a history of COVID-19, should not be neglected.

In addition, given consideration to the potential influence of different health care systems and cultural backgrounds of Western and Chinese centers, further comparisons were

TABLE 4 Change in stress, coronavirus-related risks, and workplace factors of HCWs in cohort T1+T2 ($n = 612$).

	Baseline (T1)	T2	t/χ2	*p*	Cohen's d
Perceived stress	6.0 ± 2.9	6.4 ± 3.1	−4.1	<0.001	0.13
Corona contact (%)			260.0	<0.001	-
Hardly any	69.3	63.8			
Much	30.7	36.2			
Risk perception*	3.2 ± 0.7	3.2 ± 0.7	−2.0	0.051	0.13
Health/safety in the workplace	3.9 ± 0.8	4.2 ± 0.7	−9.0	<0.001	0.40
Support in the workplace	2.9 ± 0.5	2.8 ± 0.6	1.8	0.069	0.18
Rejection in private life	1.8 ± 0.6	1.8 ± 0.6	0.7	0.478	0.03

*A total of 574 participants were included in the analysis of this variable, since 38 (6.2%) participants selected the option of "being infected already" and were counted as invalid values.

compared between them. Results indicated that Chinese HCWs had less contact with COVID-19 patients, a lower level of corona-related risk perception, and a higher level of health and safety in the workplace. Such a low level of risk was consistent with the low infection rate of COVID-19 in China due to the strict prevention and control measures adopted by the government. However, the stress level between Chinese and Western medical staff was comparable, and Chinese HCWs reported a significantly lower level of support in the workplace and a higher level of rejection in private life. Those negative workplace factors could explain the high stress in Chinese medical staff. Therefore, the results further highlighted the importance of approaches designed to improve workplace factors in improving the wellbeings of healthcare workers during the pandemic, despite their different cultural backgrounds, medical systems and epidemic-related policies. However, results from Chinese centers should be interpreted with caution due to the small sample size.

This study has several limitations. First, even though we recruited HCWs from multiple centers in Europe and China, most of our data was based on European centers and the representativeness of this sample was limited. As such, the results should be interpreted with caution concerning HCWs from different countries. In particular, different health care systems and cultural backgrounds could have an influence on the severity of mental stress and the influence of workplace factors. Second, only a small proportion of HCWs participated at both T1 and T2, which led to a lower generalizability of the results from the longitudinal data. Nevertheless, such a proportion has been common for similar online surveys during the pandemic. We did not observe any significant difference between people who participated in T2 (or not) concerning the level of perceived stress. In addition, we verified the multiple linear regression model using both cross-sectional and longitudinal data. Third, we noted different stress levels among different centers. This might be the outcome of the complex interaction of multiple factors, such as the incidence of COVID-19, the availability of medical and personnel resources, and a previous history of mental health problems of HCWs. We tried to explore its influence by comparing subjects from Western and Chinese centers, but more detailed comparison and discussion will be needed in the future research. Lastly, the categories of age and job experience were determined based on a heuristic approach at the beginning of the survey by the members of the research group. A more thorough assessment would be to use validated work experience scales.

In sum, using longitudinal data of HCWs from multiple centers, during the COVID-19 pandemic, the level of perceived stress has been high among HCWs, and kept increasing after more than half a year. In addition, age, a positive history of mental disorders, and workplace factors (support in the workplace, health/safety in the workplace, and rejection in private life due to work)—instead of coronavirus-related risks—can predict not only the present stress level, but also stress level over the long term. Hence, our results highlight the importance of interventions and policies at the organizational level in promoting the mental health of HCWs. Specific measures should be designed to improve support, health/safety in the workplace, as well as to reduce the rejection of the public.

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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 Review Board of Paracelsus Medical University, General Hospital Nuremberg. The patients/participants provided their written informed consent to participate in this study.

Author contributions

N-nX and T-tF contributed equally to the drafting of the manuscript, primary statistical analysis, and data interpretation. T-tF contributed to the conception of this manuscript and was responsible for it. RL contributed to the statistical analysis and data interpretation. MH, QL, and LL were responsible for different research centers in China and for the review and editing of this manuscript. KF, BS, CW, MM, and members in the Cope-Corona working group contributed to the design of this study, the coordination of the work of multiple study centers, and for the review and editing of this manuscript. All authors read and approved the final manuscript.

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Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1002927/full#supplementary-material

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The impact of caring for COVID-19 patients on nurse professional identity: A cross-sectional study using propensity score analysis

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Objective: To examine the impact of caring for COVID-19 patients on the professional identity of nurses.

Methods: An online survey was conducted between 19 May and 7 August 2020 in 11 Chinese cities, including Dongguan, Foshan, Guangzhou, Hong Kong, Huizhou, Jiangmen, Macao, Shenzhen, Zhaoqing, Zhongshan, and Zhuhai. Propensity score matching was used to adjust for confounding variables between nurses with and without experience caring for COVID-19 patients. To analyze the impact of caring for COVID-19 patients on nurses' professional identity, a nominal logistic regression model was used rather than an ordinal regression model because the parallel regression assumption was violated.

Results: After propensity score matching, the final sample contained 1,268 participants, including 634 nurses who cared for COVID-19 patients. During the COVID-19 outbreak, 88.6% of nurses had high levels of professional identity. Nurses who cared for COVID-19 patients had the lowest percentage of high score level on the professional identity subscale for "sense of organizational influence," as did nurses who did not care for COVID-19 patients. The findings indicated that nurses who cared for COVID-19 patients were 17.95 times more likely to have a high professional identity than a low professional identity (95% CI 2.38–135.39, $p = 0.005$), after completely controlling for the other factors. There were significant differences between nurses who cared for COVID-19 patients and those who did not in scores on the subscales of professional identity, except for the subscales "sense of self-decision-making" ($\chi^2 = 4.85$, $p = 0.089$) and "sense of organizational influence" ($\chi^2 = 4.71$, $p = 0.095$).

Conclusion: Nurses' professional identity is positively impacted by their experience caring for COVID-19 patients. Caring for COVID-19 patients

should be highlighted as an opportunity to enhance nurses' professional identity. To further enhance the professional identity of nurses, we call for visible nursing leadership during the COVID-19 pandemic and improve their working environment.

KEYWORDS

nurse, professional identity, propensity score matching, COVID-19 patient, COVID-19 pandemic

Introduction

Coronavirus disease 2019 (COVID-19) puts additional stress on nurses as they deal with a variety of stressors in their daily work. A meta-analysis showed that the prevalence of stress, anxiety, depression, and sleep disturbance among nurses working during the COVID-19 epidemic was 43, 37, 35, and 43%, respectively (1). High-intensity and high stress jobs caused nurses to experience high levels of burnout during the COVID-19 pandemic (2). In addition, nurses are at risk of infection and death during the COVID-19 pandemic. As of 31 December 2020, approximately 10% of those diagnosed with COVID-19 were health care workers, and COVID-19 has resulted in the deaths of 2,262 nurses in 59 countries (3). Nurses exposed to various stressors have increased levels of dissatisfaction with their jobs and are more likely to turnover. The turnover intention of nurses during COVID-19 was significantly higher than that before COVID-19 (4). It is estimated that there was a shortage of 5.9 million nurses before the COVID-19 outbreak (5). The COVID-19 pandemic is exacerbating the shortage of nurses.

Studies have confirmed that professional identity plays a critical role in nurse retention (6, 7). A recent study revealed that nurses with higher levels of professional identity were more likely to participate in the fight against COVID-19 (8). Professional identity is often defined as career, occupational or vocational identity (9) and refers to "one's professional self-concept based on attributes, beliefs, values, motives, and experiences" (10). Professional identity is an important issue for nurses because it is closely related to the nursing profession's unique nursing roles, responsibilities, values and ethical standards (11). An integrative literature review showed that the professional identity of nurses was influenced by three factors: the self, the role and the context, among which the context was the most important because the context of practice affected the other two factors (12). The professional identity of nurses is not invariable, but constantly develops and changes (13). The challenge of formulating professional identity has increased for nurses during the COVID-19 pandemic. What is the impact of the COVID-19 pandemic on nurses' professional identity? Existing studies of the professional identity of nurses during the COVID-19 pandemic have focused on status (14), influencing factors (15), and correlations with stress (14) and burnout (16). To our knowledge, studies on the professional identity of nurses caring for confirmed patients when major public health emergencies occur are lacking. Thus, this study is timely. Additionally, the number of nurses who will care for COVID-19 patients will continue to rise as the pandemic progresses. However, nurses who care for COVID-19 patients may experience negative emotions, including fatigue and helplessness, as a result of their intense work and fear, which can negatively impact their professional identity (17). To develop appropriate countermeasures, it is crucial to gain an in-depth understanding of the influence experienced in caring for patients with COVID-19 on nurses' professional identity. The aim of the study was to examine the level of nurses' professional identity during the COVID-19 pandemic and the impact of caring for COVID-19 patients on the professional identity of nurses.

Professional identity develops dynamically (18) and is influenced by a variety of factors, including the work environment (12), and public image (19). It has been reported that nurses' attitudes, experiences, and behaviors are influenced by the complexity, severity, proximity, and novelty of emerging infectious disease epidemic events (20). As a result, their professional identity may be positively or negatively affected (21). Both positive and negative effects of the COVID-19 pandemic were observed on nurses' professional identity, but overall, their professional identity rose during the pandemic (22, 23). Based on the results of previous studies, this study hypothesized that the COVID-19 pandemic had a positive impact on nurses' professional identity.

It is difficult to use an experimental design to study the influence of caring for confirmed patients on nurses' professional identity during major public health emergencies. It is unethical and infeasible to assign nurses to care for confirmed patients or not, since even nurses assigned to the non-confirmed group typically provide care for confirmed patients at uncertain times. Nurses caring for confirmed patients account for a small proportion of the total nurse population, and the characteristics of the two groups may differ considerably. As a statistical method for dealing with data from observational studies, propensity score matching is used to reduce the impact of data bias and confounding variables, allowing for a more reasonable

comparison between the exposure group and the control group (15). In this study, the analysis was conducted using propensity score matching to correct for confounding variables, allowing objective analysis of the relationship between the experience of caring for COVID-19 patients and professional identity.

Methods

Study design, setting and participants

A cross-sectional survey was conducted among 8,065 nurses between 19 May and 7 August 2020 in 11 Chinese cities, including Dongguan, Foshan, Guangzhou, Hong Kong, Huizhou, Jiangmen, Macao, Shenzhen, Zhaoqing, Zhongshan, and Zhuhai. This study was conducted during the COVID-19 pandemic, which was declared a global pandemic in March 2020 (24). In 2019, these 11 cities accounted for 11.4% of China's gross domestic product (25). There were 258,364 nurses in these 11 cities, which represented 6.3% of the total number of nurses in China (26). The sample size was calculated using an online sample size calculator (http://www.raosoft.com/samplesize.html), assuming a 50% response distribution, a 99% confidence interval, and a 3% margin of error. For added contingency, the minimum sample size ($n = 1,688$) was increased by 20% to $n = 2,026$.

Convenience sampling was used to recruit nurses who met the following inclusion and exclusion criteria. The inclusion criteria were as follows: (1) nurses working in the above 11cities and (2) nurses with Chinese language skills. The exclusion criteria were as follows: (1) nurses who were trainees; (2) nurses who were currently on probation; (3) nurses who had come out of retirement to provide temporary support; and (4) nurses who refused to participate.

The survey was conducted online using the Wenjuanxing e-questionnaire platform (Wenjuan Xing Tech Co. Ltd., Changsha, China), which is widely used in China. The poster containing the QR code of the survey was pushed through WeChat, the most popular social networking app in China, to nurses across 11 cities. To promote this study effectively, the research team invited hospitals, nursing professional groups, and nursing colleges in 11 cities to assist. After reading the informed consent, participants clicked the "Agree" button before answering the questionnaire. For anonymity purposes, no personal information, such as name or contact information, was collected in the questionnaire. To improve the quality of the data, each device was set to answer the questionnaire once, and questionnaires with response times below 90 s were excluded from the study.

A total of 8,065 questionnaires were collected in this study. Further screening of the questionnaires was performed according to the exclusion criteria, and 8,030 nurses were entered into the matching baseline (Figure 1).

Questionnaire

Demographic characteristics

Data on participants' demographic information were collected, including gender, age, education background, marital status, number of children, years of working as a nurse, years of working at the current company, professional title, whether they were administrative supervisors, whether they were clinical teaching teachers, and the sufficiency of their ward workforce.

The experience of caring for COVID-19 patients

It was measured by asking "Did you care for COVID-19 patients during the COVID-19 outbreak?"

The nurse's career identity scale

Professional identity can be measured with a variety of screening tools. According to a systematic review of professional identity screening tools, the Macleod Clark Professional Identity Scale is the most effective tool for a range of health professions, while the Nurses' Professional Values Scale-Revised (NPVS-R) is the most effective tool for nurses (27). The Chinese (Taiwanese) version of the NPVS-R showed satisfactory reliability and validity. As Chinese from Taiwan use the traditional written system with complicated strokes, whereas Chinese from mainland China use the simplified written system with fewer strokes, applying the Chinese (Taiwanese) version applied to mainland Chinese may not be appropriate.

The nurse's career identity scale developed by Asians was translated into simplified Chinese and widely applied to nurses in mainland China, so this study used the scale. The nurse's career identity scale contains 21 items that are rated from 1 (completely disagree) to 7 (completely agree), with a score ranging from 1 to 7 to measure nurses' professional identity (28). It consists of seven subscales: (1) sense of control; (2) sense of agreement; (3) sense of meaning; (4) sense of self-potency; (5) sense of self-decision-making; (6) sense of organizational influence; and (7) sense of patient influence. The simplified Chinese version of the scale was considered valid and reliable with a content validity index of 0.92 and a Cronbach's alpha of 0.84 (29). Participants were divided into low (score < 3), medium (score 3–5), and high (score > 5) professional identities according to their scores. Obtaining authorization for the use of the scale was done at the beginning of the study.

Data analysis

Pearson's χ^2 test or Fisher's exact test was employed to examine associations between demographic characteristics and experience of caring for COVID-19 patients.

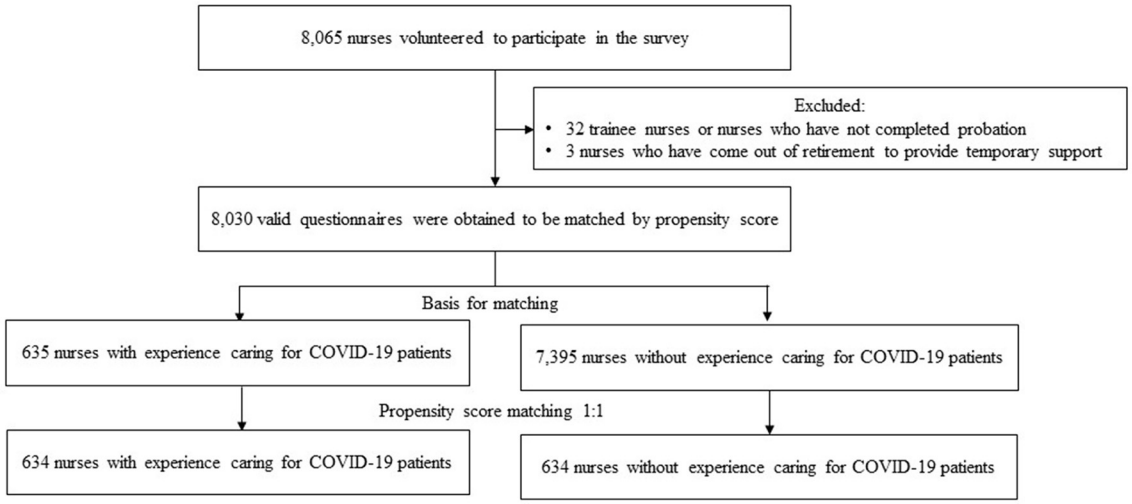

FIGURE 1
Flowchart of nurses inclusion.

Propensity score matching has been widely used in observational studies and nonrandomized clinical trials to make data for experimental and control groups comparable in retrospective analyses. In the present study, propensity score matching was used to adjust for confounding variables between nurses with and without experience of caring for COVID-19 patients to draw more accurate conclusions about the association between experience of caring for COVID-19 patients and professional identity. Two steps are involved in propensity score matching. First, logistic regression was used to estimate the propensity score. The variables used in the propensity score included gender, age, education background, marital status, number of children, years of working as a nurse, years of working at the current company, professional title, whether they were administrative supervisors, whether they were clinical teaching teachers, and the sufficiency of their ward workforce. The second step is the matching procedure. Propensity score matching was performed at 1:1 with a caliper value of 0.02 using a logistic regression. A sufficient number of controls is one of the most important factors for ensuring quality in matching procedures. It has been suggested that a factor over 4:1 (control group: experimental group) is acceptable (30), whereas in the current study the factor was larger than 11:1 (7,395:635; nurses with experience of caring for COVID-19 patients: nurses without experience of caring for COVID-19 patients).

Pearson's χ^2 test or Fisher's exact test was used to examine associations between demographic characteristics and professional identity categories. To analyze the impact of caring for COVID-19 patients on nurses' professional identity, a nominal logistic regression model was used rather than an ordinal regression model because the parallel regression assumption was violated. If a significant difference existed in nominal logistic regression between difference experiences of caring for COVID-19 patients, Pearson's χ^2 test or Fisher's exact test was used to analyze the relationship between the score level of seven subscales of professional identity and experience of caring for COVID-19 patients and the significance level was adjusted using the Bonferroni method. Data were analyzed using SPSS 22.0, and statistical significance was set at $p < 0.05$.

Result

Characteristics of participants

This study eventually included 8,030 nurses. The majority of participants were women (96.6%), and more than half of them had a bachelor's degree or above. Fewer than 8% of respondents had experienced caring for COVID-19 patients (Table 1). According to chi-square test results, there was a significant difference in gender, education background, marital status, number of children, years of working as a nurse, years of working at the current company, whether they were administrative supervisors, and whether they were clinical teaching teachers between nurses with and without caring for COVID-19 patients, but no significant difference was observed in age, professional title, or the sufficiency of their ward workforce (Table 1).

After propensity score matching, the final sample contained 1,268 participants, including 634 nurses who cared for COVID-19 patients and 634 nurses who did not (Figure 1). After propensity score matching, no significant differences were found in gender, age, education background, marital status, number of children, years of working as a nurse, years of working at the current company, professional title, whether

TABLE 1 Characteristics of participants before and after propensity score matching.

	Before matching ($N = 8,030$)				After matching ($N = 1,268$)			
	The experience of caring for COVID-19 patients		χ^2	p	The experience of caring for COVID-19 patients		χ^2	p
	Yes n (%)	No n (%)			Yes n (%)	No n (%)		
Overall	635 (7.9)	7,395 (92.1)			634 (50.0)	634 (50.0)		
Gender			35.977	<0.001			0.100	0.751
Male	48 (7.6)	587 (7.9)			47 (7.4)	50 (7.9)		
Female	226 (92.4)	7,169 (92.1)			587 (92.6)	584 (92.1)		
Age (years)			2.546	0.280			0.924	0.630
≤30	345 (54.3)	3,851 (52.1)			345 (54.4)	361 (56.9)		
31–50	279 (43.9)	3,352 (45.3)			278 (43.8)	264 (41.6)		
≥51	11 (1.7)	192 (2.6)			11 (1.7)	9 (1.4)		
Education background			14.707	0.001			0.922	0.631
Diploma	243 (38.3)	3,411 (46.1)			243 (38.3)	247 (39)		
Graduate	381 (60.0)	3,859 (52.2)			380 (59.9)	380 (59.9)		
Postgraduate	11 (1.7)	125 (1.7)			11 (1.7)	7 (1.1)		
Marital status			21.442	<0.001			2.577	0.276
Single	269 (42.4)	2,472 (33.4)			268 (42.3)	279 (44)		
Married	352 (55.4)	4,775 (64.6)			352 (55.5)	348 (54.9)		
Other	14 (2.2)	148 (2)			14 (2.2)	7 (1.1)		
Had one or more children			18.020	<0.001			0.079	0.779
Yes	325 (51.2)	4,423 (59.8)			325 (51.3)	320 (50.5)		
No	310 (48.8)	2,972 (40.2)			309 (48.7)	314 (49.5)		
Years of working as a nurse			8.333	0.016			1.155	0.561
≤10	398 (62.7)	4,309 (58.3)			397 (62.6)	414 (65.3)		
11–20	165 (26.0)	1,948 (26.3)			165 (26)	157 (24.8)		
≥21	72 (11.3)	1,138 (15.4)			72 (11.4)	63 (9.9)		
Years of working at the current company			8.132	0.017			0.505	0.777
≤10	456 (71.8)	5,033 (68.1)			455 (71.8)	466 (73.5)		
11–20	134 (21.1)	1,580 (21.4)			134 (21.1)	127 (20)		
≥21	45 (7.1)	782 (10.6)			45 (7.1)	41 (6.5)		
Professional title			1.201	0.273			1.324	0.250
Junior	426 (67.1)	5,116 (69.2)			426 (67.2)	445 (70.2)		
Intermediate and senior	209 (32.9)	2,279 (30.8)			208 (32.8)	189 (29.8)		
Administrative supervisor			4.546	0.033			1.177	0.278
Yes	89 (14.0)	829 (11.2)			89 (14)	76 (12)		
No	546 (86.0)	6,566 (88.8)			545 (86)	558 (88)		
Clinical teaching			6.670	0.010			0.029	0.864
Yes	259 (40.8)	2,637 (35.7)			259 (40.9)	262 (41.3)		
No	376 (59.2)	4,758 (64.3)			375 (59.1)	372 (58.7)		
Workforce			2.128	0.345			0.036	0.982
Enough	152 (23.9)	1,860 (25.2)			151 (23.8)	149 (23.5)		
Barely enough	266 (41.9)	2,880 (38.9)			266 (42)	265 (41.8)		
Not enough	217 (34.2)	2,655 (35.9)			217 (34.2)	220 (34.7)		

they were administrative supervisors, whether they were clinical teaching teachers, and the sufficiency of their ward workforce between nurses with and without caring for COVID-19 patient experience (Table 1), indicating a good match.

Professional identity

In this study, 88.6% of nurses during the COVID-19 outbreak had high levels of professional identity. There was no significant difference in the level of professional identity among nurses by gender, age, education background, years of working as a nurse, or whether they were clinical teaching teachers ($p > 0.05$). Nurses with low professional identity were more likely to be married ($p = 0.047$), have children ($p = 0.005$), have worked at their current company for ≤10 years ($p = 0.042$), hold junior professional titles ($p = 0.035$), not serve as administrative supervisors ($p = 0.036$), work in organizations with enough staffing ($p = 0.017$), and not have any experience caring for COVID-19 patients ($p < 0.001$) than those with moderate or high professional identity (Table 2).

Impact of caring for COVID-19 patients on nurse professional identity

For the nominal regression, variables were selected that differed significantly between the three professional identity category groups in Table 2. As shown in Table 3, the findings indicated that nurses who cared for COVID-19 patients were 2.38–135.39 times more likely to have a high professional identity than a low professional identity ($p = 0.005$), after completely controlling for the other factors.

Nurses who cared for COVID-19 patients had the highest percentage of high score level on the professional identity subscale for "sense of self-potency," followed by "sense of control," and had the lowest percentage for "sense of organizational influence," followed by "sense of self -decision-making," as did nurses who did not care for COVID-19 patients (Table 4). The proportion of nurses who cared for COVID-19 patients with low score levels on the five subscales, including "sense of control," "sense of agreement," "sense of meaning," "sense of self-potency," and "sense of patient influence," was significantly lower than those who did not. There was no difference in the two subscales of "sense of self-decision-making" and "sense of organizational influence" among nurses with different experiences in caring for COVID-19 patients (Table 4).

Discussion

To our knowledge, this study is the first to examine the impact of caring for confirmed patients on nurses' professional identity during a major public health emergency. The results of this study showed that nurses' professional identity during the COVID-19 outbreak was high. This study found that nurses who cared for COVID-19 patients were more likely to have a high professional identity than those who did not.

Overall, our results reveal that nurses' professional identity was at a high level during the COVID-19 pandemic. Ren et al. (31) used the same tool to conduct a cross-sectional survey on the professional identity of nurses in China before the outbreak of COVID-19 (March–April 2018), and the study results showed that only 57.0% of nurses' professional identity was at a high level. The results of this study showed that 88.6% of nurses' professional identity was at a high level during the COVID-19 pandemic (May–August 2020). It is suggested that the COVID-19 pandemic has a positive impact on nurses' professional identity. An Italian study found similar results (32), while a Spanish study revealed both positive and negative effects of the COVID-19 pandemic on health care workers' professional identity (21). A scoping review found that during the initial stages of the pandemic, health care workers reported overwhelmingly negative emotions, which gradually was followed by increasing positive reports of the impact on their professional identity (33). As a result of this study, Chinese nurses' identity has been positively impacted by the COVID-19 pandemic, and two potential reasons can be attributed to this. First, while nurses have experienced exhaustion and fear in dealing with the COVID-19 challenge, seeing patients improve and the outbreak successfully contained has given them a deeper understanding and confidence in the nature of nursing (34). Second, the professional self-perception of nurses will affect the formation of their professional identity and the professional identity of nurses is influenced by the public (35). The public and the media strongly identify with the bravery, selflessness and value of nurses during the COVID-19 pandemic (36). Nurses were rewarded financially and honorably for their contributions to the epidemic, which made nurses feel their own value and social image improved (34, 37). Thus, the COVID-19 pandemic had a positive impact on nurses' professional identity. Researchers may explore ways to sustain the positive impact on nurses' professional identity caused by the COVID-19 pandemic in the future.

However, it is worth noting that nurses had the lowest score in "sense of organizational influence," meaning nurses perceived that they had insufficient influence on the organization. In China, doctors are the main body of hospitals, and some managers think that nursing is an occupation to carry out doctors' orders (38), which gives nurses few opportunities to participate in hospital management (39). Therefore, the "sense of organizational influence" dimension has always been the lowest scoring for Chinese nurses (40). The COVID-19 pandemic has required more than ever teamwork among health care workers caring for COVID-19 patients. This blurred professional boundaries, particularly between doctors and nurses, who often

TABLE 2 Characteristics of participants according to the categorized professional identity after propensity score matching.

	All, *n* (%)	Low professional identity, *n* (%)	Moderate professional identity, *n* (%)	High professional identity, *n* (%)	χ^2	*p*
Overall	1,268 (100)	19 (1.5)	126 (9.9)	1,123 (88.6)		
Gender					0.535	0.765
Male	97 (7.6)	2 (10.5)	8 (6.3)	87 (7.7)		
Female	1,171 (92.4)	17 (89.5)	118 (93.7)	1,036 (92.3)		
Age (years)					6.531	0.163
≤30	706 (55.7)	11 (57.9)	82 (65.1)	613 (54.6)		
31–50	542 (42.7)	7 (36.8)	42 (33.3)	493 (43.9)		
≥51	20 (1.6)	1 (5.3)	2 (1.6)	17 (1.5)		
Education background					7.183	0.127
Diploma	490 (38.6)	11 (57.9)	50 (39.7)	429 (38.2)		
Graduate	760 (59.9)	8 (42.1)	76 (60.3)	676 (60.2)		
Postgraduate	18 (1.4)	0 (0)	0 (0)	18 (1.6)		
Marital status					9.615	0.047
Single	547 (43.1)	9 (47.4)	70 (55.6)	468 (41.7)		
Married	700 (55.2)	10 (52.6)	54 (42.9)	636 (56.6)		
Other	21 (1.7)	0 (0)	2 (1.6)	19 (1.7)		
Had one or more children					10.538	0.005
Yes	645 (50.9)	11 (57.9)	47 (37.3)	587 (52.3)		
No	623 (49.1)	8 (42.1)	79 (62.7)	536 (47.7)		
Years of working as a nurse					7.861	0.097
≤10	811 (64)	11 (57.9)	94 (74.6)	706 (62.9)		
11–20	322 (25.4)	6 (31.6)	24 (19.0)	292 (26.0)		
≥21	135 (10.6)	2 (10.5)	8 (6.8)	125 (11.1)		
Years of working at the current company					9.936	0.042
≤10	921 (72.6)	12 (63.2)	105 (83.3)	804 (71.6)		
11–20	261 (20.6)	6 (31.6)	16 (12.7)	239 (21.3)		
≥21	86 (6.8)	1 (5.3)	5 (4.0)	80 (7.1)		
professional title					6.683	0.035
Junior	871 (68.7)	14 (73.7)	99 (78.6)	758 (67.5)		
Intermediate and senior	397 (31.3)	5 (26.3)	27 (21.4)	365 (32.5)		
Administrative supervisor					6.656	0.036
Yes	165 (13.0)	2 (10.5)	8 (6.3)	155 (13.8)		
No	1,103 (87.0)	17 (89.5)	118 (93.7)	968 (86.2)		
Clinical teaching					2.449	0.294
Yes	521 (41.1)	9 (47.4)	44 (34.9)	468 (41.7)		
No	747 (58.9)	10 (52.6)	82 (65.1)	655 (58.3)		
Workforce					12.051	0.017
Enough	300 (23.7)	7 (36.8)	22 (17.5)	271 (24.1)		
Barely enough	531 (41.9)	7 (36.8)	44 (34.9)	480 (42.7)		
Not enough	437 (34.5)	5 (26.3)	60 (47.6)	372 (33.1)		
The experience of caring for COVID-19 patients					17.783	<0.001
Yes	634 (50.0)	1 (5.3)	72 (57.1)	561 (50.0)		
No	634 (50.0)	18 (94.7)	54 (42.9)	562 (50.0)		

TABLE 3 Predictors of professional identity after propensity score matching (multivariable nominal regression).

	Moderate professional identity vs. low professional identity			High professional identity vs. low professional identity		
	OR	95% CI	*p*	OR	95% CI	*p*
Marital status						
Single = Ref						
Married	0.052	0.004, 0.672	0.052	0.049	0.004, 0.580	0.017
Other	0	0, 0	<0.001		0, 0	
Had one or more children						
Yes = Ref						
No	28.096	2.300, 343.253	0.009	19.878	1.805, 218.937	0.015
Years of working at the current company						
≤10 = Ref						
11–20	0.365	0.027, 4.977	0.450	0.517	0.046, 5.792	0.593
≥21	1.492	0.131, 16.950	0.747	1.458	0.160, 13.334	0.738
Professional title						
Junior	0.458	0.098, 2.151	0.322	0.469	0.112, 1.974	0.302
Intermediate and senior = Ref						
Administrative supervisor						
Yes	0.895	0.136, 5.895	0.908	1.516	0.273, 8.416	0.634
No = Ref						
Workforce						
Enough = Ref						
Barely enough	0.453	0.137, 1.498	0.195	0.521	0.176, 1.543	0.239
Not enough	0.235	0.065, 0.843	0.026	0.471	0.144, 1.543	0.214
The experience of caring for COVID-19 patients						
Yes	23.727	3.058, 184.102	0.002	17.954	2.381, 135.391	0.005
No = Ref						

OR, odds ratio; 95% CI, 95% confidence interval.

switched roles when caring for patients (41). The importance of nurses in safeguarding the health and well-being of patients has been highlighted by their significant contribution to the fight against COVID-19, so nursing groups even call for "the need for visible nursing leadership during COVID-19" (42).

According to this study, nurses' professional identity is positively impacted by their experience caring for COVID-19 patients. One of the prevention and control measures for COVID-19 in China is that both suspected and confirmed patients need to be isolated and treated in designated hospitals (43). Government policy stated that designated isolation hospitals were not allowed to visit patients during the COVID-19 outbreak. Because of the isolation policy, patients can only be accompanied by health care workers, and their basic care and emotional support were mainly provided by nurses (34, 44), who were the middleman in maintaining the close relationship between relatives and patients (45). Nurses providing direct care to COVID-19 patients said they were "meeting patient care needs in new ways while staying safe" (46). Nurses working in isolation hospitals felt they received more respect and recognition during the pandemic. They thought patients were more cooperative than before, showing more respect for nurses and expressing their gratitude (47). Nurses who had worked in the COVID-19 ward for more than 2 months pointed out that they spent most of their time with patients; thus, they saw themselves at the forefront of the fight against the epidemic and felt like heroes (48). Nurses working in isolation hospitals said they gained additional expertise and skills while caring for COVID-19 patients, which helped in their self-growth and future nursing practice (34). In addition, nurses who did not provide direct patient care during the COVID-19 pandemic believed the label "healthcare hero" was most appropriate for direct care nurses who risked everything (49). Based on the above, nurses caring for COVID-19 patients were significantly improved in the "sense of control," "sense of agreement," "sense of meaning," "sense of self-potency," and "sense of patient influence." Nursing's "sense of self-decision-making" and "sense of organizational influence" are not affected

TABLE 4 Relationship between the score level of subscales of professional identity and experience of caring for COVID-19 patients.

	The experience of caring for COVID-19 patients		χ^2	*p*
	Yes *n* (%)	No *n* (%)		
Sense of control			13.032	0.001
Low	2 (0.3)$_a$	18 (2.8)$_b$		
Moderate	55 (8.7)$_a$	52 (8.2)$_a$		
High	577 (91.0)$_a$	564 (89.0)$_a$		
Sense of agreement			12.383	0.002
Low	3 (0.5)$_a$	17 (2.7)$_b$		
Moderate	80 (12.6)$_a$	61 (9.6)$_a$		
High	551 (86.9)$_a$	556 (87.7)$_a$		
Sense of meaning			17.056	<0.001
Low	3 (0.5)$_a$	20 (3.2)$_b$		
Moderate	83 (13.1)$_a$	58 (9.1)$_b$		
High	548 (86.4)$_a$	556 (87.7)$_a$		
Sense of self-potency			14.444	0.001
Low	1 (0.2)$_a$	17 (2.7)$_b$		
Moderate	47 (7.4)$_a$	47 (7.4)$_a$		
High	586 (92.4)$_a$	570 (89.9)$_a$		
Sense of self-decision-making			4.847	0.089
Low	14 (2.2)	27 (4.3)		
Moderate	123 (19.4)	110 (17.4)		
High	497 (78.4)	497 (78.4)		
Sense of organizational influence			4.705	0.095
Low	35 (5.5)	34 (5.4)		
Moderate	217 (34.2)	182 (28.7)		
High	382 (60.3)	418 (65.9)		
Sense of patient influence			8.797	0.012
Low	8 (1.3)$_a$	21 (3.3)$_b$		
Moderate	123 (19.4)$_a$	98 (15.5)$_a$		
High	503 (79.3)$_a$	515 (81.2)$_a$		

Each subscript letter denotes a subset of the categories whose column proportions do not differ significantly from each other at the 0.05 level.

by the experience of caring for COVID-19 patients, which merits further investigation to develop better measures to enhance nurses' professional identity.

The findings of this study revealed that there was no difference in the "sense of self-decision-making" and "sense of organizational influence" among nurses with different experiences in caring for COVID-19 patients. Nurses caring for COVID-19 patients experienced high levels of stress, anxiety, depression, and burnout (2, 50). Burnout among nurses working in COVID-19 designated hospitals and COVID-19 wards was high and increased with the length of working time in these facilities (2). Therefore, nurses who cared for COVID-19 patients reported lower job satisfaction and higher turnover intention than those who did not (46, 51). Increased workloads and deteriorating working conditions have affected the health and well-being of nurses frontline nurses caring for COVID-19 patients. Therefore, the experience of caring for COVID-19 patients did not positively impact on nurses' sense of self-decision-making. To mitigate the negative impact of caring for COVID-19 patients on nurses' professional identity, health policy makers should take measures to control and prevent their mental disorders and improve their working environment.

Regarding the sense of organizational influence, nurses believed that the workplace culture in isolation hospitals had improved and that management's attitude toward nurses had improved. While the hierarchy of doctors and other health care professionals still exists, this situation has become less pronounced in isolated hospitals (47). It is important to note that this positive impact is not limited to isolated hospitals. The results from a study of Chinese nurses' perceptions of the impact of the COVID-19 pandemic showed that the COVID-19 pandemic appears to have had positive

effects at the social and organizational levels (47). Therefore, there was no difference in the "sense of organizational influence" among nurses with different experiences in caring for COVID-19 patients.

There are some limitations to this study and the results must be interpreted with caution. First, this study was conducted in only 11 cities out of 293 in China, and convenience sampling was used, which affected the generalizability of the findings. Second, this study was designed as a cross-sectional study, but cross-sectional studies assessed exposure and outcomes at the same time, making it difficult to infer causality. The strength of this study is that the total sample size is large enough, and it covers low, medium and high income cities, thus achieving powerful statistical results. Moreover, the analysis was conducted using propensity score matching to correct for confounding variables.

Conclusions

Chinese nurses' professional identity was at a high level during the COVID-19 pandemic. Nurses who cared for COVID-19 patients were more likely to have a high professional identity than those who did not. Nurses caring for COVID-19 patients demonstrated significantly better "sense of control," "sense of agreement," "sense of meaning," "sense of self-potency," and "sense of patient influence," but there was no difference between nurses with different experiences caring for COVID-19 patients with regard to "sense of self-decision-making" and "sense of organizational influence."

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics statement

This research was approved by the Research Management and Development Department of Kiang Wu Nursing College of Macau (No. 2019APR01). Informed consent was obtained from all respondents before they began the online questionnaire. Taking part in the survey was completely anonymous, and participants may withdraw at any time.

Author contributions

IV conceived the study and was responsible for project administration. LT interpreted the data, conducted an in-depth analysis, and wrote the manuscript. MZ, SW, and PC were responsible for data collection. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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The impact of nurses' sense of security on turnover intention during the normalization of COVID-19 epidemic: The mediating role of work engagement

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Background: COVID-19 pandemic has entered a normal stage in China. During this phase, nurses have an increased workload and mental health issues that threaten the sense of security. Poor sense of security may have a considerable impact on turnover intention through low work engagement. It was challenging to maintain the nurse workforce. Fewer studies have been conducted on the effect of nurses' sense of security on their turnover intention in that phase. This study aimed to investigate the interrelationship between nurses' sense of security, work engagement, and turnover intention during the normalization phase of the epidemic in China and to explore the impact of sense of security on turnover intention.

Methods: A cross-sectional survey was conducted from September 2020 to May 2021 in Guangdong Province, China. Data were collected online using Sense of Security Scale for Medical Staff (SSS-MS), Utrecht Work Engagement Scale (UWES), and Turnover Intention Scale. Pearson's correlation analysis was used to assess the correlation between sense of security, work engagement, and turnover intention. The hypothesis model used multiple linear regression models and the bootstrapping procedure to analyze the relationship between these variables.

Results: Data were collected from 2,480 nurses who met the inclusion criteria. Over half(64.5%) of nurses had a high and very high turnover intention. After controlling the demographic and working variables, sense of security ($\beta = 0.291$, $P < 0.001$) had a direct positive effect on work engagement. Sense of security ($\beta = -0.447$, $P < 0.001$) and work engagement ($\beta = -0.484$, $P < 0.001$) had a direct negative effect on turnover intention. Sense of security and all of its components were associated with turnover intention through the partially mediating effects of work engagement.

Conclusions: Nurses' turnover intention was at a high level during the normalization phase of the epidemic. Sense of security and its components act as positive resources to reduce turnover intention by improving work engagement. Policy makers and managers may pay attention to the needs of nurses' sense of security, which may be a new perspective to help managers reduce their turnover intention and stabilize the nurse team.

KEYWORDS

COVID-19, normalization, sense of security, work engagement, turnover intention, nurse

Introduction

Nurses, as the largest health care professional grouping, play a critically significant role in the fight against the COVID-19 epidemic. The shortage of nurses in China remains a severe problem, and nurse turnover exacerbates shortages. Although the number of nurses in China is increasing yearly, the shortage of nurses due to the vast population base is a problem that cannot be ignored. According to the latest the latest WHO data (WHO NHWA Data Platform–January 2021 update), the density of nurses and midwives per 1,000 population in Europe and the Americas Region exceeds 8, and the average density of nurses and midwives per 1,000 population in 194 countries is 4.49 (1). However, according to the statistical bulletin on China's health care development in 2021 released by the China Health Care Commission, there were only 3.56 registered nurses per 1,000 population (2). Thus, the shortage of nurses has become a major health human resource problem to be solved urgently in China.

At the end of April 2020, China entered the phase of normalization of COVID-19 epidemic prevention and control. The goal was to strictly prevent imported cases, center on nucleic acid testing for risk prevention and control, and control the spread of the epidemic within 2 to 3 incubation periods (3). The constant mutation of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) poses a considerable challenge to outbreak prevention and control (4). Although the epidemic was not spreading or outbreaking on a large scale, unanticipated sporadic disseminated cases occurred from time to time. The work of many nurses has changed dramatically from the past. Due to the shortage of human resources in the community, nurses in general hospitals have been required to accept out-of-hospital nursing assignments in addition to clinical care in the hospital. For example, they were sent to the community or other places to participate in nucleic acid testing and vaccination (5). Moreover, the change in workflow and shift patterns have also resulted in nurses working long hours, insufficient rest, and constant overtime (6). The need for nurses in China has continued to increase during the normalization phase of the COVID-19 epidemic.

The COVID-19 epidemic contributed to an adverse working environment for healthcare workers. In the face of increased risk of infection, long work shifts, overload, and lifestyle changes may significantly affect healthcare workers' mental health, such as burnout, stress, depression and anxiety, insomnia, post-traumatic stress disorder, and insomnia (7, 8). Results from meta-studies during the COVID-19 epidemic reported that nurses demonstrated significantly worse mental health outcomes compared to other healthcare workers (9, 10). Since most nurses are women, they are more sensitive to the perceived emotional burden in the workplace (11). Moreover, the occupational characteristics of nurses tend to more extended patient contact and follow-up, experiencing more workload and risk of infection (12, 13). Nurses also have a negative psychological impact during the normalization phase of the COVID-19 epidemic (14). Increasing work stress and psychological stress made some of them opt to leave, but not in nursing, leading to an increased shortage (15). The shortage may aggravate the burden on the healthcare system (16).

Turnover intention is an employee's behavioral intention or attitude toward leaving his or her organization or unit, which is a psychological state or tendency before generating turnover behavior (17). Moreover, it is a crucial antecedent variable for turnover behavior and can predict turnover behavior (18). Research has previously observed that nurse turnover impacts the quality of care and generates many lost economic benefits (19), rendering it an ongoing concern for administrators. Notably, nurses with higher turnover intention may not decide to engage in turnover behavior. However, high turnover intention were associated with absenteeism (20) and missed nursing care (21). Thus, nurses' willingness to work may affect patients and their self-safety, especially caring for COVID-19 patients. Surveys such as that conducted by Nashwan have shown that nurses' turnover intention increased significantly during COVID-19 (from a mean score of 13.24 to 15.54) (22). Therefore, the turnover intention of nurses under the normalization of the epidemic situation needs further research.

Previous studies have mentioned job insecurity as a predictor of turnover (23). During COVID-19, many studies

verified that insecurity was related to turnover intention (24–26). Insecurity is associated with physical and mental health well-being, and insecurity can contribute to the development of mental illness and somatic symptoms, and job burnout (27–29). However, due to medical professionals' professional and workplace characteristics, their security may be derived from their experiences at work, such as social media, doctor-patient relationships, medical work environment, and promotion system (30, 31). According to the work characteristics of medical personnel, the sense of security of medical personnel consists of five components: work environment, patient, self-competence, organizational management, and social support (32). During the normalization of the COVID-19 epidemic, overload and nurse-patient conflicts also lead to a high incidence of anxiety and depression among nurses (33, 34). These psychological risks may threaten the nurse's sense of security during this period (35), and the poor sense of security may increase the possibility of turnover. The association between insecurity and turnover intention among hotel employees (36) and corporate employees (37) during the COVID-19 pandemic has been identified. Nevertheless, has been scarce research on the relationship between nurse sense of security and turnover intention during the normalization of the COVID-19 epidemic.

Work engagement was defined as a positive, fulfilling psychological state characterized by vigor (i.e., abundant energy and resilience); dedication (i.e., a sense of meaning, pride, and challenge to the work); absorption (i.e., concentration on the work and readily absorbed in work) (38). Since the rising of positive psychology, work engagement has received more and more attention. Previous studies have referred to work engagement as a protective factor for turnover intention (39), which promotes job outcomes such as job satisfaction, job performance, and organizational citizenship behavior (40, 41).

The research was based on the job demands-resources model (JD-R Model) and the conservation of resources (COR) theory. The characteristics of any job could be divided into job demands and resources concerning the JD-R model (42). Job demands refer to characteristics that require continuous physical or mental consumption. In contrast, job resources refer to characteristics that can support and help employees, reduce consumption, and motivate growth. Sense of security and work engagement help prevent burnout (43, 44). They belong to positive job resources. According to the positive process of the JD-R model, work engagement plays a vital role in acting as a bridge between available job resources and positive work outcomes (i.e., reduced turnover intention). An adequate sense of security could enable this positive path to reduce turnover intention by increasing work engagement. COR theory suggests that individuals tend to avoid the loss of resources (i.e., they have a tendency to retain, protect, and create resources) (45). Sense of security and work engagement are significant job resources that individuals value. Thus, avoiding the loss of resources may lead individuals to choose to stay with the organization. Based on the above, this study proposes a conceptual model map, as shown in Figure 1. In addition, studies showed a correlation between sense of security and turnover intention. In this mediation model, however, we are unclear whether the components of sense of security contribute to it. Therefore, we considered different components of sense of security to bring into this research model to fill this gap in research.

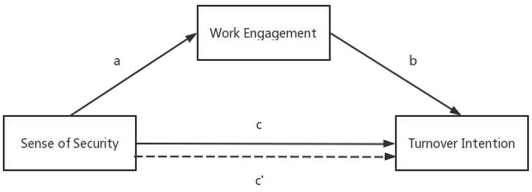

FIGURE 1
The theoretical model.

The aim of this study is to examine the relationship between sense of security, work engagement, and turnover intention among Chinese nurses under the epidemic normalization of the COVID-19 epidemic. We propose four hypotheses as follows:

H1: Sense of security has a positive impact on work engagement (path a).

H2: Sense of security has a negative impact on turnover intention (path c).

H3: Work engagement negatively has a negative impact on turnover intention (path b).

H4: The effects of sense of security on turnover intention are partially mediated by work engagement (path c').

Materials and methods

Design, setting and participants

A cross-sectional study was conducted between September 2020 and May 2021 using snowball and convenience sampling in Guangdong Province, China. The sample size was estimated based on Wu's (46) proposal that a sample size >200 is needed to construct a stable model. Therefore, we aimed to collect at least 200 valid questionnaires. Inclusion criteria: (1) Age ≥18, engaged in clinical work; (2) No mental or cognitive dysfunction; (3) Registered nurses who are qualified to practice; (4) Volunteer to participate in this study. Exclusion criteria: (1) Practice nurses and trainee nurses who have not obtained the practice qualification; (2) Nurses who did not work in the clinic during the survey period (such as studying abroad, not participating in the clinic while engaged in management work, asking for leave and being hospitalized).

Data collection

We sent the questionnaire to the members of the Guangdong Nursing Association through Wenjuanxing (a professional questionnaire website, https://www.wjx.cn). We explained the aim of the study and the principles of voluntary and anonymous participation. Then, the members forwarded the questionnaire to the head nurse of each nursing unit, who invited the nurses in each department to fill in the questionnaire.

Ethical considerations

The Ethics Committee has approved this study of Guangdong Provincial People's Hospital (NO. Ky2020-579-01). On the premise of strictly implementing the informed consent and voluntary principles, the research objectives, methods and significance was explained to the subjects on the title page of the questionnaire, and consent was obtained before the questionnaire could be filled out. We fully respect subjects' informed consent and privacy, and subjects can withdraw from the investigation to comply with their wishes.

Measurements

Demographic characteristics and working characteristics

We designed the demographic and working information questionnaire, including nine items: gender, age, marital status, education, professional title, work seniority, hospital level, employment status, and department. Based on past research on turnover intention (47–49), we set these variables as covariates to exclude potential confounding bias in examining mediation effects.

Sense of security

Sense of security was measured using the Sense of Security Scale for Medical Staff (SSS-MS), validated among the Chinese medical staff (32). The scale was mainly composed of 5 dimensions and 22 items: environmental (4 items; e.g., "I am worried about the physical environment and occupational exposure in the hospital";$\alpha = 0.843$), patient (4 items; e.g., "The patient's distrust scares me at work";$\alpha = 0.890$), self (3 items; e.g., "I am worried that the lack of comprehensive ability leads to contradictions and inability to deal with emergencies";$\alpha = 0.788$), organizational management (7 items; e.g., "The lack of care and support from my superiors made me feel isolated and helpless";$\alpha = 0.917$), and social support (4 items; e.g., "The tense atmosphere of medical treatment reported by media reports upsets me";$\alpha = 0.890$). The scale was scored using the Likert 5-level method, ranging from 1 (absolutely agree) to 5 (absolutely disagree). The higher the score, the higher the sense of security. The scale has been shown to have good reliability among medical personnel. We calculated the average and the total scale score ($\alpha = 0.966$).

Work engagement

Work engagement was measured by the Chinese version of the Utrecht Work Engagement Scale (UWES) (50). The scale contained 3 dimensions and 16-item, vigor (6 items; e.g., "I feel strong and vigorous at work";$\alpha = 0.902$), dedication(5 items; e.g., "I am proud of my current job";$\alpha = 0.953$), and absorption (5 items; e.g., "When I am working all I think about is work";$\alpha = 0.907$). The scale was scored using the Likert 7-level method, ranging from 0 (never) to 6 (always). The higher the score, the greater the work engagement. We calculated the average and total scale scores ($\alpha = 0.962$).

Turnover intention

To assess turnover intention, we used the Turnover Intention Scale (TI), translated and revised by LI Dongrong and LI Jingyuan (49). This scale consisted of 6 items under three subscales: TII-the possibility of turnover (2 items; e.g., I am going to quit my present job'); TIII-the motivation to look for another job (2 items; e.g., I want to find another job of the same nature); TIIII-the possibility of obtaining another job (2 items; e.g., 'The likelihood that I will find a suitable position in another organization). The scale was scored using the Likert 4-level method, ranging from 1 (absolutely disagree) to 4 (absolutely agree). The higher the score, the greater the turnover intention. The higher the score, the greater the turnover intention. Nurses' turnover intention was classified as very low turnover intention (≤ 1), low turnover intention (>1, ≤ 2), high turnover intention (>2, ≤ 3), and very high turnover intention (>3). We calculated the average and total scale scores ($\alpha = 0.799$).

Data analysis

IBM SPSS 26.0 and AMOS 24.0 were used for analysis. First, the data with the normal distribution of continuous variables were represented by mean and standard deviation. The categorical variables were described as frequency and percentage. Secondly, Pearson's correlation analysis was used to analyze the relationship between sense of security, work engagement, and turnover intention for normally distributed data. Finally, we used the PROCESS macro mediation model (model 4) (51) in SPSS. We set the sense of security as the independent variable, work engagement as the intermediary

variable, and turnover intention as the dependent variable to estimate the size and significance of the mediation effect. The bootstrap method was used, with a sample size of 5,000 and a confidence interval of 95%. The mediation effect was considered significant if the confidence interval did not include zero. The same procedure was conducted to analyze five dimensions of sense of security to determine different components' effects (52).

Results

Participants characteristics

A total of 2,554 nurses were distributed the online questionnaire, and 2,480 returned the survey (response rate: 97.1%). Participants were from 29 hospitals in Guangdong Province, including 14 tertiary hospitals, 8 secondary hospitals, and 7 primary hospitals. Most of them (89.9%) were female,51.5% were < 30 years old,60.0% were married,61.8% had junior college education,71.9% held the junior professional title, 34.0% had worked in hospitals for 6–10 years, 59.0% had worked in tertiary hospitals, and 64.6% were temporary. 26.5% of them were from the medicine unit. The characteristics of other participants are shown in Table 1.

TABLE 1 Demographic characteristics of participants($N = 2480$).

Variable	Categories	*n*(%)
Gender	Male	250(10.1)
	Female	2230(89.9)
Age (years)	≤30	1277(51.5)
	31-40	835(33.7)
	≥41	368(14.8)
Years of service (years)	≤5	746(30.1)
	6–10	844(34.0)
	11–20	555(22.4)
	≥21	335(13.5)
Professional title	Junior	1782(71.9)
	Intermediate	602(24.3)
	Senior	96(3.9)
Marital status	Married	1489(60.0)
	Unmarried	962(38.8)
	Divorce or widowed	29(1.2)
Education level	Secondary school	18(0.7)
	Junior college	1532(61.8)
	Undergraduate or above	930(37.5)
Department	Intensive care unit	173(7.0)
	Medicine	656(26.5)
	Surgery	473(19.1)
	Obstetrics or gynecology	298(12.0)
	Pediatrics	173(7.0)
	Emergency	264(10.6)
	Medical technology department	281(6.5)
	Others	162(17.8)
Employment status	Temporary	1603(64.6)
	Permanent	877(35.4)
Hospital level	Primary hospital	178(7.2)
	Secondary hospital	840(33.9)
	Tertiary hospital	1462(59.0)
Turnover intention	Very low turnover intention	73(2.9)
	Low turnover intention	817(32.9)
	High turnover intention	1147(46.3)
	Very high turnover intention	443(17.9)

Descriptions and correlations of variables

Pearson's correlation coefficients of sense of security, turnover intention, and work engagement are shown in Table 2. Sense of security was positively correlated with work engagement. Turnover intention was negatively related to sense of security and work engagement.

Test of the hypothesized model and associations among variable

Table 3 tabulates the results of the regression analyses examining the mediation hypothesis. The negative effect of sense of security on turnover intention was significant ($\beta = -0.447$, $t = -24.522$, $p < 0.001$), and the indirect negative effect of sense of security on turnover intention remained significant ($\beta = -0.306$, $t = -18.923$, $P < 0.001$) when the mediating variables were involved. Sense of security had a significant positive impact effect on work engagement ($\beta = 0.291$, $t = 14.706$, $P < 0.001$), and work engagement had a significant negative predictive effect on turnover intention ($\beta = -0.484$, $t = -30.539$, $P < 0.001$). As shown in Table 4, the association between sense of security and turnover intention was partly mediated by work engagement. As to its five dimensions, the relationship between environment, patient, self, organizational management, social support, and turnover intention was also partially mediated by work engagement.

Discussion

This study constructed a hypothetical model based on theories to explore the relationship between nurses' sense of security and turnover intention during the normalization of the COVID-19 epidemic and with work engagement as a mediator in this relationship. We found that sense of security impacted positively and independently on work engagement

TABLE 2 Means, standard deviations (SD) and correlations among study variables ($N = 2480$).

	Variables	Mean	SD	1	2	3
1	Sense of security	79.62	19.61	1		
2	Work engagement	65.76	20.24	0.260***	1	
3	Turnover intention	14.13	4.28	−0.390***	−0.413***	1

***$p < 0.001$.

and negatively and directly on turnover intention. Moreover, work engagement had a direct negative effect on turnover intention and partially mediated the relationship between sense of security and turnover intention among nurses. In addition, we examined the effects of the components of sense of security in this mediation model. All components of sense of security were negatively related to turnover intention. There were direct and indirect effects between the variables. It was shown that all components of sense of security (environment, patients, self, organizational management, and social support) may act as protective factors in reducing turnover intention and that work engagement partly mediated their relationship with turnover intention. This study may provide managers with new perspectives on sustaining the nursing team and developing nursing interventions during the normalization of the COVID-19 epidemic.

In the present research, the score of nurses' turnover intention was (14.13 ± 4.28), and nurses' turnover intention was at a high level during the normalization phase of the epidemic, which was higher than the findings of a previous survey of nurses in 23 hospitals in China before the epidemic (53). We revealed that more than half of the nurses reported high turnover intention (46.3%) or very high turnover intention (17.9%). This may result from the changes that the epidemic has brought to work. In order to control sporadic epidemics, nurses were required to work overtime and accepted emergency assignments to do large-scale screening, increasing psychological problems and burnout (45). One study noted that after the COVID-19 epidemic, the most reported predictors of nurses' turnover intention included fear of illness, stress, and anxiety (54). Meanwhile, the psychological impact of the epidemic may be long-lasting after the epidemic (55). All these reasons may lead to an increase in nurses' turnover intention.

Nurses' work engagement in this study was medium, consistent with previous studies under the COVID-19 epidemic (56, 57). During the normalized epidemic phase, despite the burnout of long-term epidemic prevention and control (58), the role played by nurses in the epidemic is socially recognized as high, which is conducive to nurses' professional identity (59). Higher work engagement could lead to higher self-efficacy and a sense of accomplishment in the workplace (60), leading to more inclination to stay with the organization. Consistent with previous literature, work engagement was negatively associated with turnover intention (61).

The study showed that nurses' sense of security tended to be on a high level, which indicates that nurses could feel supported and within control in the workplace during the epidemic normalization. The results showed that nurses' sense of security came most from organizational management, referring to hospital management and systems, leadership from superiors, and cooperation among colleagues, indicating that the participants indicated that the hospital was able to protect nurses' fundamental rights and interests (30). The excellent atmosphere and cohesive team were so that nurses could obtain support and security from the organization, consistent with the previous study (62, 63).

Our study found that nurses' sense of security had a direct negative predictive effect on turnover intention and an indirect negative predictive effect on turnover intention through work engagement. The sense of security is a subjective feeling in the workplace and is the basic need of clinical nurses. Therefore, in this work environment, nurses could be satisfied and benefit from their work (64). Furthermore, the five components of a sense of security were involved in the model. To some extent, work engagement partially mediated their association with turnover intention, indicating a positive process that reflected the JD-R model. It may be due to the open, inclusive and respectful work environment, nurse-patient relationship, and social support that allows nurses to speak up and generate positive creativity in their work, thus increasing their engagement and promoting commitment. In addition, in a well-managed organization, receiving recognition and praise from the team would provide positive feedback to promote engagement. When nurses feel protected by the organization, they feel satisfied with their work and are less likely to leave (65). The self-factor is the nurse's resilience and ability to face an adverse event that affects the individual's perception and behavior toward the event. It is worth noting that their direct effects are all greater than the indirect effects. In the current period, measures to enhance the sense of security may be more effective in reducing turnover intention. Therefore, it is recommended that an improved external environment and organizational support be considered in intervention programs to promote a sense of security and that the training of nurses is increased to improve competency. However, it is not enough

TABLE 3 Results of the regression models testing the mediation hypothesis ($N = 2480$).

Variable	Total effect of sense of security on turnover intention		Direct effect of sense of security on work engagement		Direct effects of sense of security on turnover intention and work engagement on turnover intention	
	Path c		Path a		Path c' and Path b	
	β	t	β	t	β	t
Sense of security	−0.447	−24.522***	0.291	14.706***	−0.306	−18.923***
Work engagement	–		–		−0.484	−30.539***
Gender						
Male (ref)						
Female	0.021	1.175	0.023	1.165	0.033	2.097*
Age (years)						
≤30 (ref)						
31–40	−0.031	−1.144	0.066	2.253*	0.001	0.046
≥41	−0.023	−0.514	0.007	0.155	−0.019	−0.508
Years of service (years)						
≤5 (ref)						
6–10	−0.03	−1.299	0.104	4.162***	0.02	1.036*
11–20	−0.022	−0.717	0.107	3.221**	0.03	1.14
≥21	−0.016	−0.344	0.19	3.878***	0.076	1.979*
Professional title						
Junior (ref)						
Intermediate	0.013	0.697	0.019	0.888	0.022	1.366
Senior	0.003	0.147	0.028	1.414	0.016	1.043
Marital status						
Married (ref)						
Unmarried	−0.007	−0.371	−0.018	−0.875	−0.016	−0.975
Divorce or widowed	−0.003	−0.174	0.02	1.026	0.006	0.427
Education level						
Secondary school (ref)						
Junior college	−0.188	−1.843	−0.024	−0.216	−0.2	−2.297*
Undergraduate or above	−0.118	−1.156	0.027	0.24	−0.105	−1.21
Department						
Intensive care unit (ref)						
Medicine	−0.018	−0.548	−0.001	−0.026	−0.019	−0.66
Surgery	0.02	0.654	−0.049	−1.463	−0.003	−0.134
Obstetrics or gynecology	0.041	1.496	−0.025	−0.824	0.029	1.25
Pediatrics	0.009	0.372	0.004	0.156	0.011	0.533
Emergency	−0.025	−0.949	−0.021	−0.736	−0.036	−1.568
Medical technology department	−0.008	−0.299	−0.064	−2.144*	−0.039	−1.67
Others	0.051	2.124*	0.016	0.604	0.058	2.867**
Employment status						
Temporary (ref)						
Permanent	−0.026	−1.283	−0.088	−4.007***	−0.069	−3.963***
Hospital level						
Primary hospital (ref)						
Secondary hospital	−0.058	−1.673	0.042	1.11	−0.038	−1.28
Tertiary hospital	−0.102	−2.905**	−0.014	−0.364	−0.109	−3.637***
Constant	24.023	23.421***	37.637	7.147***	27.869	31.584***
R^2	0.247		0.113		0.454	
F	34.939***		13.579***		85.044***	

*P < 0.05, **P < 0.01, ***P < 0.001.

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TABLE 4 Direct and indirect effects of sense of security and its dimensions on turnover intention ($N = 2480$).

Effect	B	BootSE	95%BootCI	
			Lower	Upper
Sense of security → turnover intention				
Total effect	−0.097	0.004	−0.105	−0.090
Direct effect	−0.067	0.005	−0.075	−0.058
Indirect effect	−0.031	0.002	−0.036	−0.026
Environment → turnover intention				
Total effect	−0.444	0.020	−0.484	−0.405
Direct effect	−0.305	0.021	−0.346	−0.262
Indirect effect	−0.139	0.012	−0.162	−0.115
Patient → turnover intention				
Total effect	−0.410	0.020	−0.450	−0.371
Direct effect	−0.276	0.021	−0.317	−0.234
Indirect effect	−0.134	0.012	−0.158	−0.111
Self → turnover intention				
Total effect	−0.539	0.028	−0.595	−0.484
Direct effect	−0.345	0.029	−0.403	−0.286
Indirect effect	−0.195	0.017	−0.229	−0.163
Organizational management → turnover intention				
Total effect	−0.275	0.012	−0.298	−0.252
Direct effect	−0.187	0.013	−0.212	−0.161
Indirect effect	−0.088	0.007	−0.102	−0.074
Social support → turnover intention				
Total effect	−0.423	0.019	−0.461	−0.385
Direct effect	−0.287	0.021	−0.327	−0.246
Indirect effect	−0.135	0.012	−0.158	−0.113

to rely on hospital administrators alone; it is also necessary to improve the health care system and laws and regulations that protect the rights and interests of nurses. It is vital to increase the confidence and positive affect of nurses, which contributes to the professional identity of nurses and is very important to stabilize the nursing team and reduce nurse turnover.

We revealed the relationship between work engagement and turnover intention. Work engagement as a protective factor for turnover intention was consistent with previous studies (66, 67). The reason probably was that nurses with work engagement would benefit from their work. First, nurses with high work engagement are full of energy and can recover quickly, even in difficult situations (68). Secondly, nurses with high work engagement would have positive emotional and cognitive states and experience pleasure and immersion at work, as well as feel pride and inspiration at work (69). Work engagement as a positive resource facilitates the improvement of negative affect. Therefore, there is a suggestion that managers may facilitate nurses' work engagement and thus reduce turnover intention. In the context of the normalization of the COVID-19 epidemic, nurses were involved in the fight against the epidemic more extensively, and more nurses were involved. Providing nurses with support and rewards that match the effort promotes nurses' sense of belonging to organizations. At the same time, social media during that period also provided robust support for medical staff, contributing to increased work engagement.

The current study verified the relationship between work engagement and sense of security and turnover intention and the mediating role of work engagement in the relationship between sense of security and turnover intention. The findings of this study may have considerable clinical implications. The implications are far-reaching in the event of a significant public safety event or a major incident such as an infectious epidemic. They may threaten the sense of security of health care system professionals (70). The study was designed to enhance measures of sense of security and work engagement and may decrease nurses' turnover intention. It requires health systems, hospital administrators, and society to join together to increase investment in nursing and build a network of security to promote the sustainability of the nurse workforce. In addition, our study validated and supplemented JD-R Model and COR theory (42, 45). This study could be precious to fill the role

of work engagement between sense of security and turnover intention in the Chinese context. Sense of security and work engagement as resources, primarily work engagement as an essential bridge between job resources and turnover intention, could help reduce turnover intention. The sense of security establishes an environment of mutual trust. A good sense of security would trigger individuals' tendency to avoid resource loss and motivation to create more work resources to dedicate more energy and effort input and increase their attachment to the organization, which provides a new perspective for reducing turnover intention.

Conclusion

This study found that sense of security and work engagement were negatively associated with turnover intention. Work engagement mediated the relationship between sense of security and turnover intention. The results suggest that managers should formulate policies and strategies to ensure and improve the interests and well-being of nurses and improve the practice environment to protect the sense of security of nurses, which is helpful to increase work engagement and reduce turnover intention. In addition, formulating strategies and measures to encourage and reward nurses in the work of expression and innovation, and improve work participation, will also help reduce the intention to leave, reduce the occurrence of turnover, and maintain the stability of the nurse team.

Limitation

Firstly, this study used a convenience sampling method considered simple, applicable, and appropriate for the study purpose. However, this method has the potential to produce sampling bias. Secondly, the subjects of this study are all nurses from hospitals at all levels in various regions of guangdong province, which can only represent the level of sense of security, work engagement, and turnover intention among nurses in Guangdong Province. Guangdong Province is a relatively developed province in China, and economic development may cause differences in different regions. Third, this sample was collected from September 2020 to May 2021, which may be biased. Finally, as this study was a cross-sectional survey, it cannot explain the causal relationship between relevant factors and turnover intention.

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

The studies involving human participants were reviewed and approved by the Ethics Committee of Guangdong Provincial People's Hospital (No. Ky2020-579-01). The patients/participants provided their written informed consent to participate in this study.

Author contributions

H-gH: conceptualization. Q-xH: methodology. YT: software, formal analysis, and original draft preparation. S-bW and LD: writing—review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1051895/full#supplementary-material

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Impact of the COVID-19 pandemic on risk of burn-out syndrome and recovery need among secondary school teachers in Flanders: A prospective study

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Background: Due to the COVID-19 pandemic, schools were closed, teachers had to teach from home and after a while, they had to return to the classroom while the pandemic was still on-going. Even before the pandemic, teachers were already more at risk for burn-out syndrome compared to the general population. Furthermore, not much research pertaining to this population has been carried out during the pandemic and so the impact of the pandemic on teachers' risk of burn-out syndrome and recovery need remains unclear. The aim of the current study was to fill this knowledge gap and map out the impact on risk of burn-out syndrome and recovery need at different time points during the pandemic.

Methods and findings: At baseline, 2,167 secondary school teachers in Flanders were included in this prospective study. Questionnaire data were obtained at ten different time points between September 2019 and August 2021. To assess risk of burn-out syndrome and its dimensions, the Utrecht Burn-out Scale for Teachers was administered. Need for recovery was assessed using questions adopted from the Short Inventory to Monitor Psychosocial Hazards. The results revealed an initial positive effect of the first lockdown (Mar/Apr 2020) with a decrease in risk of burn-out syndrome [Odds ratio (OR) Jan/Feb 2020–Mar/Apr 2020 = 0.33, $p < 0.001$], emotional exhaustion (EMM Jan/Feb 2020–Mar/Apr 2020 = −0.51, $p < 0.001$), depersonalization (EMM Jan/Feb 2020–Mar/Apr 2020 = −0.13, $p < 0.001$) and recovery need [Estimated marginal mean (EMM) Jan/Feb 2020–Mar/Apr 2020 = −0.79, $p < 0.001$]. No significant effect on personal accomplishment was found ($p = 0.410$). However, as the pandemic went on, higher risk of burn-out syndrome, emotional exhaustion, depersonalization and recovery need, and lower personal accomplishment were observed.

Conclusions: Despite the initial positive impact on risk of burn-out syndrome, its dimensions and recovery need, a negative long-term impact of the COVID-19 pandemic became visible. This study highlights once again the

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importance for interventions to reduce teachers' risk of burn-out syndrome, especially in such difficult times as a pandemic.

KEYWORDS

teaching staff, quarantine, lockdown, emotional exhaustion, depersonalization, personal accomplishment, mental health, longitudinal

Introduction

Besides the severe medical impact of COVID-19, the far-reaching measures taken in many countries to contain the virus also dramatically impacted our daily lives (1, 2), which in turn influenced our mental health (3, 4). Lockdowns were installed, which resulted in closure of schools, bars and restaurants and cancellation of all social and cultural events (5, 6). During the first weeks of the lockdown in Belgium (i.e., 16th of March 2020–20th of April 2020), schools were closed and no alternative way of teaching was organized. Later on, schools started online teaching, resulting in considerable implications for the teaching professionals. Teachers had to adapt to digitalized long-distance learning and teaching, and giving assignments through online platforms (5, 7, 8). After the first lockdown (i.e., March–April 2020), they moved to hybrid learning (i.e., a mixture of digital and face-to-face teaching), and thus they had to figure out how to combine online and face-to-face teaching, or teaching from home one week and in person the next week (9). Returning to the classroom also meant that teachers had to put themselves and their families at risk for infection while the pandemic was still ongoing (6, 10, 11).

During non-COVID times, it was found that teachers are particularly at risk for occupational stress that could lead to depression and burn-out syndrome (12–15). Burn-out syndrome rates in teachers are also significantly higher compared to other professions (15, 16). A study in Finland found 12% of teachers (across education levels) to experience stress and burn-out syndrome while this was only 8% in other professions (16). Moreover, in Belgium it was found that 21% of teachers (across education levels) reported burn-out symptoms compared to 13% in the general population (17). Higher burn-out syndrome rates also result in lower teacher wellbeing and higher absenteeism and turnover rates (15). A report about sick leave in Flemish secondary school teachers reported an average of 16.4 days of sick leave in 2019, of which 42.8% were due to psychosocial diseases such as burn-out syndrome (18). Different factors, such as perceived self-efficacy, job satisfaction and high social support, have been related to lower burn-out syndrome rates in teachers (19–21). Factors such as role ambiguity and high job demand on the other hand were found to be related to higher burn-out syndrome rates (19–21). Given the extra demands on teachers during the pandemic, they might be more at risk of burn-out syndrome compared to other professions.

Burn-out syndrome can be defined as a "prolonged response to chronic emotional and interpersonal stressors on the job, determined by three dimensions: emotional exhaustion, cynicism or depersonalization, and professional (in)efficacy or personal accomplishment" (22). Burn-out syndrome consists of three dimensions, namely, emotional exhaustion, depersonalization, and personal accomplishment (22). Emotional exhaustion refers to a lack of energy and depletion of an individual's emotional resources due to work (22). Depersonalization is defined as a mental distance from work or an impersonal attitude toward students and colleagues (22). Personal accomplishment refers to feeling competent in the work being carried out and the contact with others (22). Besides burn-out syndrome, recovery need should be equally considered, as before a burn-out syndrome is present, individuals are often not able to recover from stress anymore (23). After a while of having a high need for recovery while not being able to recover, the stress system adapts itself resulting in chronically high stress levels and, later on burn-out syndrome (23). As long as people are able to recover from the (stressful) day they have had, the risk for burn-out syndrome remains low but when they are not able to recover, this risk increases (23). Need for recovery and burn-out syndrome are thus closely related (23).

During the COVID-19-pandemic, a decline in wellbeing and an increase in mental health problems were observed in the general population (3, 4). During periods of less strict measures, wellbeing increased, and the number of mental health problems decreased (24, 25). A recent report by the World Health Organization found an increase of 25% in anxiety and depression during the pandemic (26). However, as soon as measures became stricter again, deteriorations in mental health were visible (24, 25). Even though measures and their strictness differed among countries, comparable results regarding the impact of the COVID-19 pandemic on mental health were found across borders (4, 24, 25).

In comparison with other at-risk groups, such as healthcare workers and youngsters, research on mental health of teachers during the pandemic is scarce. Previous studies focusing on mental health in teachers during the pandemic mainly used a cross-sectional design (10, 27–31), and thus precluding comparison with data collected prior to the pandemic. In general, these studies found increased levels of depression,

anxiety and high levels of stress during the pandemic (27, 31–37). However, a few studies also found a positive effect of the pandemic on teachers' mental health. This was mainly the case in the first few months of lockdown (11, 28, 38). Regarding burn-out syndrome levels in teachers during the pandemic, only a few studies, showing contradicting results, were found. A study by Pereira et al. (39) found teachers to have overall low levels of burn-out syndrome during the pandemic, whereas other studies showed increased levels of burn-out syndrome (40, 41) and its dimensions (35, 40, 42, 43). However, these studies were not able to compare the levels of burn-out syndrome during the pandemic to the levels of burn-out syndrome before. Hence, the effect of the pandemic on burn-out syndrome among teachers remains unclear, nor is there any evidence on recovery need, which may partially mediate the relationship between work stress and burn-out syndrome (23, 44).

This study presents unique natural experiment data on how the COVID-19 pandemic impacted risk of burn-out syndrome and its dimensions, and recovery need over a two-year timespan in Flemish secondary school teachers. The research objective of this study is to map out the changes in risk of burn-out syndrome and recovery need in secondary school teachers during the COVID-19 pandemic.

Methods

Participants

Flemish secondary school teachers were recruited in August and September 2019 using a non-probability cluster sampling approach. We contacted all secondary schools in Flanders (Belgium) through e-mail and telephone and invited them to participate. The Flemish Department of Education (*Vlaams Departement Onderwijs*), as well as all education networks (i.e., Flemish community schools, subsidized public schools, subsidized free schools) were involved in the recruitment and were asked to promote the study among all school principals and by posting advertisements on their social media. Furthermore, a convenient selection of schools in Flanders were visited to promote our study face-to-face. Schools that were willing to participate were asked to share an e-mail with a link to the online questionnaire with their teaching staff. The link to the online questionnaire was also spread through social media (e.g., Facebook and Twitter). Teachers not teaching in secondary education and teachers being in sick leave due to illness were excluded from the final sample.

Design and procedure

This prospective cohort study is part of another longitudinal study (investigating the association between risk of burn-out syndrome and energy balance related behavior), including six time points throughout the 2019–2020 school year [i.e., Sep/Oct (T0), Nov/Dec (T1), Jan/Feb (T2), Mar/Apr (T3), May/Jun (T4), and Jul/Aug (T5)]. For the purpose of the present study (i.e., measuring the (long-term) impact of COVID-19 on secondary school teachers' risk of burn-out syndrome and recovery need), four extra measurements were conducted during the 2020–2021 school year [i.e., Jan/Feb (T6), Mar/Apr (T7), May/Jun (T8), and Jul/Aug (T9)]. Measurements were not conducted in Sep/Oct and Nov/Dec of the 2020–2021 school year, as it was decided on an *ad hoc* basis to conduct additional measurements when it became clear that COVID-19 had not yet come to an end. The measurements T0, T1, and T2 of the school year 2019–2020 can be defined as pre-pandemic measurements, while all other measurements took place during the COVID-19 pandemic. The timeline of the measurements is displayed in Figure 1. At all time points, teachers were asked to complete an online questionnaire, including questions regarding burn-out syndrome, recovery need, socio-demographics and work-related factors. During each measurement period of two weeks, three reminders were sent to the non-responders, each on the 4th, 8th, and 11th day after activation of the online questionnaire.

Measures

Risk of burn-out syndrome

Risk of burn-out syndrome was assessed using the Dutch version of the validated Maslach Burn-out Inventory (MBI) (45): Utrechtse Burn-out Schaal voor Leerkrachten (UBOS-L; Utrecht Burn-out Scale for Teachers) (46). The UBOS-L is especially developed for teachers, administrators and other staff members working in educational settings and assesses the three dimensions of burn-out syndrome (i.e., emotional exhaustion, depersonalization, and personal accomplishment). The questionnaire consists of 22 items (8 items relate to emotional exhaustion, 7 items to depersonalization and 7 items to personal accomplishment) presented on a 7-point Likert scale ranging from 0 (never) to 6 (every day). An average score of each dimension was calculated by dividing each scale score by the number of items. The three dimensions' scores were then combined to calculate risk of burn-out syndrome. Individuals scoring high on emotional exhaustion (i.e., $>$ 2.5) and low on personal accomplishment (i.e., $<$ 3.56), or high on emotional exhaustion (i.e., $>$ 2.5) and high on depersonalization [i.e., $>$ 1.43 (males) and $>$ 2.00 (females)], are considered at risk for burn-out syndrome based on the UBOS-L norms (46). This validated questionnaire showed a good internal consistency (Emotional exhaustion: Cronbach's alpha = 0.91; Depersonalization: Cronbach's alpha = 0.73; Personal accomplishment: Cronbach's alpha = 0.85) and a good test-retest reliability (Emotional exhaustion: Pearson's

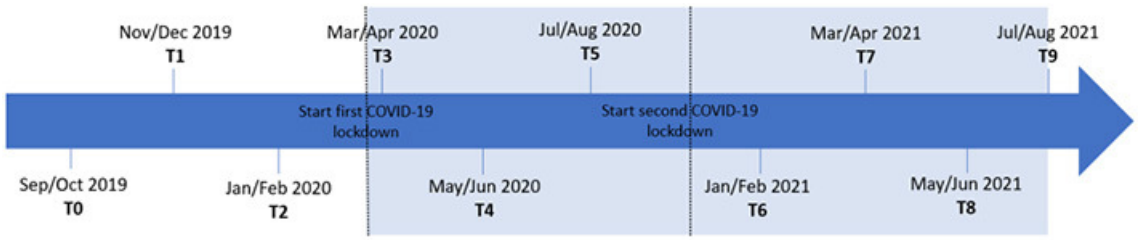

FIGURE 1
Timing of the measurements.

$r = 0.81$; Depersonalization: Pearson's $r = 0.65$; Personal accomplishment: Pearson's $r = 0.72$).

Recovery need

Recovery need was assessed by using the validated Short Inventory to Monitor Psychosocial Hazards (SIMPH) (47). Only the "recovery need" part of this questionnaire, including 5 yes (= 1)/no (= 0) questions, was used. A total score on 5 was calculated. Participants having a score ≥ 3/5 were classified in the category "high need for recovery". The part "recovery need" of this questionnaire showed a good reliability (Cronbach's alpha = 0.78).

Socio-demographics and work-related information

Socio-demographics include sex, age, highest diploma (i.e., secondary school degree, post-secondary school degree or certificate, Bachelor's degree, Master's degree, PhD degree), marital status (i.e., single, married, unmarried, living together with partner, divorced, widowed), having children (yes/no) and ethnicity (i.e., White–European, White–other, North-African, Afro-American, Indian, Middle-Eastern, South-Asian, Southeast-Asian, other). Work-related factors include grade (1st, 2nd, and 3rd), school type (i.e., general secondary education, technical secondary education, art secondary education, vocational secondary education), school, education network (i.e., Flemish community schools, subsidized public schools, subsidized free schools) and total teaching hours per week.

Ethics statement

This study was conducted in accordance with the Helsinki Declaration and its later amendments. Written informed consent was obtained from all participants prior to study enrolment. The study protocol was approved by the Medical Ethics Committee of the University Hospital (UZ Brussel, Brussels, Belgium; B.U.N. 143201940533).

Statistical analyses

All data were analyzed using R [R core Team, (48); R Studio version 3.6.2]. *P*-values <0.05 were considered statistically significant. Representativeness of the sample at baseline (T0) was assessed by conducting two proportions z-tests. Regarding the outcomes emotional exhaustion, depersonalization, personal accomplishment, risk of burn-out syndrome and recovery need, drop-out analyses between each consecutive time point and between each time point and baseline (T0) were conducted to assess possible differences between the drop-out and retention group, and thus possible selection bias of the retention group. Additionally, drop-out analyses regarding sex and age (which are non-fluctuating variables over time) were performed between each time point and baseline (T0).

Preliminary analyses checked if a multilevel model was advised (repeated measures clustered within participants, participants clustered within grades or school types or schools or education networks) by inspecting the amount of variance explained by each cluster. If necessary, one (or more) levels were dropped. For the continuous outcomes, general linear mixed models were applied using the R package lme4 (49). Regarding the categorical outcome, generalized linear mixed models (i.e., the Binominal model) were applied, also using the R package lme4 (49). Models were built bottom-up starting with the intercept only model, adding first level predictors and second level predictors. Confounders (i.e., age, sex, and teaching hours per week) that did not statistically impact the outcome were temporarily removed from the model and an ANOVA comparing the original model to the reduced model was performed. Furthermore, to decide upon which confounders had to be taken into account, Akaike Information Criterion (AIC) values were compared. When no statistical difference was found between the full and reduced model and the AIC did not improve, the confounder was removed from the model. The model selection procedure of each outcome is explained

in Appendix S1. To compare each time point to the subsequent time point, the contrasts were set to the successive difference of the treatment means.

Results

Two thousand one hundred ninety-seven secondary school teachers filled in the first questionnaire at the start of the larger study (T0; Sep/Oct, 2019), of which 1,741 provided their e-mail address and thus consented to be recontacted for each following time point. Of the initial 2,197 participants, 2,167 remained after exclusion (i.e., sick leave ($n = 23$) and not working in secondary education ($n = 24$). At the final time point (T9; Jul/Aug, 2021), three hundred thirty-nine participants completed the last questionnaire, which corresponds to a total drop-out rate of 84.4% across the complete measurement period. More detailed information regarding drop-out rates and the number of excluded participants across all time points can be found in Figure 2.

Sample characteristics

At baseline (T0), the sample included 2,167 participants consisting of 77.6% females and having a mean age of 42.0 ± 10.2 years. At the start of the school year, about 1/5 of secondary school teachers reported to be at risk for burn-out syndrome, while more than half reported to have a high need for recovery. More detailed information regarding sample characteristics can be found in Table 1.

Representativeness of the baseline sample

The baseline sample was not representative for sex (i.e., sample vs. population: males: 22.4 vs. 35.1%, females: 77.6 vs. 64.9%; $p < 0.001$), age groups 20–29 (i.e., sample vs. population: 12.2 vs. 14.8%; $p < 0.001$) and 30–39 (i.e., sample vs. population: 32.5 vs. 29.4%; $p = 0.001$) and education network (i.e., sample vs. population: Flemish community schools: 51.3 vs. 22.5%, subsidized free schools: 45.2 vs. 68.0%, subsidized public schools: 3.5 vs. 9.4%; $p < 0.001$). Details regarding the representativeness of the sample can be found in Appendix S2.

Drop-out analyses

Drop-out analyses between each consecutive time point showed a significant difference in recovery need between Jan/Feb 2020 (T2) and Nov/Dec 2019 (T1) between the retention and drop-out group. On average, drop-outs showed a higher recovery need (2.95 ± 1.67) than those who remained in the study (2.75 ± 1.74; $p = 0.0448$). Between other consecutive time points, no significant differences were found between both the retention and drop-out groups for any of the outcome measures, namely, risk of burn-out syndrome, emotional exhaustion, depersonalization, personal accomplishment and recovery need. More detailed information can be found in Table A2 in Appendix S2.

Drop-out analyses between each time point and baseline (T0) showed significant differences for age at all time points (all p-values < 0.001), with the retention group being slightly older (around 2–4 years, depending on the time point) than the drop-out group. More detailed information can be found in Table A3 in Appendix S2. From T6 onwards, the proportion of females was more or less 6% higher in the retention group compared to the drop-out group (all p-values < 0.05). At T1-5, no significant sex-differences between the retention and the drop-out group were observed. More detailed information can be found in Table A3 in Appendix S2.

Changes in risk of burn-out syndrome, burn-out syndrome dimensions and recovery need over time

Percentages of risk of burn-out syndrome and recovery need ranged from 20.8 to 30.8 and 34.0 to 61.4%, respectively, across all time points. More detailed information can be found in Appendix S3.

The estimated marginal means/odds ratios and standard errors as well as the estimates of the predictors for all outcomes across all time points can be found in Appendix S4. Three levels (repeated measures clustered within participants clustered within schools) were included in the models. The models including grade, school type and education network in which the respondent was teaching, showed that hardly any variance was explained by these levels. Therefore, these levels were not included in the final models, assuming that the time effect is invariant across grades, school types and/or education networks. All models include random intercepts for the participants.

From Sep/Oct 2019 to Nov/Dec 2019, risk of burn-out syndrome (OR = 1.83, $p < 0.001$), emotional exhaustion (Estimated marginal mean (EMM) = 0.10, $p = 0.001$), depersonalization (EMM = 0.15, $p < 0.001$) and recovery need (EMM = 0.14, $p = 0.010$) significantly increased, whereas personal accomplishment significantly decreased (EMM = −0.15, $p < 0.001$). From Nov/Dec 2019 to Jan/Feb 2020, only a significant increase in personal accomplishment was found (EMM = 0.08, $p = 0.009$). At the time of the first lockdown, so from Jan/Feb 2020 to Mar/Apr (2020), risk of burn-out syndrome (OR = 0.33, $p < 0.001$), emotional exhaustion (EMM = −0.51, $p < 0.001$), depersonalization (EMM = −0.13, $p < 0.001$) and recovery need (EMM = −0.79, $p < 0.001$)

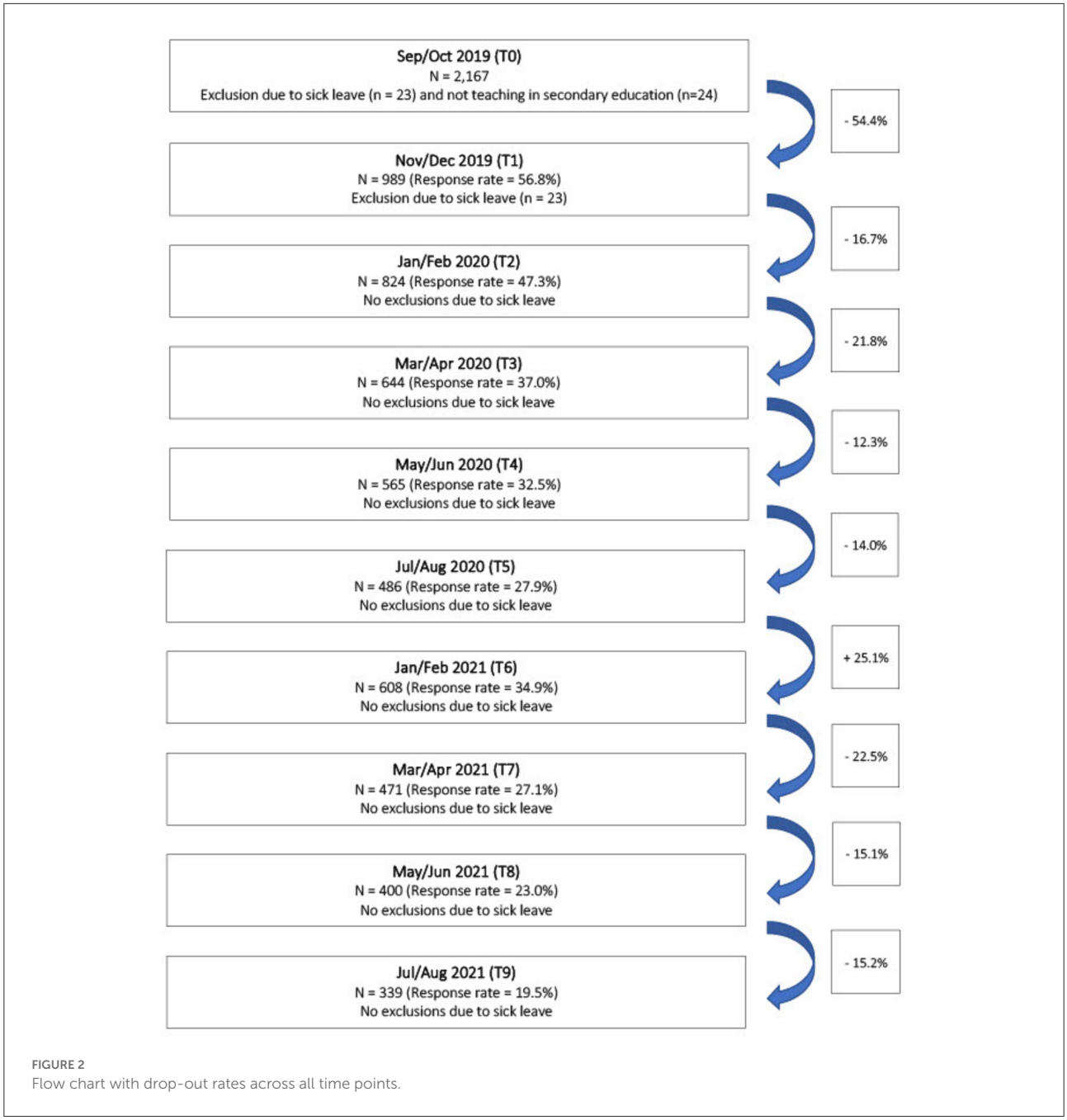

FIGURE 2
Flow chart with drop-out rates across all time points.

significantly decreased. From Mar/Apr 2020 to May/Jun 2020, risk of burn-out syndrome (OR = 2.61, $p < 0.001$), emotional exhaustion (EMM = 0.21, $p < 0.001$) and recovery need (EMM = 0.36, $p < 0.001$) significantly increased. From May/Jun 2020 to Jul/Aug 2020 (i.e., summer holidays 2020), risk of burn-out syndrome (OR = 0.32, $p < 0.001$), emotional exhaustion (EMM = −0.23, $p < 0.001$), personal accomplishment (EMM = −0.08, $p = 0.048$) and recovery need (EMM = −0.48, $p < 0.001$) significantly decreased. After the summer holidays, so from Jul/Aug 2020 to Jan/Feb 2021 (including the second lockdown), significant increases in risk of burn-out syndrome (OR = 5.30, $p < 0.001$), emotional exhaustion (EMM = 0.65, $p < 0.001$), depersonalization (EMM = 0.13, $p < 0.001$) and recovery need (EMM = 1.10, $p < 0.001$) were found. No significant differences were found from Jan/Feb 2021 to Mar/Apr 2021. From Mar/Apr 2021 to May/Jun 2021, only risk of burn-out syndrome (OR = 1.85, $p = 0.036$) and depersonalization increased significantly (EMM = 0.09, $p = 0.032$). Lastly, significant decreases were found from May/Jun 2021 to Jul/Aug 2021 (i.e., summer holidays 2021) for risk of burn-out syndrome (OR = 0.28, $p < 0.001$), emotional exhaustion (EMM = −0.60, $p < 0.001$), depersonalization (EMM = −0.12, $p = 0.005$),

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TABLE 1 Baseline sample characteristics (T0; $n = 2{,}167$).

	Mean ± SD; %
Sex (% females)	77.6
Age (years)	42.0 ± 10.2
Diploma (%)	
Secondary school degree	1.5
Post-secondary school degree	1.8
Bachelor's degree	59.2
Master's degree	37.6
PhD degree	0.9
Having an extra job (%)	13.8
Marital status (%)	
Single	13.1
Married	51.7
Unmarried	5.0
Living together with partner	23.9
Divorced	5.7
Widowed	0.6
Having children (%)	72.3
Ethnicity (%)	
White, European	99.0
White, other	0.1
North-African	0.3
Middle Eastern	0.4
Southeast Asian	0.1
Mixed	0.1
Education network (%)	
Flemish community schools	51.1
Subsidized free schools	45.0
Subsidized public schools	3.5
Mixed	0.4
Teaching hours per week (hours/week)	18.9 ± 5.0
Teaching experience (years)	14.8 ± 9.4
Risk of burn-out syndrome (%)	20.8
Need for recovery (%)	55.7

SD, standard deviation.

personal accomplishment (EMM = −0.16, $p = 0.002$) and recovery need (EMM = −1.12, $p < 0.001$). All changes over time in risk of burn-out syndrome, its dimensions and recovery need are displayed in Figure 3.

Discussion

This prospective study investigated changes of risk of burn-out syndrome, its dimensions and recovery need in secondary school teachers prior to and during the COVID-19 pandemic including ten different time points. Across all time points, we observed a high percentage of teachers being at risk for burn-out syndrome (ranging between 20.8 and 30.8%) and having a high recovery need (ranging between 34.0 and 61.4%). An initial positive effect of the pandemic was found with a decrease in risk of burn-out syndrome and recovery need. However, risk of burn-out syndrome and recovery need showed increased values as the pandemic went on.

Overall, about 1/5–1/3 of teachers in the current study were at risk for burn-out syndrome. This is in line with a recent report on burn-out in Flanders where 21% of teachers reported burn-out symptoms in 2019. This is higher than in the general Flemish population with 13% of individuals reporting burn-out symptoms (17). Previous research indeed indicated that teachers have more burn-out symptoms compared to the general population (15, 16). A recent Belgian report by the Sociaal-Economische Raad van Vlaanderen (17) also highlighted that in 2019 mainly individuals in care and education reported more burn-out symptoms. Moreover, our results showed that the percentages of teachers with a high risk of burn-out syndrome and high need for recovery follow an almost identical pattern over time. This may be worrying, as a high risk of burn-out syndrome is more alarming when also recovery need is high (23).

Overall, the first lockdown had a positive effect on teachers' wellbeing. In the initial stages of the COVID-19 pandemic, significant decreases in risk of burn-out syndrome, emotional exhaustion, depersonalization and recovery need were found. During the first lockdown (i.e., Mar/Apr 2020), schools were closed and teachers did not have any educational tasks. This is also in line with the study by Hilger et al. (38) who found a decrease in fatigue and the demanding aspects of the teaching job. It should be mentioned that these results are based on measurements conducted in May 2020 and took place in Germany, where the COVID-19 measures differed slightly from those in Belgium.

However, after the first lockdown, increases in risk of burn-out syndrome, emotional exhaustion, and need for recovery were observed. This may be due to the fact that teachers had to adapt to a new way of teaching (i.e., hybrid teaching). Furthermore, they were putting their own health and the health of their students at risk. Moreover, due to the lockdown measures they were not able to lean on their social network to decompress. These findings are in line with other research demonstrating an increase in anxiety, burn-out syndrome and a decrease in general quality of life when teachers had to return to the classroom while the pandemic was still ongoing (10, 11).

Despite these increases, summer vacations had a clear positive impact on teachers' risk of burn-out syndrome and recovery need. Both during the summer holiday of 2020 and 2021, a clear decrease in risk of burn-out syndrome and need for recovery was visible. During these months, measures were less strict and teachers did not have to teach. Nevertheless, burn-out syndrome level and recovery need

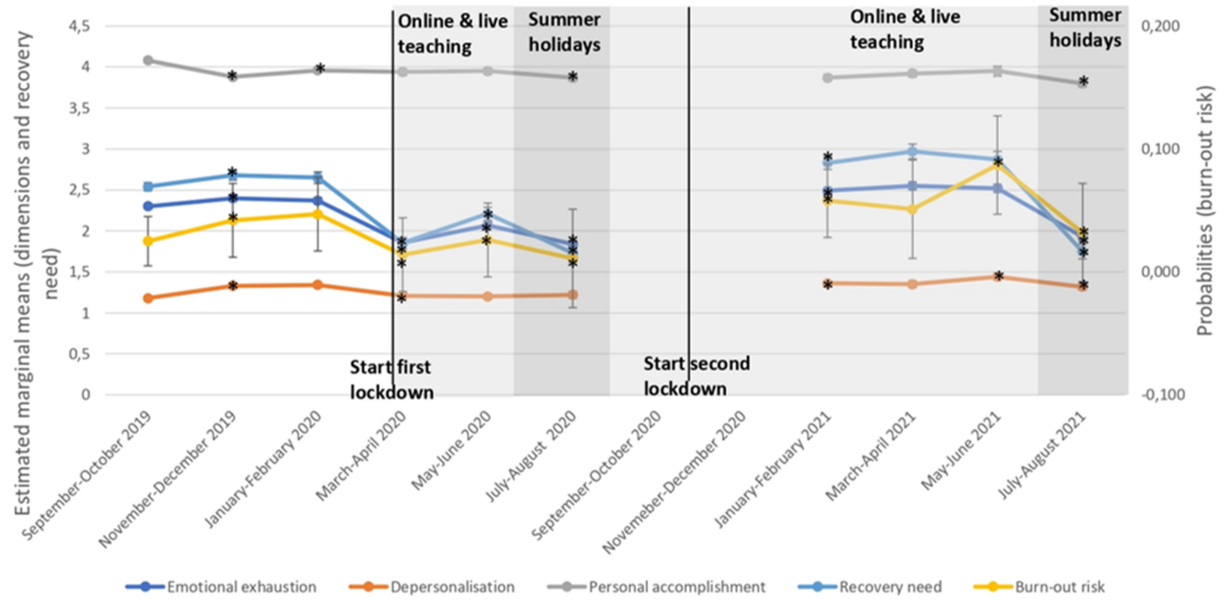

FIGURE 3
Changes in burnout risk, burnout dimensions and recovery need over time. *Time point significantly different ($p < 0.05$) from previous time point.

seemed to be higher during the second summer holidays (2021), showing a possible negative long-term impact of the COVID-19 pandemic (summer holidays 2020 vs. 2021: risk of burn-out syndrome: 14.6 vs. 20.9%; recovery need: 34.0 vs. 39.8%). Moreover, the percentage of teachers having risk of burn-out syndrome during the summer holidays 2021 (i.e., 20.9%) was at the same level as the percentage in Sep/Oct 2019 (i.e., 20.8%). These findings suggest that teachers suffered from an additional mental burden due to the lockdown measures which disabled them to recover properly during the summer recess. In contrast to the other burn-out syndrome dimensions, a negative impact of the summer vacation on personal accomplishment was found, as a significant decrease at both time points (i.e., summer vacation 2020 and 2021) was observed. We reason that this might be related to the prospect of going back to teaching face-to-face while the pandemic was still going on. Moreover, when teachers are not teaching and thus decompressing, they might start to self-reflect and doubt themselves opposed to when they get immediate validation while they are teaching. These findings are in line with other research showing teachers to have high levels of stress and anxiety about the anticipation of schools reopening (10, 40, 50).

The first time point of school year 2020–2021 (i.e., T6; Jan/Feb 2021) again showed significant increases in risk of burn-out syndrome, emotional exhaustion, depersonalization and recovery need. It was shown in the general population that wellbeing and mental health decrease when lockdowns go on for longer periods of time (25). Our findings clearly indicate that there was a negative long-term impact of the COVID-19 pandemic on teachers' mental health.

An important strength of the present cohort study is its prospective time series design enabling to assess the effect of the COVID-19 pandemic on risk of burn-out syndrome, its dimensions and recovery need in secondary school teachers. These natural experiment data are unique and give a lot more information compared to any (retrospective) cross-sectional studies. Moreover, as the installation of a control group during such a pandemic is not possible, we aimed to reduce bias by installing several (control) measurement points over time. It should be mentioned though, that without a control group, it is still difficult to unravel causal effects of the pandemic from natural fluctuations throughout the school year.

A first limitation to this study is the fact that no data were collected during September–October 2020 and November–December 2020, as the final moment of data collection of the initial study was planned for August 2020. Although not intended, we decided (on an *ad hoc* basis) to prolong the initial study protocol and monitor the long-term effects of the pandemic. As the school year was already up and running, we were only able to monitor from January onwards.

Second, selection bias is likely to be present. Teachers were recruited on a voluntary basis, and thus teachers having high risk of burn-out syndrome might have been less willing to participate in this study. This may have resulted in an underestimation of the prevalence of risk of burn-out syndrome and recovery

need. Although we tried to address this issue by sampling participants from all secondary schools in Flanders, our study sample consisted of more females and less teachers between 20 and 29 years old compared to the teaching population in secondary education in Flanders. On the one hand, this may have resulted in a higher prevalence of risk of burn-out syndrome, as females are more susceptible for burn-out syndrome (51). On the other hand, a meta-analysis showed a small and negative correlation between age and burn-out syndrome, possibly resulting in a small underestimation of risk of burn-out syndrome (52). Nevertheless, this small underestimation may have been canceled out as our sample also consisted of more teachers between 30 and 39 years old compared to the teaching population in Flanders. Although generalizability may be compromised, it is difficult to predict how (i.e., in which direction) our results were affected by the observed selection bias. Similarly, the changes over time of risk of burn-out syndrome, its dimensions and recovery need may have been affected by the fact that the proportions of the sample regarding sex and age changed over time. Our drop-out analyses showed that, at each time point, the retention group consisted of more female as well as older teachers compared to the drop-out group. Again, both proportional changes in sex and age may have influenced the results (probably in the opposite direction) as they are both associated with burn-out (51, 52).

Third, factors such as technostress (i.e., fear of using technology), COVID-19 fear and seasonal conditions may also have had an impact on mental wellbeing, and thus the changes in burn-out syndrome risk and recovery need may not be solely caused by the pandemic. Research suggested that more technostress may cause higher levels of emotional exhaustion and lower levels of personal accomplishment (53). Despite the fact that teachers had to use technology more often in the beginning of the pandemic, which may have resulted in more technostress, the current study found an initial positive effect of the pandemic on emotional exhaustion and no effect on personal accomplishment. Furthermore, multiple studies found a positive relationship between COVID-19 fear and burnout (54–56). Since teachers were among the first to return to work in person, it would have been interesting to take this factor into account. Moreover, we also found fluctuations of burn-out syndrome risk and recovery need over time even before the pandemic. It is likely that there are periods of higher levels of burn-out syndrome risk and recovery need during a normal school year, possibly influenced by the weather and seasonal conditions. Previous research showed the weather to have an impact on depression (57), job satisfaction and wellbeing (58), while seasonal conditions may influence anxiety (59) and depression (59, 60).

Fourth, since COVID-19 measures were different among countries, and as our study only included secondary school teachers, our findings may not be generalized to other countries, nor teaching populations.

Finally, self-report questionnaires were used to measure risk of burn-out syndrome (i.e., UBOS-L) and recovery need (i.e., SIMPH), possibly resulting in social desirability bias. However, we do not expect this to have influenced the results as this way of measuring was applied systematically across all time points.

Conclusions

During the initial stages of the pandemic, positive lockdown effects were visible; a lower percentage of teachers were at risk for burn-out syndrome, decreases in emotional exhaustion and depersonalization were found and less teachers showed a high need for recovery. However, in the long-term, negative effects became visible, as increases in risk of burn-out syndrome, emotional exhaustion, depersonalization and recovery need were observed. Although summer vacations should help to reduce the risk of burn-out syndrome and need for recovery, burn-out levels and recovery need seemed to be higher during the second summer holidays (2021) compared to the first one (2020), suggesting elevated mental burden due to the ongoing pandemic and related lockdown measures. This study highlights once again the importance for interventions to reduce secondary school teachers' risk of burn-out syndrome and recovery need, especially in such difficult pandemic times. We advise policy makers and schools to focus on developing tools and interventions that cushion the impact of the pandemic on mental wellbeing in teachers. Moreover, the current teacher training course should be adapted to include tools on how to teach online, while practicing teachers should be offered training courses on this topic. This will allow teachers to feel more comfortable to teach online in case of school closures. Lastly, it would benefit teachers to gain the necessary know-how on how to deal with stress and to keep their recovery need low.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Medical Ethics Committee of the University Hospital Brussels. The patients/participants provided their written informed consent to participate in this study.

Author contributions

HDL, YV, EVH, and TD wrote and revised this manuscript. KDM and EZ reviewed this manuscript. YV collected the data for this manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1046435/full#supplementary-material

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The prevalence of functional gastrointestinal disorders related symptoms and the association with working place among healthcare workers who were in the fighting against COVID-19 in regional China

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Objectives: To investigate the prevalence of functional gastrointestinal disorders (FGIDs) related symptoms among healthcare workers (HWs) who were in the fighting against COVID-19 in Nanjing of China, and further to examine the association between working place and FGIDs-related symptoms among HWs during the period of COVID-19 epidemic.

Methods: An online anonymous survey was conducted among those HWs without history of FGIDs, who took part in the fighting against the COVID-19 epidemic between July and September of 2021 in Nanjing, China. All the 15 FGIDs-related symptoms included in the Rome IV diagnostic questionnaire for adults were investigated in this study. The outcome variable was the presence of FGIDs-related symptoms ("Yes" or "No"), while the independent measure was participants' working place ("in-ward" or "out-ward"). Logistics regression models were applied to calculate odds ratios (ORs) and 95% confidence intervals (CIs) to assess the association of working place with FGIDs-related symptoms among those healthcare workers.

Results: Totally, 336 eligible participants completed the survey. The prevalence of FGIDs-related symptoms was 48.8% (95%CI = 43.4%, 54.3%) among overall participants, with 40.7% (95%CI = 33.14%, 48.71%) and 56.3% (95%CI = 48.59%, 63.73%) for in-ward and out-ward HWs, respectively. Compared to their in-ward counterparts, those out-ward HWs were at a 1.88-fold likelihood (95%CI = 1.22, 2.89) to experience FGIDs-related symptoms during the period of fighting against the COVID-19 epidemic. After adjustment for potential confounders, such a positive association attenuated but still remained significant.

Conclusions: A high prevalence of FGIDs-related symptoms was observed among those HWs who were without history of FGIDs during the fighting against COVID-19, and out-ward HWs were at a significantly higher risk to experience FGIDs-related symptoms relative to their in-ward counterparts in regional China. It has important implications that particular attention shall be paid to functional gastrointestinal issues for healthcare workers, especially those who are at uncertain risks of infectious diseases, when they participate in response to public health emergencies in future.

KEYWORDS

COVID-19, function gastrointestinal disorders related symptom, healthcare worker, prevalence, China

Introduction

Functional gastrointestinal disorders (FGIDs) are non-organic diseases, usually referring to common syndromes with either upper or lower gastrointestinal (GI) symptoms, which are diagnosed based on the Rome IV criteria in clinical practice (1, 2). It has been well documented that psychosocial factors, including anxiety, stress, fatigue and depression, are the main risk factors of FGIDs (3–6). During the epidemic of COVID-19, elevated prevalence of FGIDs-related symptoms was observed among community residents than that under the usual circumstance before the outbreak (7). Moreover, an increased prevalence of FGIDs-related symptoms was also recorded within healthcare workers (HWs) who took part in the fighting against COVID-19 in China (8). The health states of healthcare workers are crucial for them to maintain good performance in health service activities/behaviors, so it is of particular interest to further investigate the occurrence of FGIDs-related symptoms among healthcare workers who are participating in the fighting against COVID-19.

Since the first wave of COVID-19 outbreak was contained in March of 2020, China has developed an effective management strategy, namely "zero tolerance for local transmission (dynamic zero-COVID)", to tackle local outbreaks of COVID-19 (9). This strategy worked very effective for limiting the spread of COVID-19 within a small community or a city and then eliminating it completely in two or three latent periods, and consequently community residents lived relatively normal life in China (10). Based on this COVID-19 control strategy, healthcare workers involved in the fighting against COVID-19 were required to be managed with a closed-loop mode in China, which referred to a special system that, during the entire duration of fighting against COVID-19, all the healthcare workers: (1) would be accommodated in separate rooms of isolated hotels (one person, one room), (2) worked within a designated place (e.g., hospital wards, fever clinics, quarantine rooms, labs for testing SARS-CoV-2, or field sites for sample collection) and were not allowed to visit un-designated sites, (3) could not contact each other face-to-face without protective suits, and (4) would be quarantined for at least 2 weeks before returning to regular life (11).

For HWs, they were also vulnerable to SARS-CoV-2, even though they used personal protective equipment when they were fighting against COVID-19 (12, 13). Moreover, the HWs faced some psychological problems, including stress, depression, etc, brought by the SARS-CoV-2 epidemic (14). For Chinese HWs under the closed-loop management for fighting against COVID-19, they would face much more psychological issues than usual, e.g., fear and fatigue in addition to stress and anxiety (15, 16). Meanwhile, a positive association of these psychological factors with FGIDs-related symptoms was observed among healthcare workers during the period of fighting against COVID-19 in China (8). However, in the study on healthcare workers' psychological stress and FGIDs-related symptoms in China, participants were limited to physicians and nurses (in-ward HWs) who were responsible for treating COVID-19 patients in isolated hospital wards regardless of their FGIDs history (8). On the other hand, in addition to physicians and nurses who worked within hospital wards, there were a lot of healthcare workers involved in the fighting against COVID-19, including those who worked at fever clinics, quarantine rooms, labs for testing SARS-CoV-2 and field sites for specimen collection. Obviously, these healthcare workers (out-ward HWs) who took part in the fighting against COVID-19 at designated places outside hospital wards were also at a risk of SARS-CoV-2 and faced psychological stress too.

These two categories of healthcare workers would contact different subjects: in-ward HWs would directly contact the diagnosed COVID-19 patients in hospital wards, while out-ward HWs would closely reach those people who might be or might not be infected with SARS-CoV-2. These two types of HWs were at risks of COVID-19 with different natures. From psychological perspectives, in-ward HWs faced certain risks of COVID-19, while out-ward HWs had to face uncertain/unpredictable COVID-19 circumstances. Meanwhile,

uncertainty might produce more stress, anxiety and fear for people compared to certainty (17). It has been observed among Israelis that those participants who could not ensure whether being infected with SARS-CoV-2 tended to report negative psychological emotions relative to those who were certain that they had been infected with the virus (18). Thus, it is reasonable to assume that the occurrence rate of FGIDs-related symptoms might be different between the in-ward and out-ward healthcare workers, as they, respectively, faced certain and uncertain risks of COVID-19 and thus suffered from different levels of psychological stress.

Although the "dynamic zero-COVID" strategy worked well, China still saw local outbreaks of COVID-19 occasionally. For example, a COVID-19 epidemic (Nanjing epidemic) occurred with 9 patients confirmed on July 20 of 2021 and lasted 19 days in Nanjing, China (19). The initial 9 patients were international air-flight cabin cleaners and finally 329 patients in total, infected with delta variant strains, were identified in the Nanjing COVID-19 epidemic (19). To fight against this epidemic, all the dispatched healthcare workers were administered with different tasks under the closed-loop management system from July 20 to September 2 in 2021 after a specific emergency response was activated (19).

To better understand the prevalence of FGIDs-related symptoms among healthcare workers who took part in the fighting against COVID-19, a study was conducted among those healthcare workers during the period of COVID-19 epidemic in Nanjing, China. The aims of this study were: (1) to investigate the prevalence of FGIDs-related symptoms among the healthcare workers who were without FGIDs history; and (2) to test the hypothesis that out-ward HWs were more likely to experience FGIDs-related symptoms compared to those in-ward HWs during the period of fighting against COVID-19 in regional China.

Methods

Study design and participants

This self-administered online anonymous survey was conducted on September 14 of 2021. The eligible participants were all the healthcare workers: (1) who took part in the fighting against Nanjing COVID-19 epidemic in 2021 and were willing to participate in the study, (2) who were under the closed-loop management, and (3) who reported no history of FGIDs. These healthcare workers included physicians, nurses, lab technicians and administrative staffs. All of them worked at hospital wards\ICUs, fever clinics, quarantine rooms, labs for testing SARS-CoV-2 or field sites for specimen collection according to their specific working tasks.

The sample size was estimated based on the study design, expected statistical power and estimated prevalence of FGIDs-related symptoms among healthcare workers without FGIDs history. The study was designed as a cross-sectional survey and statistical power was expected as 90%. Regarding the estimated prevalence of FGIDs-related symptoms, there was no figure available for healthcare workers without FGIDs history. Then, the prevalence of FGIDs-related symptoms observed among overall healthcare workers during COVID-19 pandemic in 2020 in Wuhan city (83.2%) and that among general Chinese adults (34.4%) could be used to presume the prevalence of FGIDs-related symptoms as ∼48.8% (83.2–34.4%) among healthcare workers without FGIDs history (8, 20). Thus, with additional consideration of safety efficiency, the sample size was finally determined as ∼290 in our study.

Written informed consent form was prepared as the second page of the online questionnaire. Each eligible participant would read this form and then decided whether or not to take part in the survey. If he/she was willing to join the survey, the participant must ensure he/she had read and understood all the information presented in the consent form. Otherwise, the survey could not be activated. This study was reviewed and approved by the Ethics Committee of The Affiliated Nanjing Hospital of Nanjing Medical University. All methods were performed in accordance with relevant guidelines and regulations based on the Declaration of Helsinki.

Data collection

All the healthcare workers were classified into different working teams based on their working sites (one site, one team) during the period of fighting against Nanjing epidemic of COVID-19. The members within a working team were organized into a WeChat group for easy communication and coordination with each other (one working team, one WeChat group), resulting in totally 15 WeChat groups. Each team member was usually registered with only one WeChat group. However, some administrative staff and chief/senior professionals would be involved in two or more WeChat groups, as they were responsible for supervising different working teams with similar tasks. For example, one chief physician might be in charge of two or more COVID-19 patient wards.

The survey instrument was developed as an internet-based questionnaire using the platform of SO-JUMP, a free-to-use internet-based survey questionnaire provider in China (21). The online questionnaire collected information on participants' socio-demographic, years of professional employment, daily time with protective suit, working duration of involvement in the fighting against Nanjing COVID-19 epidemic, night shift, history of selected chronic diseases (diabetes, hypertension and COPD) and all the 15 FGIDs-related symptoms included in the Rome IV questionnaire. On the first page of the questionnaire, survey purposes, summary description of survey contents, inclusion criteria, the time it would take to complete, and

attention points were described, while written informed consent was shown on page two. Only those participants who signed the consent form (ticked the option of "YES" to question: I have read and understood all the information presented in this consent form and am willing to participate in this study) could start and complete the entire survey. On the last page, each participant was still asked to make sure that he/she had properly responded to each question item, although each question was designed as compulsory item to warrant no missing answers. Only after completing this step, he/she was able to click the button "SUBMIT" to finish the survey.

Additionally, considering that: (1) one healthcare worker might join in two or more WeChat groups, and (2) this was an anonymous survey, one reminding sentence was prepared as a separate short paragraph on page one. It reads that "Please kindly note that one person is expected to participate in this survey one time only. If you joined in two or more WeChat groups and received this survey invitation in different WeChat groups, please respond to it only once". In this way, "one person, one response" would be maximally warranted in the present study. The survey was conducted on September 14, the second day that the last team left the closed-loop management for 2 weeks quarantine before returning to their regular job/life. On the survey day, the e-questionnaire was distributed to each WeChat group and all eligible members were invited to take part in the survey. The participants' selection and survey procedure were illustrated in Figure 1.

Study variables

The Rome IV diagnostic questionnaire for adult FGIDs was developed for physicians to clinically diagnose FGIDs cases or investigators to define FGIDs cases in epidemiological surveys (22). For diagnosing/defining FGIDs cases, this Rome IV questionnaire includes totally 89 question items that consist of FGIDs-related symptoms, presence frequency of the FGIDs-related symptoms, onset time of FGIDs-related symptom, etc. (22). However, of these 89 questions in the Rome IV questionnaire, only 15 items ask about FGIDs-related symptoms regarding esophagus, stomach/intestines, gallbladder and pancreas, rectum and anal canal (22). In detail, these 15 FGIDs-related symptoms are: sensation of a lump or foreign body in the throat, dysphagia, retrosternal chest pain, heart burn, postprandial fullness, early satiation, early satiation that prevents finishing a regular meal, nausea, vomiting, reflux, belching, abdominal pain, constipation, diarrhea, bloating and incontinence (22). In our study, the purpose was to investigate the prevalence of FGIDs-related symptoms and to examine the association of working place with FGIDs-related symptoms among healthcare workers, not to determine the cases of FGIDs. Therefore, it was not necessary to include all the 89 question items of The Rome IV questionnaire in our study. It was appropriate that these FGIDs-related symptoms were used as outcome events in our survey. Each participant was asked to respond to the question "From the beginning you took part in the fighting against this wave of COVID-19 epidemic till you left the closed-loop management, during this whole time period, did you ever experience, at least once, any of the following symptoms?". All participants were asked to carefully respond to the 15 symptom items one by one.

The outcome variable was the prevalence of FGIDs-related symptoms. The positive outcome event was defined as self-reported experience of any of the 15 FGIDs-related symptoms by participants when they took part in the fighting against Nanjing COVID-19 epidemic in 2021. Therefore, participants were classified as: "Experienced FGIDs-related symptoms ("Yes")" or "Did not experience any FGIDs-related symptoms ("No")" in the analysis.

Independent measure was working places that healthcare workers were assigned to during their involvement in the fighting against this wave of COVID-19 epidemic. Participants were then categorized into: "in-ward HWs" or "out-ward HWs" in our analysis. "in-ward HWs" referred to healthcare workers who were responsible for treating confirmed COVID-19 patients in isolated hospital wards/ICUs, while "out-ward HWs" were all those who worked at places other than hospital wards/ICUs, including fever clinics, quarantine rooms, labs for testing SARS-CoV-2 and field sites for specimen collection.

The covariates adjusted for in the analysis were participants' age (<30, 30–39 or 40+ years), gender (men or women), educational level (junior college, undergraduate or graduate), professional title (junior, medium-grade or senior), occupation (physician, nurse or others), years of professional employment (1–5, 6–10, 10–20, 20–30, or 31+ years), daily time with protective suit (2.0–2.9, 3.0–3.9, 4.0–4.9, or 5.0+ h), continuous working days of involvement in fighting against this epidemic (7, 14, 21, 30, or 31+ days), night shift ("Yes" or "No"), history of selected NCDs ("Yes" or "No").

Statistical analysis

The Chi-square test was applied to compare differences in working places and prevalence of FGIDs-related symptoms between participants by selected socio-demographic characteristics. The prevalence of FGIDs-related symptoms was reported as percentage and 95% confidence interval (95% CI). Three logistic regression models were introduced to compute odds ratios (OR) and 95% CIs for assessing the associations between working place and FGIDs-related symptoms. Model 1 was an unvariate analysis with working place as the independent variable only. Model 2 was a multivariate analysis with working place as the independent variable and adjustment for participants' age, gender and educational level. And model 3 was also a multivariate analysis

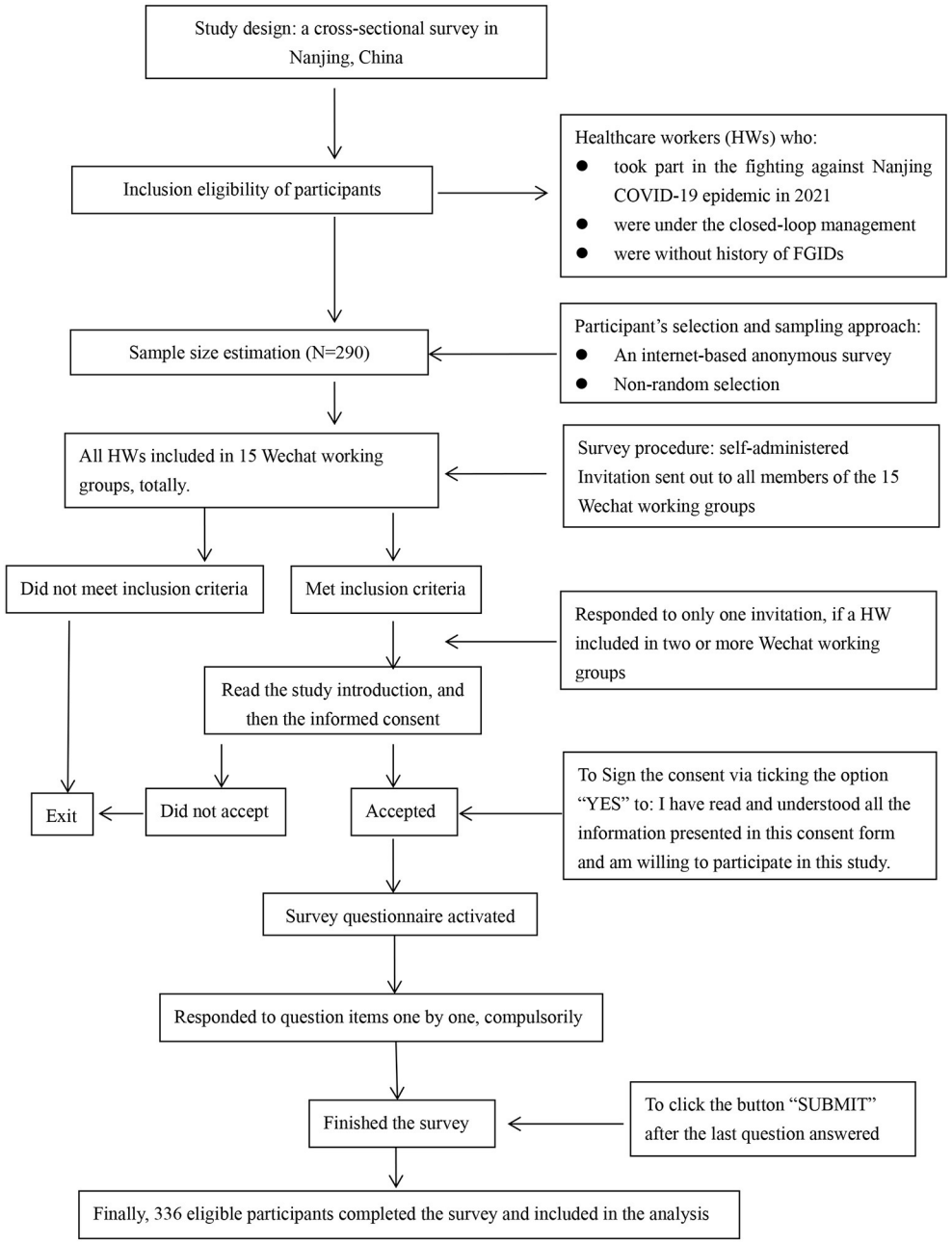

FIGURE 1
Flowchart of participant's selection and survey procedure in the study.

with working place as the independent variable and further consideration of participants' occupation, professional title, years of professional employment, daily time with protective suit, continuous working days of involvement in fighting against Nanjing COVID-19 epidemic, night shift, history of selected NCDs in addition to those controlled for in Model 2. Two-sided statistical significance was set as $P < 0.05$. Data were entered using EpiData 3.1 (The EpiData Association 2008, Odense, Denmark), and analyzed with SPSS 21.0 (IBM Corp, Armonk, NY, USA).

Results

In the study, totally 336 healthcare workers from all the 15 WeChat groups completed the survey. Due to the nature

TABLE 1 Selected characteristics of participants in the study.

		Participants		Work places				*p*-value*
				Out-ward		In-ward		
		N	%	*n*	%	*n*	%	
Overall		336	100	174	51.8	162	48.2	
Age (years)								
	<30	176	52.4	92	52.9	84	51.9	
	30–39	133	39.6	65	37.4	68	42.0	0.40
	40+	27	8.0	17	9.8	10	6.2	
Gender								
	Man	68	20.2	34	19.5	34	21.0	0.74
	Woman	268	79.8	140	80.5	128	79.0	
Educational level								
	Junior college	36	10.7	18	10.3	18	11.1	
	Undergraduate	240	71.4	120	69.0	120	74.1	0.37
	Graduate	60	17.9	36	20.7	24	14.8	
Professional title								
	Junior	211	62.8	105	60.3	106	65.4	
	Medium-grade	99	29.5	54	31.0	45	27.8	0.60
	Senior	26	7.7	15	8.6	11	6.8	
Occupation								
	Physician	78	23.2	55	31.6	23	14.2	
	Nurse	225	67.0	87	50.0	138	85.2	<0.01
	Others	33	9.8	32	18.4	1	0.6	

*Chi-square test.

of anonymous survey, it was not possible for us to gather personal identifications from all WeChat members, and thus we had no information on those who did not participate in our survey. Consequently, we were not able to make comparison of the potential difference in personal characteristics between the respondents and those who did not take part in the survey. Table 1 presented the selected characteristics of participants in the study. Among the 336 respondents, there were 52.4% participants aged <30 years, 79.8% of women, 71.4% with undergraduate education, 62.8% with junior professional title and 67.0% of nurses. There was no difference in out-ward and in-ward participants in terms of age, gender, educational level and professional title, while the proportion of nurses was significantly higher among in-ward than out-ward HWs ($p < 0.01$).

Table 2 showed the prevalence of FGIDs-related symptoms among participants in the study. The overall prevalence of FGIDs-related symptoms was 48.8% (95%CI = 43.4%, 54.3%) among the study population. There was no difference in prevalence of FGIDs-related symptoms examined between participants' categories by age, gender and professional title. Participants who obtained graduate educational level tended to report FGIDs-related symptoms (junior college vs. undergraduate vs. graduate: 10.7 vs. 71.4 vs. 17.9%; $p = 0.02$), and the lowest prevalence of FGIDs-related symptoms was recorded among nurses (physician vs. nurse vs. others: 56.4 vs. 44.0 vs. 63.6%; $p = 0.03$). However, the difference in prevalence of FGIDs-related symptoms between participants' sub-groups by education and occupation became non-significant after all the covariates were adjusted for in our analysis.

Table 3 displayed the association between working place (out-ward vs. in-ward) and FGIDs-related symptoms among study participants. Among the 162 in-ward HWs who were at certain risks of COVID-19, 40.7% (95%CI: 33.14%, 48.71%) reported the presence of FGIDs-related symptoms, while 56.3% (95%CI: 48.59%, 63.73%) ever experienced FGIDs-related symptoms within those 174 out-ward HWs who faced uncertain risks of COVID-19. Those out-ward HWs were at a 1.88-fold likelihood (95%CI: 1.22, 2.89) to experience FGIDs-related symptoms compared to their in-ward counterparts. Furthermore, after adjustment for potential confounders, such a positive relationship between working place (out-ward vs. in-ward) and FGIDs-related symptoms attenuated but still remained significant (Model 2: OR = 1.85, 95%CI = 1.19, 2.89; Model 3: OR = 1.77, 95%CI = 1.01, 3.13) among participants in the study.

TABLE 2 The prevalence of FGIDs-related symptoms among participants in the study.

		Participants		FGIDs-related symptoms				*p* value*
				Experienced		Did not experience		
		N	%	*n*	%	*n*	%	
Overall		336	100	164	48.8	172	51.2	
Age (years)								
	<30	176	52.4	79	44.9	97	55.1	
	30–39	133	39.6	72	54.1	61	45.9	0.27
	40+	27	8.0	13	48.1	14	51.9	
Gender								
	Man	68	20.2	27	39.7	41	60.3	0.09
	Woman	268	79.8	137	51.1	131	48.9	
Educational level								
	Junior college	36	10.7	11	30.6	25	69.4	
	Undergraduate	240	71.4	117	48.8	123	51.2	0.02
	Graduate	60	17.9	36	60.0	24	40.0	
Professional title								
	Junior	211	62.8	96	45.5	115	54.5	
	Medium-grade	99	29.5	54	54.5	45	45.5	0.29
	Senior	26	7.7	14	53.8	12	46.2	
Occupation								
	Physician	78	23.2	44	56.4	34	43.6	
	Nurse	225	67.0	99	44.0	126	56.0	0.03
	Others	33	9.8	21	63.6	12	36.4	

*Chi-square test.

Discussion

In this internet-based population study, we aimed to investigate the prevalence of FGIDs-related symptoms and to examine the association between working place and FGIDs-related symptoms among healthcare workers who were involved in the fighting against COVID-19 in the summer of 2021 in Nanjing of China. It was observed that, overall, 48.8% of the healthcare workers ever experienced at least one FGIDs-related symptom. Moreover, it was also examined that those who worked outside hospital wards were more likely to experience FGIDs-related symptoms relative to their counterparts who were within hospital wards responsible for treating COVID-19 patients.

It is really difficult for us to make comparison of the prevalence of FGIDs-related symptoms between our study and others, as there are very few similar studies available investigating FGIDs-related symptoms among HWs and particularly no previous studies, from the perspective of population-based occupational health, examining the potential influence of working place on FGIDs-related symptoms for HWs when they were in the fighting against COVID-19. Only one similar study was conducted in Wuhan city of China to investigate FGIDs-related symptoms among HWs who were involved in treating COVID-19 patients in early 2020 (8). And, one study was implemented in Bulgaria to examine changes in the prevalence of FGIDs-related symptoms due to COVID-19 pandemic among community residents (7). Although it is difficult to make direct comparison of findings between our study, the Wuhan and the Bulgaria studies, it is still important to make a broad comparison between them in order to help potential readers easily understand and prudently interpret the findings in our study.

Based on a latest report published in 2020, the overall FGIDs prevalence was documented as 40.3% (95%CI: 39.9%, 40.7%) among general adults worldwide and 34.4% (95%CI: 32.7%, 36.1%) in China (20). Moreover, during the COVID-19 epidemic period, a 12.9 percentage increase in the prevalence of FGIDs-related symptoms was observed from the summer (data collected during May and August) in 2019 (before the onset of COVID-19) to the early summer (data gathered during May and June) of 2020 (after the COVID-19 lockdown) among community adult population in Bulgaria (7). Furthermore, a cross-sectional study was conducted to investigate FGIDs-related symptoms among physicians and nurses who worked in hospital wards for treating COVID-19 patients in Wuhan

TABLE 3 The association between work places (out-ward/in-ward) and presence of FGIDs-related symptoms among participants in the study.

		Proportion of participants who experienced FGIDs-related symptoms (% and n/N)	Presence of FGIDs-related symptoms					
			Model 1[a]		Model 2[b]		Model 3[c]	
			OR	95% CI	OR	95% CI	OR	95% CI
Work places where participants took part in the fighting against COVID-19*	In-ward	40.7 (66/162)	1		1		1	
	Out-ward	56.3 (98/174)	1.88	1.22, 2.89	1.85	1.19, 2.89	1.77	1.01, 3.13

[a]Model 1: uni-variate logistic regression analysis with work mode as the independent variable.
[b]Model 2: multi-variate logistic regression analysis, with adjustment for participants' age, gender and educational level.
[c]Model: multi-variate logistic regression analysis, with consideration of professional title, occupation, years of professional employment, daily time with protective suit, continuous working days of involvement in fighting against Nanjing COVID-19 epidemic, night shift, history of NCDs in addition to those adjusted for in Model 2.
*In-ward participants directly contacted with COVID-19 patients, while out-ward participants closely contacted those might be or might not be COVID-19 patients.

of China in early 2020, showing that the overall prevalence of FGIDs-related symptoms was 83.2% among those healthcare workers (8).

The Bulgaria, Wuhan and our studies all reported the prevalence of FGIDs-related symptoms among participants based on symptoms included in the Rome IV diagnostic questionnaire. However, there were some differences between them. First of all, participants were different in these studies. In the Bulgaria study, participants were community adult population. In Wuhan survey, participants were limited to those physicians and nurses who worked in hospital wards (in-ward HWs only). However all the health workers who took part in the fighting against COVID-19 were recruited in our investigation, including not only physicians and nurses but also lab technicians and administrative staff. Moreover, different from that in Wuhan study, the participants in our survey worked not only in hospital wards but also at fever clinics, quarantine rooms, labs for testing SARS-CoV-2 or specimen collection sites. Second, those with FGIDs history were not excluded from the surveys in either Bulgaria or Wuhan study, while only those without history of FGIDs were eligible to take part in our study. Next, survey time also differed between these three studies. Both Bulgaria and Wuhan studies were implemented in early 2020, and at that time COVID-19 epidemic was still at the early stage, while our survey was conducted in mid-September of 2021, one and half a year later.

With respect to Wuhan and our Nanjing study, the figures of FGIDs-related symptoms prevalence were also different, 83.2% in Wuhan study (8) and 48.8% in our survey among overall participants. However, both the healthcare workers with and without FGIDs history were included in Wuhan study, while only those without FGIDs history were involved in our survey. Considering that the prevalence of FGIDs was about 34.4% among general adult population in China (20), the prevalence of FGIDs-related symptoms among those in-ward healthcare workers might be estimated as around 48.8% (83.2−34.4%) if the study participants were limited to healthcare workers without FGIDs history in Wuhan study, which was just slightly higher than that (40.7% = 66/162) observed among in-ward healthcare workers in our study.

When Nanjing COVID-19 epidemic occurred in July of 2020, the closed-loop management system had been well-established in China and the transmission characteristics of SARS-CoV-2 and treatment of COVID-19 patients were also further understood (10). Moreover, based on psychological insights, a negative event, such as COVID-19 epidemic, may affect people's emotion more strongly at the onset stage than some time later, as the extinction of fear-related emotion will actively occur with time going on (23, 24). This was also supported by findings from two population-based longitudinal studies during COVID-19 epidemic period (25, 26). One of them was conducted among general population with the first survey in early 2020 in China, documenting that community residents tended to report slightly but significantly lower scores for post-traumatic stress disorder (PTSD) symptoms 4 weeks later after the baseline survey (25). The other survey was implemented among healthcare workers with the first survey in May and the second in November of 2020 in Spain, showing that HWs experienced a significant improvement in stress-related symptoms over the 6-month follow-up period (26). Thus, it was applauded that the emotional/mental status (e.g., fear, stress) of healthcare workers involved in the fighting against Nanjing COVID-19 epidemic in mid-September of 2021 was still affected by COVID-19 but with a weakened extent.

In our study, one of the main findings was that a high prevalence of FGIDs-related symptoms was observed among overall HWs without FGIDs history. As COVID-19 is an emerging acute respiratory infectious disease, people initially have no clear idea on its transmission characteristics and treatment approaches (27). It could negatively affect the

emotional/mental conditions, yielding stress, fear and anxiety, during the period of its epidemic for not only community residents but also healthcare workers (15, 28, 29). Meanwhile, stress, fear and anxiety were the main influencing factors of FGIDs (4, 5). Thus, it could, at least in part, to explain that the high prevalence of FGIDs-related symptoms was observed among healthcare workers without FGIDs history during COVID-19 epidemic in our study.

Another interesting and important finding in our study was that out-ward HWs were more likely to experience FGIDs-related symptoms compared to their in-ward counterparts who were within hospital wards responsible for treating COVID-19 patients. Those out-ward HWs were at uncertain risks of COVID-19, as they had close contacts with many people who might be or might not be infected with SARS-CoV-2. On the other hand, the in-ward HWs were at certain risks of COVID-19, as they just directly contacted these confirmed COVID-19 patients within well-equipped isolated hospital wards/ICUs. From the psychological perspective, uncertainty makes it difficult for people to prepare properly for unpredictable future negative events, and consequently it might produce more anxiety, stress and fear for people relative to certainty (17, 18). This might partly explain that out-ward HWs at uncertain risks of COVID-19 tended to experience FGIDs-related symptoms compared to their in-ward counterparts who were at certain COVID-19 risks.

This is the first study investigating FGIDs-related symptoms among healthcare workers who were without history of FGIDs and involved in the fighting against a COVID-19 epidemic in regional China. There were some strengths of this study. Firstly, participants were recruited from all healthcare workers who were responsible for different specific tasks against a COVID-19 epidemic. Secondly, all of the participants were without history of FGIDs, which provided a deep insight into the potential impact of COVID-19 on the occurrence of FGIDs-related symptoms. Finally, interesting findings were examined in that a high prevalence of FGIDs-related symptoms was observed among healthcare workers who were in the fighting against COVID-19, and, moreover, those out-ward HWs tended to experience FGIDs-related symptoms relative to their in-ward counterparts.

However, limitations also should be mentioned. Firstly, as this was an anonymous survey, we could not estimate the exact number of eligible participants and thus could not calculate the response rate. Thus, potential bias regarding participant's selection existed in this study. Secondly, also due to the nature of anonymous survey, it was not possible for us to identify the healthcare workers who were registered with two or more WeChat groups and those with FGIDs history. We then could not make comparison in main characteristics between the respondents and those who did not respond to the survey. Thirdly, the survey questionnaire was internet-based and self-administered in the study. Some eligible participants might not join in the study as they were not familiar with such a survey way. And, next, FGIDs-related symptoms not FGIDs cases were investigated among healthcare workers in the study, as this investigation was not developed as a questionnaire-based clinically-diagnostic study. Therefore, the findings from this study should be interpreted prudently.

It is meaningful to sum up the findings in the present study. The prevalence of FGIDs-related symptoms was observed as 48.8% among these HWs who were without history of FGIDs during the period of fighting against COVID-19 epidemic in regional China. There was no difference in the prevalence of FGIDs-related symptoms among participants by age and gender, separately. Moreover, 40.7% in-ward and 56.3% out-ward HWs, respectively, reported ever experiencing FGIDs-related symptoms. Furthermore, those out-ward HWs were at a significantly higher risk of experiencing FGIDs-related symptoms compared to their in-ward counterparts (adj.OR = 1.77). This study added the following values to literature. For HWs who are in the fighting against COVID-19, they are at an elevated risk of experiencing FGIDs-related symptoms, even if they have no history of FGIDs; and working outside hospital wards for tackling COVID-19 may exert more impact on the likelihood for HWs to experience FGIDs-related symptoms relative to working within hospital wards from the occupational health perspective.

Conclusions

A high prevalence of FGIDs-related symptoms was observed among healthcare workers without FGIDs history during the period when they were involved in the fighting against COVID-19, and out-ward healthcare workers were more likely to experience FGIDs-related symptoms compared to their in-ward counterparts in regional China. It has important implications that particular and close attention shall be paid to functional gastrointestinal issues for healthcare workers, especially those who are at uncertain risks of infectious diseases, when they take part in response to public health emergencies in future.

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 the Ethics Committee of Nanjing First Hospital, Nanjing Medical University, China. The patients/participants

provided their written informed consent to participate in this study.

Author contributions

YZ, JY, and FX conceived, designed, and directed the study. YZ, YG, and JY performed the experiments. FX analyzed the data. YZ, YG, YS, HQ, JY, and FX wrote the manuscript text. All authors critically reviewed the manuscript and approved the submission.

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Conflict of interest

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

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Stress load of Chinese nurses in Fangcang Shelter Hospitals during the COVID-19 pandemic: A latent profile analysis

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The Omicron wave of the COVID-19 pandemic significantly affected Shanghai, China, from March to June 2022. Numbers of Fangcang Shelter Hospitals (FSHs) were conversed from stadiums and exhibition centers to tackle the pandemic. This study aimed to identify the stress load profiles of nurses working in FSHs and explore the characteristics and factors influencing stress load profiles. Totally, 609 out of 700 FSH nurses (with an effective response rate of 87%) participated in an online survey investigating their socio-demographic information, work-related stressors, and stress load. Results of the latent profile analysis identified four classes of stress load, which were labeled as the low (Class 1), mild (Class 2), moderate (Class 3), and high (Class 4) stress load class. Maternity status and self-perceived health condition were significantly different between the four stress load classes by comparisons using the Chi-square test and the Kruskal–Wallis test. The contributors to the stress load profiles were determined by the multinomial logistic regression analysis, including age, education, maternity status, self-perceived health condition, working time in FSHs, and the four dimensions of work-related stressors. Participants who were less healthy (OR = 0.045, 95% CI:0.012,0.171), worked longer time in FSHs (OR = 40.483, 95% CI: 12.103,135.410), faced with more workload (OR = 3.664, 95% CI: 1.047,12.815), and worse working environment (OR = 12.274, 95% CI: 3.029,49.729) were more likely to be classified to the high stress load class. The task arrangement and working environment for FSH nurses should be optimized, and psychological training should be conducted routinely.

KEYWORDS

stress load, Fangcang Shelter Hospital, latent profile analysis, COVID-19, work-related stressors

1. Introduction

The COVID-19 pandemic was classified by the World Health Organization as an international event of concern, with rapid transmission, widespread infection, and difficulty in prevention and control. The Omicron wave of the pandemic has been observed worldwide, with the highest number of confirmed cases exceeding

580,000 per day (1, 2). The pandemic posed a massive threat to the physical and mental health of the public (3). In the face of the outbreak, China classified the novel coronavirus pneumonia (NCP) as a class B infectious disease and implemented prevention and control measures toward NCP with the standard of class A infectious diseases. In contrast with other nations, the Chinese government is strongly dedicated to the "dynamic zero" approach (4).

At the peak of the pandemic in Shanghai, there were more than 20,000 new cases per day during the Omicron wave from Mach to June 2022 (5). Within a short time, the capacity of medical services was stunned. According to the target requirements of "timely detection, rapid disposal, precise control, and effective treatment" and the strict implementation of the "early detection, early reporting, early isolation, early treatment" principle (6), Shanghai started to build two levels (municipal-district) of Fangcang Shelter Hospitals (FSHs) of different sizes, the total number of which had reached more than 110, with more than 250,000 running beds. FSHs, often called cabin hospitals, are frequently employed in large-scale disasters due to their speedy construction, enormous scale, and low cost to accommodate emergency medical rescue missions (7). To combat the COVID-19 pandemic, they have lately been widely adopted in China by transforming current stadiums and exposition halls into medical facilities (8). FSHs played an essential role in increasing admission capacity, treating infected patients under mild or moderate conditions, isolating confirmed and asymptomatic cases, and blocking community spread (9).

Sudden public health events were previously reported predisposing individuals to a psychological crisis, with temporary failure of conventional coping strategies accompanied by mental dysfunction (10, 11). Healthcare workers have become the leading force in this battle against COVID-19, and nursing professionals, who account for more than half of them, hold the front line of prevention and treatment of NCP. Studies at home and abroad have shown that in the face of work-related stress, most people experience adverse psychosomatic reactions, leading to depression and low work efficiency (12, 13). Due to high occupational risks of infection, features of the working environment, and requirements of occupational protection, the stress on nursing professionals is much higher than on other healthcare workers (14). Although most FSH nurses received psychological training beforehand, they were more likely than other frontline or non-frontline personnel to report psychological issues (15).

Studies have confirmed that stress has a functional relationship with nurses' work adaptation (16, 17). It is also one of the external factors affecting the quality of life. Previous studies have shown that nurses' stress is mainly caused by the death of patients, conflicts with physicians, lack of support, inadequate knowledge base, heavy workload, conflicts with other colleagues, insufficient knowledge, low social status, low financial income, and lack of job autonomy (18–21). Moderate stress has a motivational effect and promotes resilience, enabling nurses to cope with work-life challenges (22). Conversely, excessive stress could negatively impact patient safety, job satisfaction, environmental adaptation (the process by which the individual balances with the environment), performance, burnout, career development, physical and mental health, and turnover intention (23–27).

Previous studies have shown that healthcare workers are among those exposed to a wide range of risks, and psychosocial risks are prevalent in this sector even during routine work (28–30). Of course, the pandemic might amplify the underlying risk factors (31). During the pandemic, studies on negative emotions among healthcare workers were widely conducted, especially among nurses (32, 33). The high risk of infection, excessive workload, unsafe working environment, increased number of confirmed and suspected cases, negative patient emotions, lack of touch with family members, and a social context with uncertainty and conflicts might contribute to their stress (34–36). Frequent night shifts, fatigue, fear of infection, overwork, and self-blame for patients' adverse outcomes have been proven factors for frontline healthcare workers' stress load (35, 36). Additionally, researchers have emphasized the necessity to concentrate on the work-related stress experienced by frontline healthcare workers during the COVID-19 outbreak (37).

Psychosocial risk factors in workplaces and their impact on health and the economy have become one of the most challenging issues in the field of occupational safety and health (OSH) in developed industrialized countries, and research on this issue began in the early 1960s in Europe and the United States (38). These countries have now incorporated psychosocial risk factors and workplace stress prevention and control into their national OSH regulations, such as the Occupational Safety and Health Act (1970) in the United States (39). Since the introduction of the Occupational Disease Prevention and Control Act of the People's Republic of China in 2001 (40), China's regulations and standards on OSH have been continuously improved. However, Chinese research on psychosocial risks in OSH started in the early 1990s and mainly focused on occupational stress and its effects on health (41, 42).

However, there are very few studies on FSH nurses. The few studies that have been conducted suggest that nurses may have higher levels of burnout and lower sleep quality during the pandemic (15, 43). Hence, FSH nurses' stress and mental health status during outbreak control require much attention. In addition, existing studies tend to classify subjects' psychological stress levels based only on their scores on standardized instruments [e.g., the Impact of Event Scale-6 (IES-6), the Nurse Job Stressors Scale, Perceived Stress Scale (PSS)], ignoring the heterogeneity of stress among individuals (44–46). It is a limitation of such an approach when distinguishing between group characteristics of stress and within-group differences because individuals with the same stress score may respond differently to each item. Latent profile

analysis (LPA) is an individual-centered approach to determine the classification of observations based on posterior probability. LPA has been widely used in psychology, pedagogy, and other academic fields (47, 48).

Therefore, the purpose of this study was to identify FSH nurses' stress load profiles, explore their characteristics and determine influencing factors of profile membership. We hope this study would serve as a basis for early intervention and enhancement of the mental health of nurses in FSHs and motivate initiatives on developing stress-coping strategies, psychological support procedures, and a magnetic work environment.

2. Methods

2.1. Participants

This cross-sectional study was conducted in FSHs in Shanghai from March 2022 to May 2022 and included 609 nurses finally. We calculated an estimated sample size of 426 (10 times the variables) to allow for a sample loss of 15%. Initially, we selected eight FSHs with different admission scales considering the participants' representativeness and the research's feasibility. Then, we used random clustered sampling and expected to recruit 700 nurses who met the inclusion criteria. The inclusion criteria were (1) registered nurses, (2) work experiences in the red zone (contaminated area) of FSHs, and (3) informed and willing to participate. The exclusion criteria were (1) a history of mental deficiency or psychiatric diseases; (2) working in logistics or administrative positions. Finally, 78 nurses refused to participate, and 622 subjects were recruited, with a response rate of 88.86%. After the exclusion of invalid questionnaires (with the same options selected for 70% of the items or with a completion time of fewer than 2 min), 609 questionnaires were included in the final analysis, with an effective response rate of 87%.

2.2. Procedures

In this study, questionnaires were distributed and collected during the Omicron wave in Shanghai from March 2022 to May 2022. After contacting the nursing administrators of the FSHs and obtaining cooperation, the online survey link was distributed to them through the questionnaire web platform (wjx.cn) and then distributed to the selected nurses' WeChat groups. Participants completed a structured online questionnaire anonymously to provide information on socio-demographic data, work-related stressors, and stress load. A total of 609 questionnaires were collected. This study was reviewed and approved by the Ethics Committee of NO 905 Hospital of PLA Navy (NO.2022-17), and all the participants gave consent to complete the online survey.

2.3. Measures

2.3.1. Socio-demographic information

This section of the questionnaire included gender, age, education, professional title, marital status, maternity status, working time in FSHs, self-perceived health condition, history of psychological training, and experience in epidemic control.

2.3.2. Chinese nurses stressor scale

The Chinese Nurses Stressor Scale (CNSS) was developed by Li and Liu (49) to assess perceptions of work-related stressors with reference to nurse occupational stress research approaches proposed by Wheeler (50). After cultural adaptation and validation, the CNSS consists of 35 items divided into five dimensions covering profession development (PD), workload (WL), work environment (WE), patient care (PC), and relationship with administrators and colleagues (RAC). A Likert 5-point scale was used in our study, with "1" meaning "strongly disagree" and "5" meaning "strongly agree". This scale has been widely used to investigate the work stressors of ICU, psychiatric, and standardized training nurses in China, with the Cronbach's alpha coefficient for the original scale being 0.94. The Cronbach's alpha coefficient of the present study was 0.97, and the coefficients of the five dimensions were above 0.8.

2.3.3. Stress overload scale

Amirkhan (51) created the Stress Overload Scale (SOS), which Xi and Leilei (52) translated and culturally adapted in China. Following extensive consultation with relevant experts and stringent tests on nurses in clinical settings. The Cronbach coefficient was 0.936, the retest reliability was 0.858, and the content validity was 0.86, indicating good reliability and validity. The SOS is divided into two dimensions: Personal Vulnerability (PV, 12 items), in which people react to events that cause them to feel powerless, frail, and tired, and Event Load (EL, 10 items), in which people are subjected to extreme external events, responsibilities, and pressure. A Likert 5-point scale was used, with never = 1, rarely = 2, occasionally = 3, frequently = 4, and always = 5. The total PV score was 60, and the total EL score was 5, with higher scores in each dimension indicating greater stress. The Cronbach's alpha coefficient for the present study was 0.98.

2.4. Statistical analysis

We performed LPA using the R software 3.4.2 based on a set of indicators (the 22 items of the SOS) to identify the latent subgroups of FSH nurses' stress load. To determine the optimal number of subgroups, we applied the following fit indices: the Bayesian information criterion (BIC), the Akaike information criterion (AIC), the entropy test for model evaluation, and the

bootstrapped likelihood ratio test (BLRT) for model comparison. Lower BIC, AIC, and entropy values indicate a better fit. The BLRT compares the differences in fitting between *k*-1 and *k* class models. The theoretical foundation for class solutions was also considered when determining the optimal number of participant classes.

The statistical software SPSS 21.0 was also applied for data analysis. Socio-demographic data were displayed in frequency and percentage. Continuous variables like the scores of the CNSS and SOS were displayed using mean and standard deviation. Comparisons of categorical variables between the potential classes of stress load were carried out using the Chi-square test, while that of continuous variables using the Kruskal–Wallis test. Finally, multinomial logistic regression was conducted to examine the potential relationship between the stress load classes and socio-demographic variables. A statistically significant difference was accepted at a p-value <0.05.

3. Results

3.1. Socio-demographic characteristics of the participants

Table 1 displays the characteristics of the participants. Of the 609 participants, 584 (95.89%) were female, 25 (4.11%) were male, and the median of their age was 30 years old. Most participants (441, 72.41%) reported bachelor's degrees or above education levels, and more than half of the participants were senior or supervisor nurses. About half of the participants were married and had one or more children. Most participants had sound (37.11%) or moderate (53.20%) self-perceived health conditions. The percentages of participants who received psychological training and had experiences in epidemic control were 57.64 and 24.47%, respectively.

TABLE 1 Socio-demographic characteristics of the sample ($n = 609$).

Variables	Categories	[M (P25, P75)]/ [*n* (%)]
Gender	Male	25 (4.11)
	Female	584 (95.89)
Age (year)		30 (26, 34)
Working time in FSHs (day)		22 (5, 30)
Education	Junior college	168 (27.59)
	Bachelor's degree or above	441 (72.41)
Professional title	Junior nurse	171 (28.08)
	Senior nurse	308 (50.57)
	Supervisor nurse or above	130 (21.35)
Marital status	Single	303 (49.75)
	Married	306 (50.25)
Maternity status	Childless	324 (53.20)
	One child or more	285 (46.80)
Self-perceived health condition	Sound	226 (37.11)
	Moderate	324 (53.20)
	Out of condition	59 (9.69)
History of psychological training	Yes	351 (57.64)
	No	258 (42.36)
Experiences in epidemic control	Yes	149 (24.47)
	No	460 (75.53)

3.2. Latent profiles analysis of stress load

We extracted and compared the two- to five-class model solutions to classify and identify the optimal model. When comparing the models, the smaller the AIC and BIC indices, the higher the Entropy index, and the BLRT <0.05, the better the model fit. As seen in Table 2, the 4-category model had the highest Entropy index and the second lowest BIC index, while the AIC index and the p-value of BLRT reached a significant level, thus making it the best model, with 232 (38.1%) in Class 1, 214 (35.1%) in Class 2, 122 (20.0%) in Class 3, and 41 (6.7%) in Class 4. Figure 1 illustrates the distribution of the potential stress load classes based on the 22 items of SOS. The x-axis of Figure 1 means the 22 items of the Stress Overload Scale (SOS), and the y-axis means the average score of each item. Thus, Figure 1 gives a snapshot of stress load levels across the four classes.

3.3. Characteristics of classes

Table 3 presents the PV and EL scores reflecting each class's stress load. Class one had the highest proportion of the sample, 38.1% (232/609), and was labeled "low stress load class." Low SOS scores in this class indicated light stress in participants. Class two, "mild stress load class," comprised 35.1% (214/609), showing relatively mild stress. Class three, "moderate stress load class," made up 20% (122/609) of the sample, while Class four, "high stress load class," had the lowest proportion, 6.7% (41/609), indicating that participants in this class had the highest level of stress load among the four classes [M (P25, P75) = 89 (84.5, 99)].

Figure 2 provides the socio-demographic characteristics of the participants in each class and their perception of work-related stressors. The characteristics of each class were compared by the Chi-square test and the Kruskal–Wallis test, as shown in Figure 2. Regarding socio-demographic characteristics, except for maternity status and self-perceived health condition, we did not find significant differences in gender, age, education, professional title, marital status, working time in FSHs, history

TABLE 2 Model fit indices of latent profile analysis of stress load (n = 609).

Model	AIC	BIC	Entropy	BLRT	Proportion of the least class
2-class	30,409.028	30,704.620	0.988	0.010	28.2%
3-class	27,632.107	28,029.171	0.965	0.010	19.9%
4-class	**25,759.536**	**26,258.072**	**0.974**	**0.010**	**6.7%**
5-class	25,160.237	25,760.244	0.956	0.010	5.6%

AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; BLRT, bootstrap likelihood ratio test.
Bold values means the selected optimal model of the latent profile analysis.

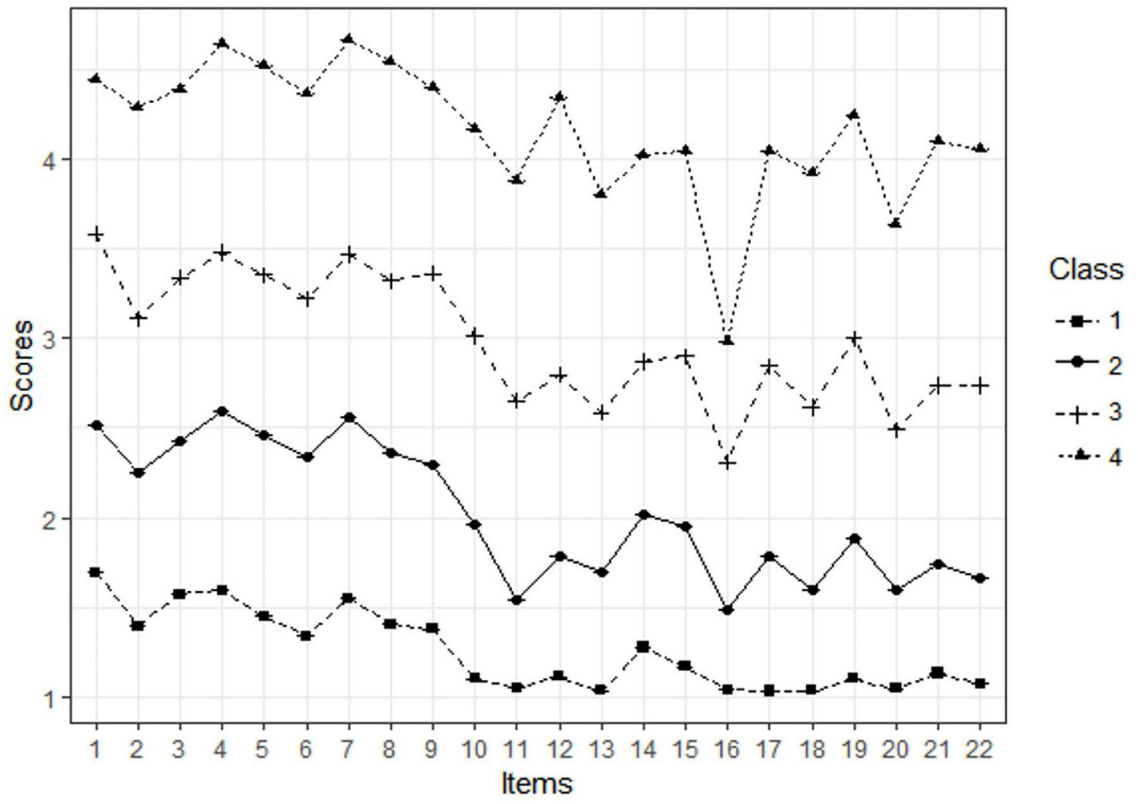

FIGURE 1
The distribution of four potential classes of stress load.

of psychological training, and experience in epidemic control among the four classes.

3.4. Multinomial logistics regression

The results of the multinational logistic regression results are shown in Table 4. The predictor variables were age, education, maternity status, working time in FSHs, and the five dimensions of work-related stressors (PD, WL, WE, PC, and RAC), with class 1 as the reference group during the analysis. Compared with Class 1, participants who were senior (OR =1.091, 95% CI: 1.023, 1.163), had children (OR = 4.169, 95% CI: 1.855, 9.368), perceived unhealthy (OR = 0.207, 95% CI: 0.059, 0.722), worked longer time in FSHs (OR = 3.765, 95% CI: 1.838, 7.714), faced challenges toward patient care (OR = 1.900, 95% CI: 1.013, 3.563) and had poorer working relationships (OR = 2.147, 95% CI: 1.078, 4.272) were more likely to enter Class 2. Furthermore, participants tended to be grouped into Class 3 if they had bachelor's degrees or above (OR =1.050, 95% CI: 1.019, 1.081), had children (OR = 3.447, 95% CI: 1.316, 9.030), perceived unhealthy (OR = 0.099, 95% CI: 0.029, 0.340), worked longer time in FSHs (OR = 7.071, 95% CI: 2.978, 16.790), faced with more workload (OR = 2.665, 95% CI: 1.140, 6.232), and worse working environment (OR = 8.922, 95% CI: 2.893, 27.513). Finally, those perceived unhealthy (OR

TABLE 3 SOS scores for different stress load classes ($n = 609$).

Dimensions	Class 1 ($n = 232$) [M (P25, P75)]	Class 2 ($n = 214$) [M (P25, P75)]	Class 3 ($n = 122$) [M (P25, P75)]	Class 4 ($n = 41$) [M (P25, P75)]	Total sample ($n = 609$) [M (P25, P75)]
Personal vulnerability	16 (13, 20)	27 (24, 30)	38 (36, 41)	52 (49, 57.5)	24 (19, 35)
Event load	10 (10, 12)	18 (15, 20)	28 (24, 30)	39 (35, 42)	16 (11, 22)
Total score	27 (23, 32)	44 (40, 48.25)	66 (61, 70)	89 (84.5, 99)	30 (42, 57)

Class one: "low stress load"; Class two: "mild stress load"; Class three: "moderate stress load"; Class four: "high stress load".

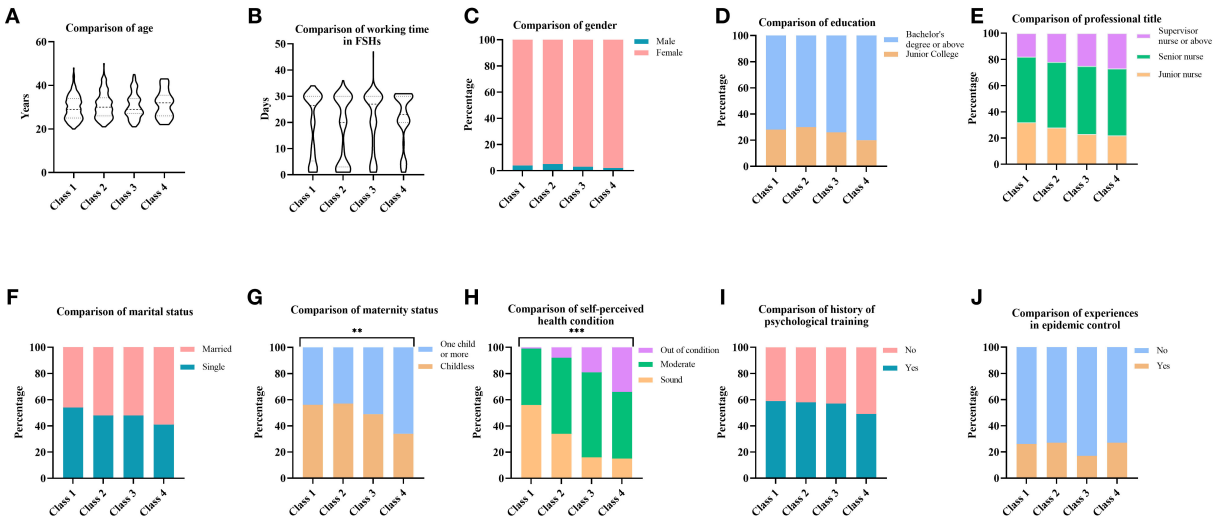

FIGURE 2
(A–J) Characteristics of individuals in potential stress load classes. ***$p < 0.001$, **$p < 0.01$.

TABLE 4 Multinomial logistic regression on stress load classes ($n = 609$).

Variables	Class 2		Class 3		Class 4	
	b	OR (95% CI)	b	OR (95% CI)	b	OR (95% CI)
Age	0.087**	1.091 [1.023, 1.163]	0.038	1.039 [0.951, 1.135]	0.065	1.068 [0.934, 1.220]
Education	0.012	1.013 [0.993, 1.033]	0.048**	1.050 [1.019, 1.081]	0.048	1.049 [0.995, 1.106]
Maternity status	1.428**	4.169 [1.855, 9.368]	1.238*	3.447 [1.316, 9.030]	0.914	2.494 [0.667, 9.321]
Self-perceived health condition	1.792**	0.207 [0.059, 0.722]	2.079***	0.099 [0.029, 0.340]	1.540*	0.045 [0.012, 0.171]
Working time in FSHs	1.326***	3.765 [1.838, 7.714]	1.956***	7.071 [2.978, 16.790]	3.701***	40.483 [12.103, 135.410]
Profession development	0.039	1.040 [0.582, 1.858]	0.390	1.477 [0.738, 2.956]	0.733	2.082 [0.861, 5.031]
Workload	0.665	1.945 [0.962, 3.930]	0.980*	2.665 [1.140, 6.232]	1.298*	3.664 [1.047, 12.815]
Environment	0.600	1.821 [0.678, 4.895]	2.189***	8.922 [2.893, 27.513]	2.507***	12.274 [3.029, 49.729]
Care for patients	0.642*	1.900 [1.013, 3.563]	0.491	1.634 [0.682, 3.913]	0.802	2.230 [0.521, 9.551]
Relation with colleagues	0.764*	2.147 [1.078, 4.272]	0.207	1.230 [0.479, 3.163]	−0.347	0.707 [0.165, 3.032]

***$p < 0.001$,
**$p < 0.01$,
*$p < 0.05$.
Reference group: class one; OR: odds ratio; 95%CI: 95% confidence interval.

= 0.045, 95% CI: 0.012, 0.171), worked longer time in FSHs (OR = 40.483, 95% CI: 12.103, 135.410), faced with more workload (OR = 3.664, 95% CI: 1.047, 12.815), and worse working environment (OR = 12.274, 95% CI: 3.029, 49.729) were more likely to be assigned to Class 4.

4. Discussion

This cross-sectional study investigated the stress load profiles of 609 nurses in FSHs and determined their characteristics and influencing factors. A total of four classes of stress load were identified through LPA, labeling as low (Class 1, 38.1%), mild (Class 2, 35.1%), moderate (Class 3, 20.0%), and high (Class 4, 6.7%) stress load. The FSH nurses' relatively low median score of SOS [*M* (P25, P75) = 30 (42, 57)] implied that most participants in our study underwent modest stress load during their working in FSHs. Through comparison analysis, maternity status and self-perceived health condition were significantly different among participants in the four classes. Furthermore, the influencing factors of the stress load profiles were determined as age, education, maternity status, working time in FSHs, and the four dimensions of work-related stressors (WL, WE, PC, and RAC). Participants who perceived less healthy, worked longer in FSHs, faced more workload, and had a worse working environment were more likely to be grouped into the high stress load class.

In contrast to previous reports, nurses in this study had less stress load, while health care workers were formerly assessed at a moderate to high stress level during the pandemic's initial stage. For instance, Murat et al. (46) found that nurses in Turkey experienced high levels of stress and moderate levels of depression during the pandemic outbreak. Shahrour and Dardas (53) found that 64% of Jordanian nurses experienced acute stress disorder during the initial phase of the pandemic, and 41% experienced psychological distress. Furthermore, Ahn et al.'s (35) team reported high work-related stress and anxiety to COVID-19 among healthcare workers in South Korea in April 2020, especially nursing professionals who are single. Similar circumstances occurred during the pandemic in Latin American nations, where one-third of healthcare workers were estimated to experience acute stress (36). This finding might be due to the rapid transmission of the epidemic, inadequate staffing, lack of awareness of the NCP, and psychological resilience in the early stages.

The LPA results showed that the stress load of FSH nurses could be divided into four classes, with Class 1 and Class 2 accounting for a total of 73.2%, indicating that the overall stress load of FSH nurses was at a modest level. As is known, occupational role, training/preparedness, high-risk work conditions, quarantine, role-related stressors, perceived risk, social support, social rejection/isolation, and the effect of diseases on personal lives were linked to the psychological health of healthcare workers (54). Administrators in FSHs recognized that management of occupational safety and health is essential and took action. Therefore, this finding might be attributed to the fact that FSHs had comprehensive preparation regarding the overall layout, work environment, work procedure, knowledge training, and supply of protective equipment.

Regarding the characteristics of FSH nurses' stress load profiles, participants in the four classes significantly differed in maternity status and self-perceived health condition. Participants who had children and perceived less healthy were more likely to be grouped into classes of higher stress load. This finding is in accord with Tahara's (55) research suggesting that good health status is associated with a reduced risk of mental health problems. However, in contrast to Vahedian-Azimi's (56) results on stress among critical care nurses, the number of children was not significantly associated with stress levels, which could be attributed to the differences in context and setting between the studies. This serves as a reminder to administrators to consider the health and maternity status of FSH nurses when recruiting frontline caregivers to participate in the fight against NCP. It is recommended that health check-ups be conducted before going to the frontline, that those in good health be selected, and that immunization-enhancing interventions be given as appropriate. For frontline personnel with heavy family burdens, individuals are suggested to seek social support and undergo a regular psychological assessment. Additionally, organizations should develop appropriate support mechanisms to help resolve challenges faced by healthcare workers and provide a safe working environment to safeguard their physical and emotional well-being.

Alarmingly, 75.53% of the FSH nurses had no experience in supporting the front line of prevention and control of COVID-19. Unlike Osman's (57) study on stigma and worry perceptions among Egyptian healthcare providers from contracting COVID-19 infection, there was no difference in epidemic prevention and control experience in stress load classes. Even so, we suggest that medical institutions gradually establish a comprehensive training system for nursing emergency human resources, organize and implement drills based on the COVID-19 outbreak, and reserve many professional nursing emergency rescue teams for epidemic prevention and control.

Concerning the influencing factors for stress load profile membership, the present study found that FSHs nurses who were senior, had children, worked longer time in FSHs, faced challenges toward patient care, and interpersonal relationships were more likely to be classified into mild stress load (Class 2). Meanwhile, participants tended to be grouped into moderate stress load (Class 3) if they were undergraduates, had children, worked longer time in FSHs, or faced more workload and worse working environment. Alarmingly, those who worked longer in FSHs, faced with more workload and a worse working environment, were prone to high stress load (Class 4). Likewise, Zhan et al.'s (45) survey on job stress among frontline

nurses fighting COVID-19 showed that nurses with higher seniority and educational level had higher job stress. One explanation might be the higher expectations of work and sense of responsibility among nurses with higher seniority and educational level. Additionally, this study found that maternity status impacted the FSH nurses' stress load profile membership, similar to earlier studies reporting that nurses concerned for families were susceptible to psychological distress (58, 59). Therefore, during the prevention and control of COVID-19, administrators need to dedicate themselves to caring for the families of FSH nurses and providing psychological support. At the same time, nursing professionals are encouraged to communicate more with their families to reduce and eliminate unnecessary barriers.

Moreover, work procedures in FSHs are complex, and conflicts with patients during care occasionally occur, which might lead to increased psychological pressure on nurses. The high workload of FSH nurses strains the workforce and leads to stress. Studies have shown that working time and workload positively correlate with mental distress (60). Other work-related stressors like WE and RAC are also worth discussing as FSH nurses are constantly faced with various tasks, isolation requirements, personal protective stress, and unknown risks. Consistent with Firew's findings (61), the more unknown and complex risks in the work environment than expected, the more negative psychological and physical outcomes for healthcare workers. Therefore, it is essential to clarify the scope of each position, scientifically allocate human resources, and adjust the nursing staff structure dynamically in the FSH nursing management. Noteworthy, feeling valued by organizations helps to eliminate stress, as mentioned previously by (62). Therefore, an emergency nursing management system for major infectious disease epidemics should create a professional emergency nursing team to ensure human resource deployment. Affirmation, encouragement, and respect from administrators could positively impact FSH nurses and enhance their sense of pride and belonging. At the same time, support and understanding among colleagues can help nurses gain social support and help them to be more committed to their careers (63).

Accordingly, policymakers and nursing administrators should pay close attention to the work stress of frontline nursing professionals while carrying out the fight against the pandemic. Taking active and effective interventions and psychological support for FSH nurses might help to have a positive mindset and ensure a regular clinical routine. At the governmental level, occupational psychosocial risks should be included in the scope of OSH, including regulations, policies, and standards. At the organizational level, administrators are encouraged to work on preventing and controlling psychosocial risks and promoting mental health in workplaces. At the individual level, healthcare workers might increase awareness through universal training in psychosocial risk coping strategies.

5. Limitations

Despite our efforts to make this study scientifically rigorous, we should be mindful of the several limitations of this study. Owing to a cross-sectional design, this study lacks a controlled sample distribution and has a degree of non-response bias, which might affect the sample's representativeness and the findings' generalisability. Furthermore, due to the need for epidemic prevention and control, the surveyors could not contact the respondents in person, so the survey was conducted on voluntary participation, and self-assessment questionnaires were used. Some FSH nurses with mental health problems may have been omitted from the survey or concealed their mental problems in the questionnaire. Meanwhile, the responses relating to self-rated work stressors and stress load were subjective and were, therefore, susceptible to recall bias. Finally, given the probability of second psychological trauma during the process of the stress survey, there may be a need for further investigation and validation using post-traumatic growth scales.

6. Conclusions

Nursing professionals might have cognitive, emotional, and behavioral changes as a result of working in FSHs. In this study, the stress load of FSH nurses was classified into four classes by LPA, and only 6.7% of participants were assigned to high stress load (Class 4), indicating that most participants were at a low stress level. The stress load profiles of nurses in different classes were well differentiated. Factors influencing stress load profiles include age, education, maternity status, working time in FSHs, and the four dimensions of work-related stressors (WL, WE, PC, and RAC). This finding suggests that we should develop different psychological training programs according to the potential class of FSH nurses to improve their stress resilience and adaptability in emergencies and to help nurses channel their stress rationally. Particular attention should also be paid to participants who worked longer time in FSHs, were faced with more workload, and had a worse working environment.

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 905th Hospital of the PLA Navy. The patients/participants provided their informed consent through online survey links to participate in this study.

Author contributions

JC and JW: conceptualization, supervision, and funding acquisition. LG, PF, and HX: investigation and data collection. LG and JC: statistical analysis and writing of the paper. LG, JC, JW, and HX: revision and editing of the paper. All authors contributed to the article and approved the submitted manuscript.

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Conflict of interest

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

Publisher's note

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The impact of leader safety communication on work engagement under pandemic: The effect of OBSE and anxiety based on COVID-19

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Introduction: The outbreak of COVID-19 has a great impact on employees daily work and psychology. Therefore, as leaders in organization, how to alleviate and avoid the negative impact of COVID-19 so that employees can maintain a positive working attitude has become a problem to be worthy paying attention.

Methods: In this paper, we adopted a time-lagged cross-sectional design to test our research model empirically. The data from a sample of 264 participants in China were collected using existing scales in recent studies, and were used for testing our hypothesizes.

Results: The results show that leader safety communication based on COVID-19 will positively affect employees' work engagement (b = 0.47, $p < 0.001$), and organization-based self-esteem plays a full mediating role in the relationship between leader safety communication based on COVID-19 and work engagement (0.29, $p < 0.001$). In addition, anxiety based on COVID-19 positively moderates the relationship between leader safety communication based on COVID-19 and organization-based self-esteem (b = 0.18, $p < 0.01$), that is, when anxiety based on COVID-19 is at higher level, the positive relationship between leader safety communication based on COVID-19 and organizational-based self-esteem is stronger, and vice versa. It also moderates the mediating effect of organization-based self-esteem on the relationship between leader safety communication based on COVID-19 and work engagement as well (b = 0.24, 95% CI = [0.06, 0.40]).

Discussion: Based on Job Demands-Resources (JD-R) model, this paper investigates the relationship between leader safety communication based on COVID-19 and work engagement, and examines the mediating role of organization-based self-esteem and the moderating role of anxiety based on COVID-19.

KEYWORDS

JD-R model, safety communication, work engagement, organization-based self-esteem, anxiety, COVID-19

1. Introduction

After a long period of confusion, isolation, anxiety and pain caused by COVID-19, employees may find it difficult to stay focused and engaged at work, which may affect their work behavior and performance (1). At the same time, employees' requirements for the safety and health of their working environment are also increasing. In recent years, more and more attention has been paid to workplace and occupational safety issues, especially the research on its antecedent factors is increasing gradually. Among them, many studies regard leadership as an important factor affecting organizational security, especially the influence of leadership behavior has attracted more attention. For example, some scholars have found that open and frequent communication

and interaction between leaders and subordinates is conducive to improving organizational safety and reducing accident rate (2) and some scholars also proposed that leaders' behaviors of information sharing and communication are one of the important factors affecting work and occupational safety (3). Leader communication is a bridge to convey behavior intention to employees, which can improve employee's identification with the organization (4).

In the field of safety management, some studies began to focus on safety communication (5). Some studies have further suggested that an important basis for judging whether an organization has high safety performance is whether there is open and fixed communication between leaders and subordinates in terms of safety (6). Many studies have found that safety communication is significantly related to safety performance indicators such as safety climate, culture and management safety commitment (2, 7, 8). Cigularov (9) stated that in a dynamic and rapidly changing work environment, more effective safety communication can reduce the possibility of employees being hurt. This shows the importance of safety communication in the workplace. In the context of COVID-19, one of the biggest challenges for enterprises in safety production and management is how to keep employees motivated. Improper safety management will cause depression and physical, mental or emotional disorders, which will affect the working state of employees and then affect the performance of enterprises. At the same time, effective safety management will make the enterprise form a good working atmosphere, and the employees will help each other to bring about the improvement of performance.

Based on the JD-R theory, this study discussed the impact of leader safety communication based on COVID-19 as a job resource on employee's work engagement in the context of COVID-19 crisis in China, and also explored the mediating mechanism and boundary moderating mechanism between the two. The main theoretical contributions of this study are as follows: (i) the conclusion of this study enriches the research on the relationship between safety communication and its outcome variables and the related mechanism; (ii) it provides a new perspective for promoting employee's work engagement; (iii) in the context of COVID-19, the research path of JD-R theory has been expanded. The theoretical model of this study is shown in Figure 1 as follow.

The main aim of this study is to examine the relationship between leader's safety communication based on COVID-19 and employee's work engagement among Chinese workers under the pandemic, so as to further explore the underlying mechanism. We propose our hypotheses as follows:

H1: Leader safety communication based on COVID-19 has a positive impact on employee's work engagement.
H2: Leader safety communication based on COVID-19 has a positive effect on organization-based self-esteem.
H3: Organization-based self-esteem mediates the relationship between safety communication based on COVID-19 and employee's work engagement.
H4: Anxiety based on COVID-19 positively moderates the relationship between leader safety communication based on COVID-19 and organization-based self-esteem, that is, the higher the level of anxiety based on COVID-19, the greater the impact of leader safety communication based on COVID-19 on employee's organization-based self-esteem; The lower the level of anxiety based on COVID-19, the less the influence of leader safety communication based on COVID-19 on employee's organization-based self-esteem.
H5: Anxiety based on COVID-19 positively moderates the mediating role of organization-based self-esteem between leader safety communication based on COVID-19 and work engagement. The more anxiety based on COVID-19, the greater mediating role of organization-based self-esteem between leader safety communication based on COVID-19 and work engagement.

2. Literature review and hypotheses

2.1. Leader safety communication based on COVID-19 and work engagement

Some scholars believe that effective safety communication between leaders and subordinates is a two-way process involving information exchange (10), that is, leaders and subordinates, respectively, provide their own safety information. To be specific, the communication process can be divided into two aspects: on the one hand, the leader constantly gives safety information and relevant feedback to the subordinates, so that the subordinates can better understand the safety issues they need to face, such as the daily safety work procedures and compliance with the safety rules and regulations formulated by the organization (11); On the other hand, the discovery and concern of safety issues raised by employees can help leaders identify threats in the work environment before accidents occur and take control measures in advance (12). Moreover, the latter belongs to upward safety communication (that is, subordinates

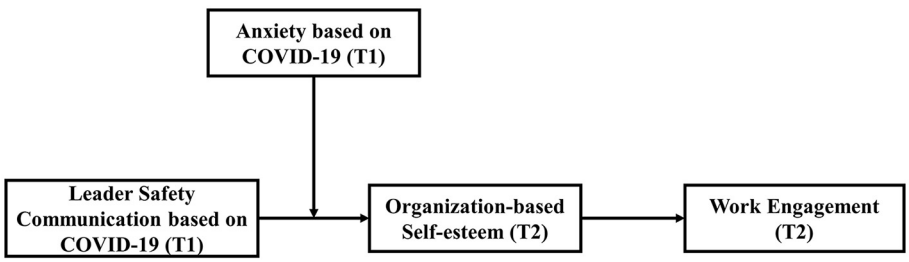

FIGURE 1
Proposed theoretical model.

communicate safely with their leaders). If they feel comfortable in upward safety communication, such communication will increase the subordinates' sense of trust in the organization, thus further improving their motivation to maintain the working environment (13). Paixão et al. (14) reviewed publications related to leadership and healthcare published during COVID-19 crisis in 2020, and found that communication is one major and critical leadership feature that would help overcoming the crisis. Mearns and Reader (15) also found that if employees can feel that health is valued by their leaders and can freely discuss health and safety issues with their leaders, they will be rewarded with safe citizenship behavior, such as caring for the safe behavior of their colleagues, correcting potential safety problems, and reporting hazards. Some scholars pointed out that a well-organized communication atmosphere has a positive impact on employee's work engagement (16), and leader safety communication is conducive to the formation of a communication atmosphere. From the perspective of social exchange, the positive safety communication between leaders and subordinates may indicate that leaders care about the safety and wellbeing of subordinates, thus prompting subordinates to take initiative and make greater efforts in return for leaders and organizations (11). At the same time, the communication between leaders and subordinates is a process to generate trust and credibility (17), which can promote employee's work engagement (18).

Work engagement refers to the positive attitude of employees who are persistent, voluntary and willing to devote themselves to their work, including three dimensions of vigor, dedication, and absorption (19). There is a wealth of research on work engagement, recently Mazzetti et al. (20) adopted meta-analysis to review on the antecedents and consequences. They categorized the antecedents of work engagement into five aspects and consider leadership as one important impact factor to work engagement (20). Other research also indicates that leadership style can improve employee's work engagement by giving them clear tasks and vision of goals, as well as timely encouragement and support (21). For the outcomes lead by work engagement, scholars found that employees with high work engagement not only do well with their job performance but also have more confidence in their capacity for work, more job commitment, higher levels of resilience and focus, greater health, and life satisfaction, as well as less psychological stress turnover (20, 22). As it is found that employee's work engagement has a positive impact on both individual and organizational performance (23). In terms of the interaction between superiors and subordinates, some scholars also found that the tacit understanding between superiors and subordinates can make employees clearly analyze the tasks and requirements arranged by leaders, reduce the errors caused by information understanding, complete tasks arranged by leaders on time and receive recognition, so as to promote work engagement (24).

JD-R model (25) proposed that job demands and job resources are two basic working conditions of organizations (26). Among them, job demands mainly focus on the aspects that consume individual vigor and energy, such as workload, complex tasks, emotional demand and conflicts; job resources are mainly focused on helping employees deal with job demands and achieve goals, such as performance feedback, social support, skill diversity and other incentive work characteristics (27). These characteristics satisfy the basic psychological needs of employees (competence, relationship and initiative) (28). Existing studies have shown that when job resources cannot meet job demands, it will produce energy consumption effect on employees through the stress process, and when job resources can meet job demands, it will produce positive work results through the incentive process (26). Because job resources provide the possibility for individuals to achieve their goals and meet people's basic needs, it has a positive incentive effect on work engagement (i.e., a state of energy, dedication, and concentration) (29). The outbreak of COVID-19, enterprises should take reasonable prevention and control measures, which will reduce their profits and even face the risk of closing down, for employees, the risk of layoffs, pay cuts, health problems and home office increases dramatically, resulting in tension and anxiety among employees (30). Facing these situations will reduce the work motivation of employees, thus affecting their work engagement. Wood (31) found the positive correlation between job anxiety and job demands. Thus, safety communication is particularly important in employee's daily work. Therefore, we define the safety communication of leader in the context of COVID-19 as the leader safety communication based on COVID-19, which can be used as a job resource to meet the psychological needs of employees at work and reduce their psychological pressure. For example, when the product sales decreased, the leader informed that the online sales model could increase the sales, which could relieve the anxiety of employees to a certain extent. Business cuts leave employees idle, and leaders shift their attention from anxiety by encouraging them to learn more skills on their own. When employees are depressed, leaders encourage them by asking and comforting them (30). Smith and Dyal (32) studied work engagement from the perspective of security and found that one of the important factors influencing job engagement is safety participation, and considered safety participation as a kind of safety behavior, which relies on open communication, cohesion, trust, respect, and shared information. It can be seen that safety communication will have a positive impact on work engagement. Based on JD-R theory, leader safety communication based on COVID-19 is a kind of leader safety communication behavior under the current epidemic situation, which can be regarded as a kind of job resource to alleviate the tension and anxiety of employees caused by COVID-19, meet the psychological work needs of employees through incentive path, keep them in a positive, relaxed and happy state, improve job satisfaction and then strengthen work engagement. To sum up, we propose:

> Hypothesis 1: Leader safety communication based on COVID-19 has a positive impact on employee's work engagement.

2.2. Leader safety communication based on COVID-19 and organization-based self-esteem

Relevant studies suggested that self-esteem expresses people's positive or negative attitude toward themselves, and self-esteem is defined as the evaluation made by individuals to themselves (33–35). Self-esteem also indicates the degree to which an individual believes that he/she is capable and reflects his/her value judgment (36). Individual organization-based self-esteem (OBSE) is a concept

derived from the perspective of organization, which is defined as the degree to an individual considers himself capable, meaningful and valuable as a member of an organization (36). Studies have shown that factors such as the high-quality relationship between employees and leaders and leaders' trust in employees can promote the formation of organization-based self-esteem of employees, and the communication between superiors and subordinates is the basis of the formation of high-quality relationship (37, 38). Some scholars argue that in the process of communication with leaders, employees can obtain and analyze the information conveyed by leaders and judge whether they are valued, so as to strengthen or weaken their initiative in work (39). Cropanzano and Mitchell (40) proposed that communication generated by work in an organization can signal to employees that they are valued by the organization, thus improving the level of organization-based self-esteem of employees. During the COVID-19 pandemic, employees are faced with the risk of being laid off. When considering employment issues, they will naturally have a sense of work insecurity, accompanied by feelings of insecurity and anxiety (41). Based on the JD-R theory, leader safe communication based on COVID-19 can be regarded as a job resource, alleviating the negative impact of such psychological needs on the health and wellbeing of employees (25), making employees directly feel valued and improving their organization-based self-esteem. To sum up, we propose:

Hypothesis 2: Leader safety communication based on COVID-19 has a positive effect on organization-based self-esteem.

2.3. The mediating role of organization-based self-esteem

Furthermore, organization-based self-esteem can effectively promote employee's work engagement. According to JD-R theory, organization-based self-esteem can also be used as a job resource to promote a variety of work-related outcomes (42). A higher level of environmental uncertainty will make employees think that the organization is at risk and produce tension and anxiety (43), which will have a negative impact on organization-based self-esteem (44). The concern, encouragement and support of organizations and leaders for employees have a positive impact on the improvement of organization-based self-esteem (45). Work stress also affects organization-based self-esteem. Some studies have found that work stress, such as role conflict, role ambiguity and role overload, has a negative effect on organization-based self-esteem (44). Meanwhile, organization-based self-esteem can effectively alleviate the negative impact of job insecurity on work engagement (46). Employees with high level organization-based self-esteem believe that they are trusted in the organization, valuable, and contribute to the organization (47). From the perspective of intrinsic motivation, when employees perceive that they are valued and useful in the organization, they will be more inclined to do more beneficial behaviors for colleagues and the organization at work, so as to help the organization achieve its goals (48). Employees with low level organization-based self-esteem are more likely to believe that they are not valued in the workplace, which will weaken employee's work motivation and work behavior (49). In addition, Hui and Lee (50) found in their study that, compared with employees with high levels of organization-based self-esteem, employees with low levels of organization-based self-esteem showed lower organizational commitment and higher absence rates, and were unwilling to engage in behaviors that beneficial to organization. A high level of organization-based self-esteem means a high level of self-perceived value. This psychological state satisfies and strengthens individual demands, thus making the organization a demand fulfiller in the life of employees (36). Therefore, employees with high level organization-based self-esteem may have more proactive behaviors at work, while employees with low level organization-based self-esteem may have less proactive behaviors at work. To sum up, we propose:

Hypothesis 3: Organization-based self-esteem mediates the relationship between safety communication based on COVID-19 and employee's work engagement.

2.4. The moderating effect of anxiety based on COVID-19

A phobia is a specific form of anxiety disorder, defined as a persistent and excessive fear of an object or situation, which can be divided into three categories: social phobia, public place phobia and specific phobia (51). Arpaci et al. (52) identified "COVID-19 phobia" as a fear of COVID-19 and classified it as one of the specific phobias in the DSM-V (Diagnostic and Statistical Manual of Mental Disorders, 5th Edition). According to the DSM-V criteria, the main characteristic of a particular phobia is a fear or anxiety that is limited by the source of the fear. COVID-19 causes anxiety in people that coexist with suicidal tendencies, depression, and physical, mental, or emotional disorders (53–56). At the same time, people's disproportionate cognitive, emotional or behavioral responses to objects and events related to the COVID-19 pandemic can also have serious negative physiological and psychological effects (52). Since the COVID-19 epidemic has seriously disrupted people's daily life, it will also cause panic and psychological anxiety (57–59). Previous studies have shown that natural disasters such as earthquakes and tsunamis; man-made disasters such as explosions, wars or terrorism; epidemics such as MERS, SARS or Ebola cause harmful emotions such as fear, anxiety, depression, hopelessness and hostility in the short and long term (60–63). COVID-19 is expected to cause more psychological anxiety problems due to easy transmission, lack of specific drugs and high virus mortality (57, 64, 65). Based on the above studies, this article referred to the anxiety caused by COVID-19 as the anxiety based on COVID-19. When psychological anxiety exceeds a certain level, employees will perform negative behavior. For example, Jones et al. (66) found that psychological anxiety would lead to the consequences of employee dimission, low attendance rate and low work performance. Other study showed that there is a significant negative correlation between job anxiety and job satisfaction. The positive correlation between job anxiety and absence has also been proved in the study (66). Among the three dimensions of work engagement, absorption means that employees have a highly focused working state and will not be easily disturbed by external factors; vigor refers to the staff have abundant energy into the work; dedication refers to the selfless

attitude that employees have in their work (19). As a leader, it is important to detect the early symptoms of anxiety based on COVID-19 in employees and provide timely psychological support (57, 67). When employees have little anxiety based on COVID-19, their mental resilience can cope with the pressure brought by anxiety well, and at this time, the safety communication based on COVID-19 is of little effect. With the increase of employee's anxiety based on COVID-19, employee's psychological resilience is not enough to cope with the increased pressure. At this time, leader safety communication based on COVID-19 makes employees clearly feel the concern of the organization for their own health and safety, which can effectively alleviate the pressure and negative emotions brought about by the anxiety based on COVID-19, and improve the organization-based self-esteem of employees. To sum up, we propose:

> Hypothesis 4: Anxiety based on COVID-19 positively moderates the relationship between leader safety communication based on COVID-19 and organization-based self-esteem, that is, the higher the level of anxiety based on COVID-19, the greater the impact of leader safety communication based on COVID-19 on employee's organization-based self-esteem; The lower the level of anxiety based on COVID-19, the less the influence of leader safety communication based on COVID-19 on employee's organization-based self-esteem.

In the above discussion, leader safety communication based on COVID-19 increased employee's work engagement through the mediating role of organization-based self-esteem. The effect of the safety communication based on COVID-19 on the organization-based self-esteem of employees will be different with the difference of the level of anxiety based on COVID-19, which will affect the work engagement of employees. In other words, the mediating effect of leader safety communication based on COVID-19 on work engagement through employee's organization-based self-esteem is affected by the level of anxiety based on COVID-19. When the level of anxiety based on COVID-19 is low, leader safety communication has only a small effect on the employee's work engagement through organization-based self-esteem, because the pressure generated by less anxiety is very small and controllable for the employee. For the employees with high level of anxiety based on COVID-19, they will face a lot of pressure and negative emotions, and the corresponding psychological demands will also increase. It is difficult to deal with them only by the employees themselves. At this time, the mediating effect of leader safety communication based on COVID-19 on improving work engagement through organization-based self-esteem is significantly enhanced. From the above inference, we can find that there is a complex relationship between leader safety communication based on COVID-19, anxiety based on COVID-19, organization-based self-esteem and work engagement. To sum up, we propose:

> Hypothesis 5: Anxiety based on COVID-19 positively moderates the mediating role of organization-based self-esteem between leader safety communication based on COVID-19 and work engagement. The more anxiety based on COVID-19, the greater mediating role of organization-based self-esteem between leader safety communication based on COVID-19 and work engagement.

3. Methods

3.1. Study protocol

This study was approved by the Ethics Committee on Human Experimentation of Wuhan Textile University (reference number: 2020OB001). We promised that all questionnaire data will only be used for this study, and only researchers can access the data, and no other organization or individual can obtain the data.

3.2. Sample and procedures

This study adopts the questionnaire survey method and the data is collected in Wuhan in two waves with 1 month interval. We labeled each survey questionnaire with a unique ID in advance and made sure that the participants can not notice the ID easily, so as to enable anonymous completion of our questionnaires and reduce the social desirability bias. Then the questionnaires are distributed to enterprises located in Wuhan using snowball sampling method (68). The enterprises come from different industries including IT, education, finance, service, manufacturing, and the medical industry. Psychologically there is enough time and influence for coronavirus generating stress and anxiety on the workers in Wuhan city. For example, when delta variant outbreaks in August, 2021 in Wuhan, some areas organized COVID-19 nucleic acid PCR test for the residents more than 10 times within a month.

At time 1 of our data collection, we both mailed the first part of the questionnaires to our contacts in different enterprises in the first week of August, 2021. The contacts are voluntarily to participate in our survey and data collection, also they are informed in advance that the questionnaire was completed anonymously and confidentially, and they can quit if they don't feel like to participate. This is because the city is threatened by delta variant outbreak during the period which may trigger more psychological anxiety from people here. We collected demographic information and leader safety communication based on COVID-19. At time 2 of our data collection, we sent out the second part of the questionnaires to the participants who have completed the first stage survey. We collected the variables of employee's organization-based self-esteem, work engagement, and anxiety based on COVID-19 (T2). Finally, we managed to have 354 employees from 8 companies agreed to participate, and 284 fully completed two questionnaires of time 1 and 2. We set criteria to exclude invalid samples, such as questionnaires with incomplete demographic information, failed with bogus items, and filled with too much same score to each item, etc. After removing invalid samples, we got 264 valid samples to conduct analysis. Among them, 56.8% were male and 43.2% were female; 91.7% of them were under 40 years old; 63.3% of the employees have bachelor's degree; The working years were mainly 1–5 years, accounting for 34.5%, followed by 5–10 years, accounting for 33.7%.

3.3. Measurement scales and analysis tools

All the measurement scales were adapted from existing literature and gone through "translation and back-translation procedure" which was widely used in cross-cultural studies (69), so that all the scales can adapt to the Chinese language environments. All measures

were rated on Likert five point scale where 1 = strongly disagree to 5 = strongly agree (see Appendix A for scale items). In this study, SPSS 22.0 was used to perform descriptive statistics and related analysis on the main variables, and Mplus 7.0 was used to analyze the validity factors to test the structural validity and distinguish the validity of the variables. In terms of hypothesis test, this study used SPSS 22.0 for multi-level regression analysis, and the bootstrapping analysis method was used to estimate the confidence interval of 95% of the effect value, so as to test the mediating effect and the moderated mediation effect.

3.3.1. Leader safety communication based on COVID-19 (T1)

Adopting the leader safety communication scale compiled by Cigularov et al. (9), including 5 questions such as "I think my leader encourages everyone to communicate frankly and openly on safety issues." Items are self-evaluated by employees in the first stage of data collection. The Cronbach's α coefficient of the scale in this study was 0.87.

3.3.2. Organization-based self-esteem (T2)

A short version of the scale was used to measure the employee's organization-based self-esteem. The original scale was compiled by Pierce et al. (36) and consisted of 10 questions. In accordance with Gordon and Hood (70), this study selected three items with the highest factor load as the measurement scale, including "I am very trusted in the organization," etc., which were self-evaluated by employees in the second stage of data collection. The Cronbach's α coefficient of the scale in this study was 0.85.

3.3.3. Work engagement (T2)

We adopted the utrecht work engagement scale (UWES−9) compiled by Schaufeli et al. (19), including 9 items such as "I am immersed in work," was self-evaluated by employees in the second stage of data collection. The Cronbach's α coefficient of the scale in this study was 0.95.

3.3.4. Anxiety based on COVID-19 (T2)

The fear scale developed by Arpaci et al. (52) for COVID-19 was used to measure the negative effects of COVID-19 on individuals in psychological, physical, economic and social aspects. In this study, psychological dimensions were selected to measure the psychological anxiety of employees on COVID-19, including 6 questions such as "news of death related to COVID-19 makes me very anxious," which were self-evaluated by employees in the first stage of data collection. The Cronbach's α coefficient of the scale in this study was 0.89.

3.3.5. Control variables (T1)

Based on previous research experience on work engagement (71), this study took the employee's gender, age, education level and working tenure as the control variables for data collection and hypothesis testing, so as to exclude their influence on the research variables and ensure the accuracy of hypothesis testing.

4. Results

4.1. Confirmatory factor analyses, descriptive statistics, and correlations

Confirmatory factor analysis was first carried out on the 4-factor model, including the four variables of leader safety communication based on COVID-19, anxiety based on COVID-19, organization-based self-esteem and work engagement reported by employees. The CFA results were shown in Table 1. As can be seen from Table 1, the fitting indexes of the 4-factor model all meet the standard, $\chi^2 = 355.88$, df = 224, RMSEA = 0.06, CFI = 0.95, TLI = 0.94; fitting indexes of the 3-factor model does not meet the common standard ($\chi^2 = 855.42$, df = 227, RMSEA = 0.15, CFI = 0.73, TLI = 0.70), as well and 2-factor model ($\chi^2 = 942.42$, df = 229, RMSEA = 0.15, CFI = 0.70, TLI = 0.67) and 1-factor model ($\chi^2 = 1178.15$, df = 230, RMSEA = 0.18, CFI = 0.60, TLI = 0.56). Therefore, the 4-factor model has better fit than the other three competitive models, indicating that there is a certain degree of differentiation between the four variables. We conducted Harman single-factor test (37.08%) and the single factor CFA ($\chi^2 = 1178.15$, df = 230, RMSEA = 0.18, CFI = 0.60, TLI = 0.56), the results indicate that the common method deviation among the variables involved is not serious and within the acceptable range.

Although this study adopts two stages to investigate the subjects and measures the variables involved at two time points, all measurement data are obtained by the same subject's self-assessment, which will inevitably lead to homology deviations. Harman single-factor test was used to verify the results. Four factors were separated out after non-rotating factor analysis for all the questions. The explanatory variation of the first factor was 37.08%, which did not exceed 40% of the recommended value. That is to say, there was no single factor to explain most of the variation, so the common method deviation of the collected data was not serious. In addition, the single factor CFA fitting indexes ($\chi^2 = 1178.15$, df = 230, RMSEA = 0.18, CFI = 0.60, TLI = 0.56) in Table 1 are very poor. It can be further seen that the common method deviation among the variables involved is not serious and within the acceptable range.

Descriptive statistics and correlation analysis results of each variable are shown in Table 2. As can be seen from Table 2, the correlation coefficient between leader safety communication based on COVID-19 and work engagement is 0.39, $p < 0.01$. The correlation coefficient between leader safety communication based on COVID-19 and organization-based self-esteem was 0.42, $p < 0.01$; The correlation coefficient between organization-based self-esteem and work engagement was 0.64, $p < 0.01$. The above results provide preliminary data support for subsequent tests.

4.2. Hypothesis testing

In this paper, hierarchical regression method was used to preliminarily test the mediating and moderating effects, and then, according to Hayes' (72) research, we further verify the hypothesis of mediator variable and moderator variable with bootstrapping method. The regression analysis results are shown in Table 3. Model 1 in Table 3 examines the direct impact of leader safety communication based on COVID-19 on organization-based self-esteem of employees

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TABLE 1 Results of confirmatory factor analysis.

Model	CMIN	DF	CFI	TLI	RMSEA	CMIN/DF
Four-factor model: LSCBC, ABC OBSE, WE	**355.88**	**224**	**0.95**	**0.94**	**0.06**	**1.59**
Three-factor model: LSCBC + ABC, OBSE, WE	855.42	227	0.73	0.70	0.15	3.77
Two-factor model: LSCBC + ABC, OBSE + WE	942.42	229	0.70	0.67	0.15	4.12
One-factor model: LSCBC + ABC + OBSE + WE	1178.15	230	0.60	0.56	0.18	5.12

Values in bold indicate the best-fitting model. LSCBC, leader safety communication based on COVID-19; ABC, anxiety based on COVID-19; OBSE, organization-based self-esteem; WE, work engagement; CMIN, Chi-square; DF, Degree of Freedom; CFI, Comparative Fit Index; TLI, Tucker–Lewis Index; RMSEA, Root Mean Square Error of Approximation; CMIN/DF, Chi-square to DF Ratio.

TABLE 2 Descriptive statistics and correlations.

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	0.56	0.49	1							
2. Age	2.48	0.67	−0.01	1						
3. Education	2.83	0.65	−0.04	0.05	1					
4. Tenue	2.92	1.06	0.09	0.77**	0.03	1				
5. Safety communication	4.04	0.71	−0.04	0.09	0.04	0.19**	1			
6. OBSE	3.46	0.86	0.02	0.13*	0.12	0.22**	0.42**	1		
7. Engagement	3.51	0.86	−0.08	0.18**	0.07	0.21**	0.39**	0.64**	1	
8. COVID-19 anxiety	3.19	0.97	0.06	−0.14*	−0.14*	−0.13*	0.03	−0.17**	−0.07	1

n = 264 employees. *p < 0.05; **p < 0.01. OBSE: organization-based self-esteem. Gender was coded as 1= male and 2= female. Age was coded as a four-level categorical variable: 1 = under 20, 2=20–30, 3=30-40 and 4 = over 40. Education was coded as a four-level categorical variable: 1 = high school or lower, 2 = 3-year collage, 3 = bachelor degree, 4= master degree and above. Working tenue was coded as a five-level categorical variable: 1 = <1 year, 2 = 1–5 years, 3=5–10 years, 4= 10–15 years, and 5 = more than 15 years.

after controlling for the effects of gender, age, education level and years of working. In model 2, we controlled for the effects of gender, age, education level and years of working, and examined the effects of leader safety communication based on COVID-19 and anxiety based on COVID-19 interaction on organization-based self-esteem of employees. Model 3 was designed to examine the direct impact of leader safety communication based on COVID-19 on employee's work engagement after controlling the effects of employee's gender, age, education level and years of working. Model 4 was designed to examine the effect of organization-based self-esteem on work engagement after controlling for the effects of employee gender, age, education level, years of working and leader safety communication based on COVID-19.

According to the model 3 in Table 3, after excluding the influence of control variables, leader safety communication based on COVID-19 has a significant positive impact on work engagement, b = 0.47, $p < 0.001$, H1 is verified. Model 1 shows that after excluding the influence of control variables, leader safety communication based on COVID-19 has a significant positive impact on organization-based self-esteem, b = 0.46, $p < 0.001$, H2 is verified. Model 4 shows that after excluding the influence of control variables and leader safety communication based on COVID-19, organization-based self-esteem has a significant positive impact on work engagement, b = 0.62, $p < 0.001$. According to the results of mediating effect analysis, the mediating effect value of organization-based self-esteem between leader safety communication based on COVID-19 and work engagement is 0.29, $p < 0.001$, 95% confidence interval is [0.19, 0.41], excluding 0. In conclusion, the results show that organization-based self-esteem plays a mediating role between leader safety communication based on COVID-19 and work engagement, and H3 is verified.

In order to test the moderating effect of anxiety based on COVID-19 on the relationship between leader safety communication based on COVID-19 and organization-based self-esteem, we first centralize the variable data, and then use hierarchical regression method to test. Results as shown in model 2 in Table 3, after controlling for the main effect, the interaction item of leader safety communication based on COVID-19 and anxiety based on COVID-19 had a significant impact on organization-based self-esteem, b = 0.18, $p < 0.01$, indicating that anxiety based on COVID-19 has a moderating effect on the relationship between leader safety communication based on COVID-19 and organization-based self-esteem. In order to make a more intuitive observation on the moderating effect of anxiety based on COVID-19, according to the suggestion of Aiken et al. (73), the moderating effect diagram of leader safety communication based on COVID-19 and organization-based self-esteem on anxiety based on COVID-19 is drawn at the level of one standard deviation higher or lower than the average. The results are shown in Figure 2. The results showed that when the level of anxiety based on COVID-19 is low, the influence of leader safety communication based on COVID-19 on organization-based self-esteem is significant (b = 0.26, $p < 0.01$). When the level of anxiety based on COVID-19 is high, the influence of leader safety communication based on COVID-19 on organization-based self-esteem is stronger, b = 0.62, $p < 0.001$. Therefore, H4 is verified.

It can be seen from Table 4, when the level of anxiety based on COVID-19 is high, the indirect effect of leader safety communication based on COVID-19 on work engagement through organization-based self-esteem is stronger, with an effect value of 0.41, and the

TABLE 3 Hierarchical regression analyses.

Dependent variable	OBSE				Engagement			
	Model 1		Model 2		Model 3		Model 4	
	b	SE	b	SE	b	SE	b	SE
Intercept	0.89*	0.43	2.96***	0.26	0.85*	0.40	0.29	0.36
Controls								
Gender	0.04	0.10	0.04	0.09	−0.12	0.11	−0.15	0.08
Age	−0.07	0.11	−0.10	0.10	0.14	0.12	0.19	0.11
Education	0.14	0.07	0.09	0.07	0.06	0.08	−0.02	0.07
Tenue	0.15*	0.08	0.15*	0.07	0.08	0.07	−0.01	0.06
Independent variable								
Safety communication	0.46***	0.08	0.44***	0.06	0.47***	0.07	0.18**	0.07
Mediator								
OBSE							0.62***	0.05
Moderator								
COVID-19 anxiety			−0.14**	0.05				
Interaction								
Safety communication × COVID-19 anxiety			0.18**	0.07				
R-sq	0.21		0.27		0.20		0.46	

*p < 0.05; **p < 0.01; ***p < 0.001. OBSE, organization-based self-esteem.

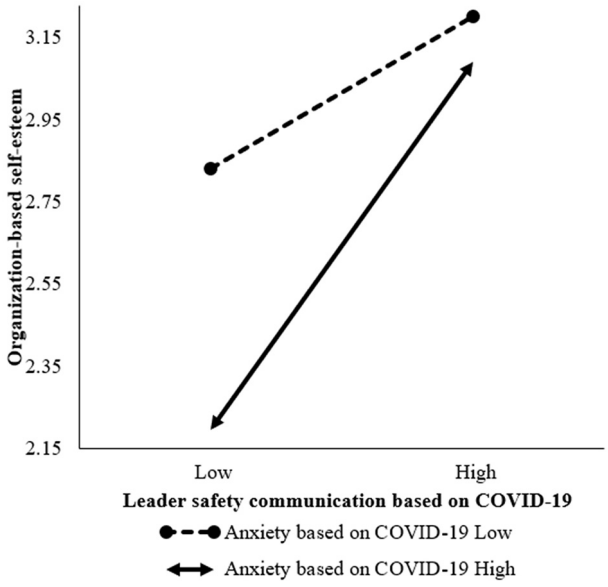

FIGURE 2
Interaction effect of leader safety communication based on COVID-19 and anxiety based on COVID-19 on OBSE.

95% confidence interval is [0.29,0.53] excluding 0. At a low level of anxiety based on COVID-19, the indirect effect value of leader safety communication based on COVID-19 on work engagement through organization-based self-esteem is 0.17, and the 95% confidence interval is [0.05,0.31], excluding 0. The difference of indirect effect values between the two groups above is 0.24, and the 95% confidence interval is [0.06, 0.40], excluding 0, indicating that the influence effect of the high-low group is significantly different. Therefore, H5 is verified.

TABLE 4 Mediating effect of organizational-based self-esteem on different levels of anxiety based on COVID-19.

Moderator	Indirect effect		95%CI	
ABC	b	SE	Low	High
High	0.41	0.06	0.29	0.53
Low	0.17	0.07	0.05	0.31
High-low group difference	0.24	0.09	0.06	0.40

ABC, anxiety based on COVID-19.

5. Discussion

On the basis of previous studies on safety communication, this study creatively combines the JD-R model to prove the influence of leader safety communication based on COVID-19 as a job resource on employee's psychology and behavior, and opens the "black box" of the influence of leader safety communication based on COVID-19 on employees' work engagement. The results show that: (i) leader safety communication based on COVID-19 can be regarded as a resource in work, which has a positive impact on employees' work engagement. Studies have shown that strengthening communication between leaders and subordinates can more clearly convey leaders' expectations and value orientation, give employees a sense of psychological security and achieve higher organizational performance by strengthen their work motivation (74). Mazzetti

et al.' (75) also provides empirical evidences that perception of a safety climate is associated with higher risk perception and safety knowledge, which in turn, results in a higher implementation of safety behavior. Thus, as "shared climate perceptions evolve as a result of ongoing member-leader and member-member interactions" (75), safety-conscious leaders can promote a safety climate within the workplace through communication and other means such as role modeling in the interpersonal interactions. In the context of the COVID-19 pandemic, employees are facing both the stress of their work commitments and the stress caused by the virus. At this time, leaders' communication about employees' physical and mental health can make employees feel that the organization is not only concerned about work performance, but also attaches importance to their health and safety (76), which can enhance employees' sense of belonging to the organization and are willing to devote more energy to their work; (ii) Organization-based self-esteem mediates the relationship between leader safety communication based on COVID-19 and work engagement, that is, leader safety communication based on COVID-19 affects work engagement through organization-based self-esteem. This is in line with the perspective of internal motivation. The safe communication of leaders makes employees feel that they are valued and useful in the organization, and then tend to do more beneficial behaviors at work (48); (iii) anxiety based on COVID-19 has a consistent positive moderating effect on the relationship between safety communication based on COVID-19 and work engagement, that is, compared with the employees with low anxiety based on COVID-19, when anxiety based on COVID-19 is in high level, the psychological anxiety based on the new coronavirus is higher, the positive relationship between leader safety communication based on COVID-19 and organization-based self-esteem and work engagement will be strengthened. Anxiety can lead to turnover tendency and work slack (66). It is crucial for leaders to provide timely psychological support to employees through communication (57, 67). The findings of this study are of great significance to the applied psychology research and practice of COVID-19. But also, we need to be careful with our results generalization, because at the time period from July to September, 2021, there may be a fatigue scenario exist due to the COVID-19 lock down and social restrictions. This may affect participants' work engagement as well as anxiety toward COVID-19 exogenously and naturally. But the effect was small, and future research could improve the problem.

5.1. Theoretical contribution

This study enriches the application of the JD-R model in the field of organizational behavior. For the first time, it considers leader safety communication under the background of COVID-19, and proves the importance of such safety communication in the workplace. At the same time, combining with JD-R model, this paper considers leader safety communication based on COVID-19 as a kind of job resource, and explores the positive effects of leader giving this kind of job resource on organization-based self-esteem and work engagement of employees. In the past, some scholars have studied humble leadership behavior (77) as an antecedent variable to affect organization-based self-esteem and work engagement, but there is no research on safety communication as a antecedent variable of this path, this study demonstrates the feasibility of this path. In addition, we also explored the moderating effect of anxiety based on COVID-19 on leader safety communication based on COVID-19 and organization-based self-esteem, and studied how anxiety based on COVID-19 moderates the mediating effect of organization-based self-esteem on leader safety communication based on COVID-19 and work engagement. This is more comprehensive and systematic than the study of a single mediating or moderating effect.

5.2. Practical implication

This study deepens the understanding of safety communication from the perspective of JD-R, and find a new path for management practice to improve employee's work engagement. In the last few years, valuable research on the protective role of leadership and communication on safety issue in the workplace have been conducted across several cultural contexts, suggesting that "compassionate, open, and highly communicative leaders foster a sense of purpose that can act to strengthen a unified public health approach" (78), and honest communication is critical (79). (i) due to the impact of COVID-19, employees are facing a sharp increase in risks such as unemployment, health and work safety. As a leader, it is necessary to find out the psychological changes of employees in time and provide appropriate psychological support to alleviate the anxiety caused by the COVID-19. For example, asking employees about their health condition, reminding them to wear masks and getting vaccinated; (ii) leader safety communication can create an atmosphere in which employees can communicate with each other imperceptibly, which can not only reduce the psychological pressure brought by COVID-19, but also enhance their feelings with colleagues; (iii), the conclusion of this study shows that safety communication based on COVID-19 can make employees feel cared and valued by their leaders, thus improving work engagement, which is positively correlated with innovation and performance of enterprises, and employees who devote themselves to their work will bring more contributions to the enterprise.

5.3. Limitation and future directions

The shortcomings of this study are as follows: (i) The mechanism of safety communication on employee outcome variables may be diverse, and future research should attempt to elaborate the mechanism of safety communication and work engagement from multiple perspectives; (ii) The data in this paper are from leaders and employees, which can control the influence of common method bias on the research results to a certain extent. However, the relationship between leader safe communication based on COVID-19, organization-based self-esteem and work engagement is only discussed from the individual level. In the future, we can adopt cross-level research methods to make a more comprehensive and systematic study of this mechanism from the individual, team, organization and so on. In the research design, the use of cross-sectional design, to reveal the causal relationship between variables will have limitations, later scholars can be at different points in time to measure each variable at the same time, so that the relationship between variables can be further analyzed. (iii) The data of this study

may have the issue of convenience sample. Besides, the COVID-19 pandemic scenario is quite different across different countries and cultures, and employee in China may have very singular experience and very different perceptions than other part of the world. Although we feel our research model based on JD-R theory is robust across countries, future studies still need to test the results in different cultures to generalize the research findings.

6. Conclusion

This study explored the impact of leader safety communication based on COVID-19 on employee work engagement. According to JD-R theory, we have introduced OBSE as an important mediator and anxiety based on COVID-19 as a moderator. The research results show that the mediating effect of leader safety communication based on COVID-19 through OBSE is positively related to work engagement, and the mediating effect is enhanced by anxiety based on COVID-19.

The contribution of this study is mainly reflected in three aspects. First, study whether leader safety communication based on COVID-19 will have a positive impact on work engagement, thus expanding relevant research. Second, we provide a theoretical basis for the mechanism of the relationship between leader communication and work engagement, and explore the boundary condition of this relationship. Third, we also provide ideas for extending the research related to JD-R model.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the School of Management at Wuhan Textile University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

Conceptualization and investigation: XZ and YL. Methodology and project administration: YL and YG. Formal analysis: YL. Resources and writing—review and editing: XZ and YG. Writing—original draft preparation and funding acquisition: XZ. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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Appendix A

Appendix A. Scale items.

Leader safety communication based on COVID-19 scale items (Cronbach's Alpha = 0.87)
1. I feel comfortable discussing safety issues with my immediate.
2. I try to avoid talking about safety issues with my immediate foreman.
3. I feel that my immediate foreman openly accepts ideas for improving safety.
4. I am reluctant to discuss safety-related problems with my immediate foreman.
5. I feel that my immediate foreman encourages open communication about safety.
Organization-based self-esteem scale items (Cronbach's Alpha = 0.85)
1. I count around here.
2. I am trusted around here.
3. There is faith in me around here.
Work engagement scale items (Cronbach's Alpha = 0.95)
1. At my work, I feel bursting with energy.
2. At my job, I feel strong and vigorous.
3. I am enthusiastic about my job.
4. My job inspires me.
5. When I get up in the morning, I feel like going to work.
6. I feel happy when I am working intensely.
7. I am proud of the work that I do.
8. I am immersed in my work.
9. I get carried away when I am working.
Anxiety based on COVID-19 scale items (Cronbach's Alpha = 0.89)
1. The fear of coming down with coronavirus makes me very anxious.
2. I am extremely afraid that someone in my family might become infected by the coronavirus.
3. News about coronavirus-related deaths causes me great anxiety.
4. Uncertainties surrounding coronavirus cause me enormous anxiety.
5. The pace that coronavirus has spread causes me great panic.
6. I argue passionately (or want to argue) with people I consider to be behaving irresponsibly in the face of coronavirus.

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How much do we care about teacher job insecurity during the pandemic? A bibliometric review

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In this study, a descriptive bibliometric analysis of the scientific production in the Web of Science on job insecurity perceived by teachers in pandemic situations was carried out. The result shows the growing interest in the topic with an upward trend with an annual growth of 41.52%. Forty-seven papers from 41 journals with 2,182 cited references were considered, with 149 researchers from 30 countries publishing at least one article. The country with the most publications was the United States, followed by *Germany* and *Spain*. The *United States* was the country with the most collaborations. A total of 95 institutions published papers, and the universities with the most registrations were *Miami University* and the *University of the Basque Country*, although *York University* and the *University of the Basque Country* had a higher overall citation coefficient (102 and 40, respectively). Of the 41 journals that have published on the topic, *Frontiers in Education* and the *British Journal of Educational Psychology* stood out in terms of their article numbers. However, this last one was superior in terms of the overall number of citations per year, followed by *Frontiers of Psychology*.

KEYWORDS

job insecurity, teachers, bibliometrics, thematic analysis, COVID-19

1. Introduction

The COVID-19 pandemic has had a number of consequences worldwide. One of them is the economic crisis resulting from the paralysis of the economy that occurred during the lockdown, mainly due to the closure of businesses, the stoppage of all non-essential activities and the reduction in mobility (1–3). The destruction of companies' productive capacity led to their closure in some cases, and to reductions in their workers' working hours and salaries in others (4). The pandemic has therefore had an unprecedented economic impact and has put many jobs at risk (5–7). In specific terms, the European Central Bank (ECB) shows an increase in the unemployment rate for the EU as a whole to 7.6% (2020 and 2021), reflecting a sharp deterioration in productivity, a decline in labor force growth and a clear stagnation in job creation (8). In Spain, the unemployment rate at the end of 2020 was 16.13 percent (9) and it was 13.3 percent in 2021, with a scenario of uncertainty about the duration of the crisis that is not improving, and with an inequality in terms of the widening of the wage gap for women (2 points above) and young people under 25 years of age (17.7 points above, amounting to 31% unemployment) (9, 10). This will obviously have an impact on all labor profiles, with the greatest impact on the most vulnerable groups (11). Given these circumstances, it seems logical to assume that the perception of job insecurity is becoming a topic of growing interest.

Job insecurity can be defined as the individual worker's perception of not being able to keep his or her job, or the loss of an important characteristic of the job in the face of a threatening

situation (12). This insecurity is caused not only by the loss of the job itself, but also by the possibility of the event occurring, which is an even greater stressor than the loss itself (13–15). However, there are several variables that modulate reactions to job insecurity, such as economic vulnerability, psychological vulnerability and the characteristics presented by the threat (16). Reports such as the one by the Organization for Economic Cooperation and Development (OECD) (17) highlight the implications that this insecurity can cause in individuals. Fear of job loss affects the worker's psychological wellbeing and health (18). It negatively influences work engagement (19), performance (20) and creativity (21). All of this ultimately affects the productivity of companies (16) and society as a whole in the form of higher levels of general dissatisfaction, as well as increased health and social costs (22).

Although job insecurity has always been an important psychosocial risk factor in developed societies, technological, economic and political changes have increased its perception in recent times (16, 23, 24). The teaching profession has several specific characteristics such as, the prevailing diversity in the classroom, constant changes to the curriculum, and the lack of social recognition for their work, which all lead to a vulnerability in the prevalence of job insecurity and the consequences of itself (23, 25–28). However, after COVID-19, this situation and specially for teachers has been aggravated and become particularly acute (27, 28) due to the constant demands for adaptive changes and requirements which they struggle to meet (25). Among other changes suffered as a result of this situation are, the transformation of the environmental working conditions and the required working resources (29, 30), as well as the organizational characteristics of work, in both quantitative terms (the amount of work) and qualitative (knowledge and skills required) demands seen in recent years (26, 31). Regarding the latter, fear of not adapting to new technologies (32, 33) the lack of preparation and resources (20, 32, 34, 35), the lack of information and sometimes insufficient measures adopted by educational institutions, autonomous communities and central government (36) causes problems in occupational health and increases the perception of insecurity (37, 38).

It should be noted that not all levels of education are equally exposed to psychosocial risks and more specifically to job insecurity. In the case of university teaching, student autonomy is greater, and the skills required of teachers are not so directly affected, since information and communication technologies were already present before the pandemic (39, 40). However, in other stages of education, the need to adapt to new technologies and the scarcity of resources available has been a greater challenge (41–43). Likewise, student-teacher interaction is not as direct as in formal education, and the involvement and dependence on the family's participation in the teaching-learning process is also less (44). In this regard, educational attention to students with special needs and in vulnerable situations has been a major challenge in formal education (45, 46).

Given the prevalence of job insecurity as a consequence of the health emergency and in the non-university teaching profession in particular, it is important to carry out this bibliometric analysis. Ascertaining the state of the question from the articles published in the Web of Science will provide an overall perspective of the existing scientific impact, and will enable measures to improve the occupational health of teachers to be adopted. This can all contribute to mitigating the effects of the pandemic and/or administering resources and policies that reduce the negative effects on their performance in the workplace.

2. Materials and methods

2.1. Data collection

This is a bibliometric study that seeks to analyze the scientific literature in a specific field of research (47). It focuses on articles published on job insecurity in the teaching field during the COVID-19 pandemic. The research was conducted on 23 June 2022 in the Web of Science Core Collection database using the SCI-EXPANDED and SSCI indexes.

An advanced search by subject was carried out by referring to the title, abstract and keywords of the articles. The search string used in the subject field was in a first identification:

TS = ((("employ *certain*" or "employ* *securit*" or "career *certain*" or "career *securit*" or "careers *certain*" or "job* *certain*" or "job* *securit*" or "labor *certain*" or "labor *securit*" or "labour *certain*" or "labour *securit*" or "métier *certain*" or "métier *securit*" or "occupation* *certain*" or "occupation* *securit*" or "profession* *certain*" or "profession* *securit*" or "work *certain*" or "work *securit*") or (*employ* or job* or labor* or labour* or métier*)) and (*certain* or *securit*) and (pandemic or covid 19 or covid-19 or covid-19 or coronavirus or "health crisis" or "sanitary crisis" or "healthcare crisis" or "health emergency" or "SARS-CoV-2"))*

The search was subsequently narrowed down to teachers, and 353 articles were obtained:

(…and (teach or school) and (pandemic or covid 19 or covid-19 or covid-19 or coronavirus or "health crisis" or "sanitary crisis" or "healthcare crisis" or "health emergency" or "SARS-CoV-2"))*

This review and selection of articles was carried out using the PRISMA (preferred reporting items for systematic reviews and meta-analyses) approach (48, 49) which is widely used in literature reviews and in various fields (50–52).

The number of records eliminated before selection was due to duplicity ($n = 8$) and based on the automation tools themselves, such as open access and/or different databases ($n = 86$), leaving a total of 259 articles to which the different inclusion and exclusion criteria were applied. The inclusion criteria were as follows: (1) literature reviews and empirical studies, (2) scientific journal articles, (3) published in any language in the last 5 years, (4) in the main collection of Web of Science, (5) addressing the job insecurity experienced by teachers and professors as a result of or during the health crisis produced by COVID-19 in their work. This resulted in 162 articles being selected.

After reviewing the content of these articles, the following exclusion criteria were subsequently applied: (1) university lecturer; (2) intervention outside the school setting; (3) inconsistency or imprecision in the study. This led to the exclusion of 115 articles and therefore to the selection of a total of 47 articles (Figure 1).

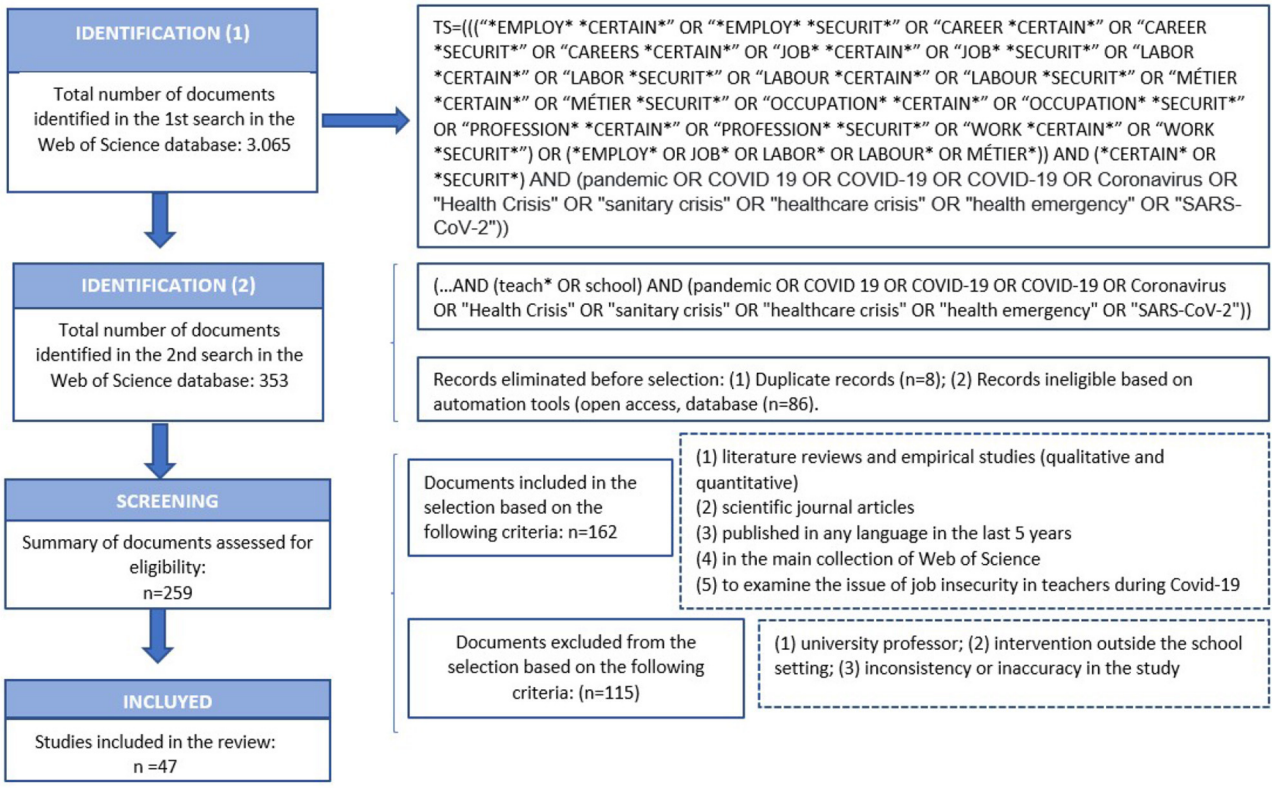

FIGURE 1
PRISMA flowchart showing the steps in source identification and selection. Adapted from Thananusak (53) and Page et al. (49).

2.2. Bibliometric analysis

The statistical programmes used and the analyses performed with each program are detailed below:

The HistCite software package (version 2010.12.6; HistCite Software LLC, New York, NY, USA) (54) was used to calculate basic bibliometric indices, consisting of the number of articles per year, per author, per country, per institution and per journal. The information is displayed in a clear and detailed way, with quality indicators such as the total global score (TGCS) as well as the local global score (TLCS). The former refers to the total number of citations received by the articles analyzed, and the latter represents the number of citations received in WoS only by the articles selected in the specific analysis carried out (55).

The VOSviewer software package (56) was used to analyze bibliographic and thematic linkage. It enabled us to perform a bibliographic linkage analysis and the direct identification of significant articles. It is particularly useful for displaying bibliometric networks as it produces clusters that show the similarity between two or more articles by identifying the number of references they have in common. The advantage of this program is that it is not influenced by when it is used, which means it is suitable for systematic literature reviews (57).

Bibliometric analysis was performed using an R software package (58, 59). This was used to identify co-authorships, collaborations between countries and the most common keywords, as well as thematic analysis, discovering emerging, current or out-of-use topics. It allows multiple types of graphics such as networks, three-field plots, wordclouds, tree maps, historiographs, strategic diagrams, evolution maps and world maps (60).

3. Results

After all the documents were reviewed, the search in the WoS database retrieved a total of 47 articles published in 41 journals, by 149 authors. The average number of citations per document is 5.851. A total of 141 keywords and 192 author's keywords were found. Finally, the number of authors per paper is around 3, with an international collaboration rate of 17.02%. This information can be seen in Table 1.

3.1. Basic indicators

This first section of the results presents the basic indicators, giving details of the papers and citations per year, the number of papers and citations per author, per institution and per country. Likewise, the journals that published at least one article, the number of publications, citations and the impact factor are listed. Finally, the authors' keywords are presented according to the year of publication.

3.1.1. Years

The number of published articles amounts to 47, published in 2020, 2021 and 2022. The publications per year range from six to 26,

TABLE 1 Main information.

Main information about data	
Timespan	2020:2022
Sources (Journals, Books, etc)	41
Documents	47
Annual growth rate%	41.42
Average age of document	0.864
Average citations per doc	5.851
References	2,182
Document contents	
Keywords plus (ID)	141
Author's keywords (DE)	192
Authors	
Authors	149
Authors of single-authored docs	5
Authors collaboration	
Single-authored docs	5
Co-authors per doc	3.3
International co-authorships%	17.02
Document types	
Article	44
Article; early access	3

with a mean of 14.67 and a standard deviation of 8.38 ($n = 47$; range = 6–26; mean = 14.67; SD = 8.38). The first article was published in 2020, with six publications ($n = 6$). In just 1 year, there was a significant increase in the number of publications ($n = 26$) on this subject, as can be seen in the graph below. Furthermore, despite a decline in the number of publications in 2022, the trend is upwards, with an annual growth of 41.52%.

3.1.2. Authors

A total of 149 researchers have published at least one article on the topic of teachers' job insecurity during the pandemic. The number of publications ranged from one to two, with a mean of 1.04 and a standard deviation of 0.20 (range = 1–2; Mean = 1.04; SD = 0.20).

The researchers with the most publications on this subject were Asbury K, Kim LE, Mishra R, Mondragon NI, Ozamiz-Etxebarria N and Santamaria MD, with two papers each. Likewise, Asbury K and Kim LE had the most overall citations with 102, followed by Mondragon NI, Ozamiz-Etxebarria N and Santamaria MD with 40. The results are shown in Figure 2, which presents the authors with the most publications and establishes two papers as the cut-off point (≥2). A comparison is also shown for the Recs, the LCS-Local Citation Score and the GCS-Global Citation Score.

These authors work in different research fields. The most common is Public Environmental Occupational Health, with eight authors ($n = 8$) followed by Education Educational Research with seven authors ($n = 7$). This is followed by Environmental Sciences with five authors ($n = 5$), Economics and Educational Psychology with four ($n = 4$) and Multidisciplinary Psychology with three ($n = 3$). Finally, Green Sustainable Science Technology, Internal General Medicine, Environmental Studies and Multidisciplinary Sciences have two authors ($n = 2$).

3.1.3. Institutions

The number of institutions with publications is 95 ($n = 95$). The number of publications ranges from one to 2, with a mean of 1.03 and a standard deviation of 0.17 (range = 1–2; Mean = 1.03; SD = 0.17). Three of them have two articles and the rest have one.

As can be seen in Figure 3, and establishing two publications as the cut-off point (≥2), Miami University, the University of the Basque Country and the University of York are the universities with the most published papers with two papers each ($n = 2$). However, there are a total of 429 global citations, ranging from 0 to 102, with a mean of 4.52 and a standard deviation of 12.45 (range = 0–102; mean = 4.52; SD = 12.45), with 29 citations as the cut-off point (≥ 29) and the University of York has the most global citations, with a total of 102, followed by the University of the Basque Country with 40 and Greylock McKinnon Associates, IZA and St Lawrence University, with 29 total global citations.

3.1.4. Countries

Researchers from 30 countries have published at least one article on this Research Topic. The total number of articles is 47. The number of publications ranges from one to 13, with a mean of 2.07 and a standard deviation of 2.24 (N = 47; range = 1–13; mean = 2.07; SD = 2.24). Establishing three articles (≥3) as the cut-off point, the country with the most publications is the United States ($n = 13$), followed by Germany and Spain ($n = 4$) and finally, Denmark, Indonesia, South Africa and Great Britain ($n = 3$). This can be seen in Figure 4.

The number of citations ranged from 0 to 102, with a mean of 9.97 and a standard deviation of 22.29 (range = 0–102; Mean = 9.97; SD = 22.29). The countries that have received the most citations in the WoS as a whole, with a cut-off point of more than 18 articles, are the following: Great Britain ($n = 102$), the United States ($n = 62$), Spain ($n = 50$), Romania ($n = 19$) and finally China and Taiwan ($n = 18$) (see Figure 5).

3.1.5. Journals

A total of 41 journals have published at least one article on this topic. Of all these journals, four have published two articles and one journal has published more than two articles, and this indicator is the cut-off point (≥2) (Table 2).

The journals with the most articles published are Frontiers in Education ($n = 3$), followed by the *British Journal of Educational Psychology, Frontiers in Psychology, International Journal of Environmental Research and Public Health and Sustainability* ($n = 2$).

Among these five journals that have published the most articles, *Frontiers in Psychology* has the highest impact factor (JCR = 4.23), followed by *International Journal of Environmental Research and Public Health* (JCR = 3.36) and in third place by *Sustainability* (JCR = 3.25). The results can be seen in Table 2.

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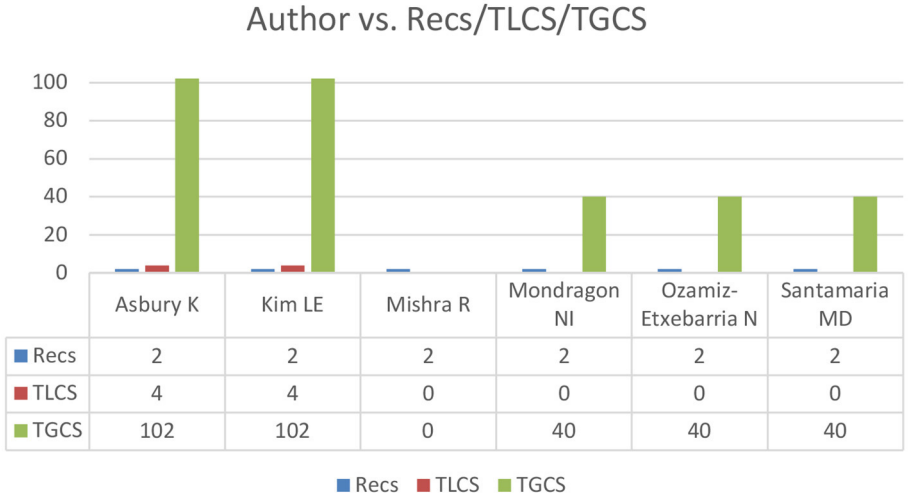

FIGURE 2
Authors with the most publications (≥2 Recs). Recs, number of articles; LCS, Local Citation Score; GCS, Global Citation Score.

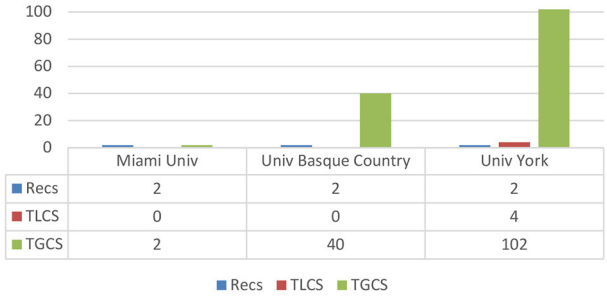

FIGURE 3
Number of publications by institution (≥2 Recs). Recs, number of articles; TLCS, Local Citation Score; TGCS, Global Citation Score.

There is a relevant link between the articles published and the total global citations received by each journal. Table 3, shown below, shows the journals with the most total global citations, ordered from highest to lowest with a cut-off set at TGCS/t = 2. The order of relevance is changed, with the most cited being the *British Journal of Educational Psychology* (n = 36.67) followed by *Frontiers in Psychology* (n = 19), *Sustainability* (15.33), *Review of Economics of the Household* (n = 14.5), *Journal of Applied Psychology and Retos-Nuevas Tendencias en Educacion Fisica Deporte y Recreations* (n = 5).

3.2. Co-citation analysis

This section presents the analysis of the co-citations. First, the co-authorship network is represented, followed by the cross-country collaboration networks, and finally the keyword networks are presented. All these results are presented in the maps below.

3.2.1. Co-authorship

Of the total of 149 authors, only collaborations between authors who have written one or more articles together are presented. The 13 co-authorship networks involving 28 researchers who have published a joint article on this topic are presented. There are two networks of three researchers, and eleven networks of two collaborators. Figure 6 shows the various collaborative networks.

3.2.2. Collaborations between countries

As shown in Figure 7, the United States is the most collaborative country in terms of cross-country collaborations, followed by China and the United Kingdom. There are also strong collaboration networks between Spain and Colombia, and between Indonesia and Malaysia, Singapore and Thailand.

3.3. Thematic analysis

Finally, this third section presents the results of the thematic analysis. First, we show the bibliographic coupling analyses both by documents and by words, and second, a strategic diagram of the various themes. All these results are represented by maps.

3.3.1. Bibliographic coupling for documents and keywords

A cut-off point of at least two citations per document (≥2) was established in the bibliographic coupling for documents. Subsequently, only those that were connected were selected, leaving the final analysis with eight documents, which were distributed in four different clusters (one color per cluster). The size of the letter is proportional to the number of citations and to the frequency of connections between them. These clusters are shown in Figure 8.

A thematic review of each cluster with the number of papers, citations and most prominent authors is provided below.

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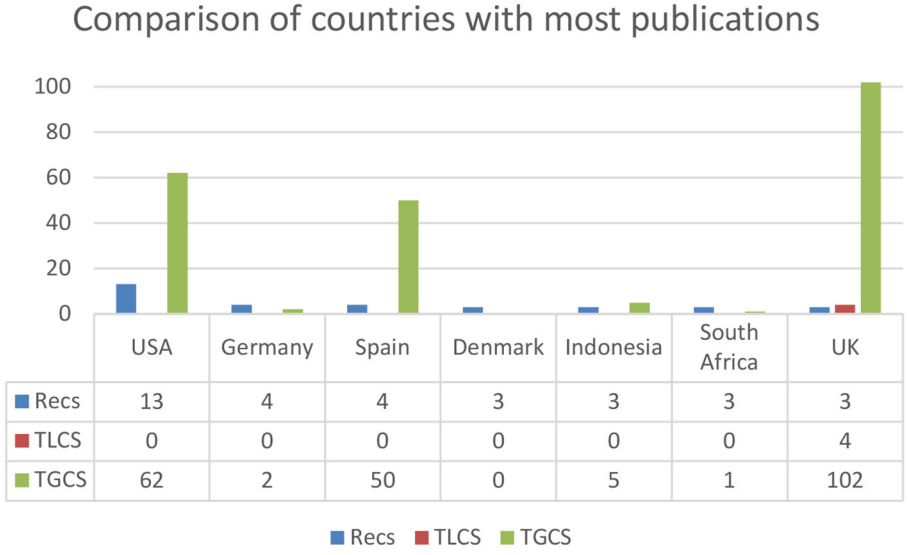

FIGURE 4
Comparison of countries with the most publications (≥3 Recs). Recs, number of articles; TLCS, Local Citation Score; TGCS, Global Citation Score.

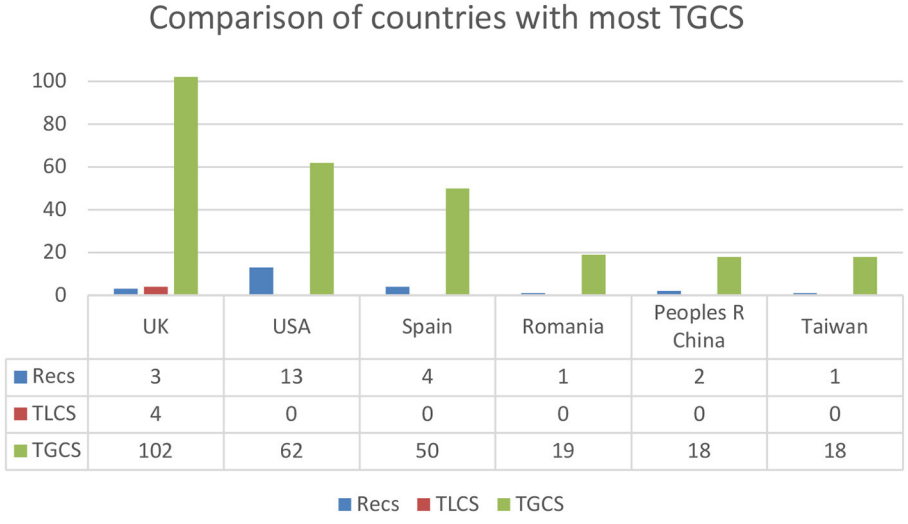

FIGURE 5
Comparison of countries with the most global citations (≥18 GCTS). Recs, number of articles; TLCS, Local Citation Score; TGCS, Global Citation Score.

TABLE 2 Journals by the number of publications and citations received (TLCS and TGCS) and impact factor (JCR) [76] (≥2 Recs).

Journal	Recs	TLCS	TGCS	TGCS	JCR
Frontiers in Education	3	0	5	2.50	2.32
British Journal of Educational Psychology	2	4	102	36.67	3.24
Frontiers in Psychology	2	0	38	19.00	4.23
International Journal of Environmental Research and Public Health	2	0	4	2.00	3.36
Sustainability	2	0	37	15.33	3.25

Recs, number of articles; TLCS, Local Citation Score; TGCS, Global Citation Score, TGCS/t, Global Citation Score per year;– means that these journals are in ESCI and they therefore do not yet have an impact factor.

TABLE 3 Journals by the number of total global citations per year (TGCS/t) (≥2 TGCS/t).

Journal	Recs	TLCS	TGCS	TGCS/t
British Journal of Educational Psychology	2	4	102	36.67
Frontiers in Psychology	2	0	38	19.00
Sustainability	2	0	37	15.33
Review of Economics of the Household	1	0	29	14.50
Journal of Applied Psychology	1	0	10	5.00
Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion	1	0	10	5.00
Journal of Chemical Education	1	0	10	3.33
Accounting Research Journal	1	0	6	3.00
Frontiers in Education	3	0	5	2.50
International Journal of Engineering Pedagogy	1	0	5	2.50
Academic Pathology	1	0	4	2.00
Asia Pacific Journal of Health Management	1	0	6	2.00
International Journal of Environmental Research and Public Health	2	0	4	2.00

3.3.1.1. Cluster 1-red (40 citations, two papers)

Psychological state of teachers when schools reopen. This cluster is made up of two articles (61, 62). It has received a total of 40 citations. The most cited article is Ozamiz-Etchevarria (62) with a total of 37 citations. It focuses on the level of stress, anxiety and depression experienced by teachers when they return to face-to-face work. The study shows that the period of isolation led to changes in social relations and in the working environment (62), and an increase in workloads due to having to adapt to online teaching. This increase resulted in psychosomatic problems and burnout (63). Meanwhile, the economic recession caused by the pandemic (64) has led to redundancies and instability. This situation increases the perception of job insecurity and has detrimental effects on health (62), leading to negative emotions such as a loss of confidence in their ability to teach (65). Moreover, the analysis conducted by the authors shows a relationship between high stress levels and age. Younger teachers (23–35 years) experience high levels of stress, caused by the financial uncertainty (66) which is related to job insecurity (67).

The second article is by Idoiaga Mondragón (61), with three citations. The subject is related to the psychological state of teachers with the opening of schools and the return to face-to-face teaching. According to this study the return to face-to-face teaching has led to relief of stress due to the support provided by interpersonal relationships and interaction with the teaching environment (68). These provide motivation to overcome the pandemic. Age is an important factor in measuring stress levels, and this is due to the increase in the use of new technologies (69). During the lockdown, teachers had to use them in their teaching and once they were back in the classroom, it was no longer possible to do without them. According to Idoiaga Mondragón et al. (61), older teachers have greater problems adapting to these new methodologies (70, 71). Teachers experiencing job insecurity suffer from significant psychological problems. In these cases, this psychosocial risk leads to a marked deterioration in the quality of life and consequently in the perception of safety, health and training opportunities (52, 72, 73).

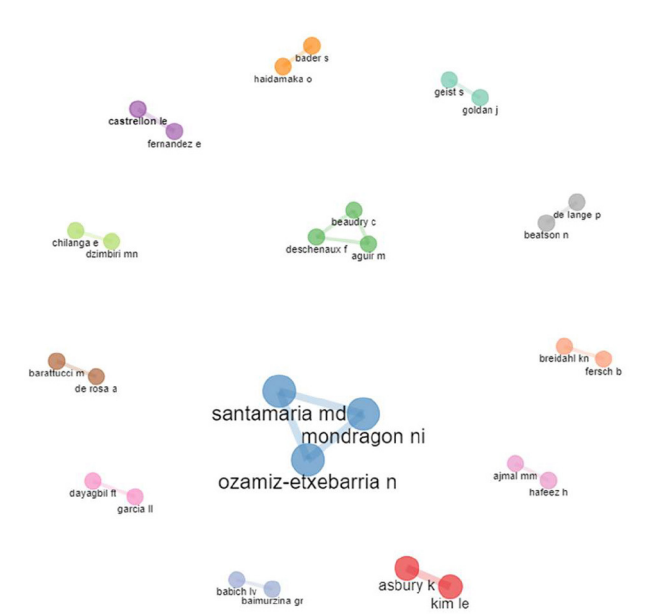

FIGURE 6
Co-authorship networks (≥1 collaboration).

3.3.1.2. Cluster 2-green (21 citations, two papers)

The emergence of new technologies and the work of teachers. The theme of this cluster is the shift from traditional teaching to online teaching and its impact on teaching performance. This cluster consists of two articles. It has received a total of 21 citations. The most cited article is Wang et al. (42) with a total of 18 citations. It discusses the change in teachers' work due to the pandemic. Mainly, traditional teaching modes have had to adapt to the online context. This has some advantages that will lead to schools considering their continuity and promoting the use of platforms for online learning, as well as the development of materials and activities for this type of teaching (74).

The second article is by Dayagbil et al. (43) with three citations, which explains the adjustments that teachers had to make and their influence on teaching performance in order to be able to continue teaching in the new context. Many learners had problems in carrying out the activities because of a lack of resources and training. The authors discuss the need to take action beyond the pandemic, and to adapt a more flexible approach. This will require the adaptation of materials and new forms of assessment by teachers, as well as the provision of the resources needed for this process in terms of equipment, systems and physical structures (75).

3.3.1.3. Cluster 3-blue (117 citations, two papers)

Insecurity in the face of new demands at work. This cluster consists of two papers. It has received a total of 117 citations. The most cited article is Kim and Asbury (44). These authors conduct a study of teachers' experiences of their performance during the lockdown. They discuss the need to adapt to new technologies, the uncertainty they experienced regarding the duration of this situation, and their lack of confidence in their ability to work in this new context. All of this has led them to suffer from burnout, stress and various psychological problems. The results obtained highlight the importance of interpersonal relationships with other colleagues, students and parents. Seeking emotional support from colleagues is one of the protective factors in mitigating stress. The change to remote teaching has affected these relationships, and has consequences for their self-esteem and job satisfaction (76).

The second article is by Obrad (19) and has 19 citations. This author explains the change in teachers' working conditions arising from the use of online tools and the difficulty experienced in achieving teaching objectives. The article analyzes whether teachers are able to meet the new requirements placed on them, and identifies educational constraints, stressors and factors that mediate resilience and work engagement (77).

3.3.1.4. Cluster 4-yellow (10 citations, two papers)

Worsening working conditions and lack of recognition of teaching by society. Kim et al. (34) studies the demands and resources at work that teachers reported experiencing in the pandemic. This article has four citations. As a result of the closure of schools, there was a negative perception in society about the work of teachers. This perception is erroneous since despite the fact that teachers did not physically go to schools, their work did not stop—on the contrary, it increased as they had to continue their classes online. This meant an increased workload. This workload also increased when teachers returned to the classroom, as in many cases they had to manage both the students in the classroom and those who had remained at home. The study found not only an increase in workload, but also a change in the nature of the workload. The feeling of being undervalued, the burnout suffered and the impact on their mental health has led some to consider leaving the profession (78).

The article by Pham and Shi et al. (79), with six citations, performs a textual analysis of various interviews discussing the mental anguish and stress suffered from being far from their country of origin, their families, isolated from school, from the facilities as well

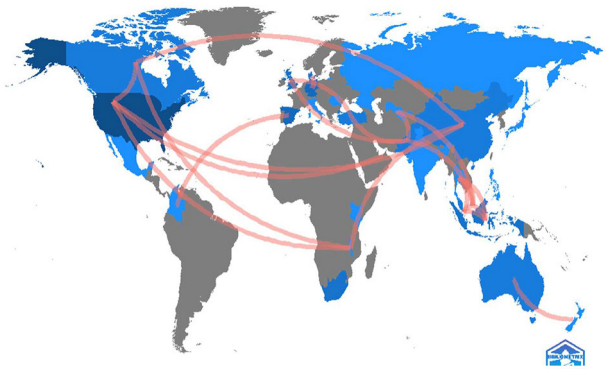

FIGURE 7
Country collaboration networks (≥1 collaboration).

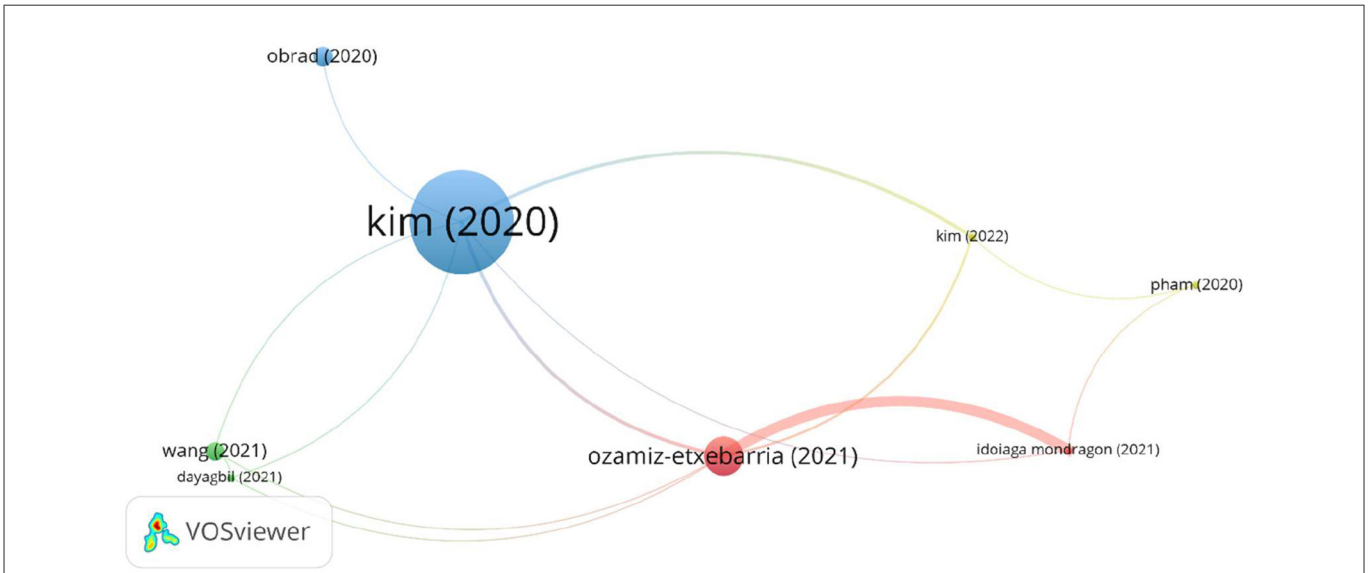

FIGURE 8
Bibliographic coupling analysis for documents (≥2 citations of publications).

as other factors affecting job security such as possible racism toward Asians, and a turbulent labor market.

A bibliographic coupling for co-word networks was then performed, and a group of seven clusters of different colors is shown in Figure 9. The size of the letter is proportional to the frequency of occurrence of the keyword and to the number of connections between them in both cases.

The most common keywords used in the publications under study total 315. If the cut-off point is set at a frequency equal to or greater than two ($\geq$2), there are 47. After screening for synonyms and groupings, we found a total of 39. Finally, after screening for non-originating words, the number is 31 ($n = 31$).

Six main groups of keywords were found. The first cluster, colored red, is composed of seven words, including "impact," "job-satisfaction," "life-satisfaction," "performance," or "self-efficacy," and refers to the impact of the pandemic on life and work and the relationship with the perception of self-efficacy. The second cluster, colored green, contains six words, including "achievement," "adjustment," "information technology," and "uncertainty." It focuses on the need for adjustment and uncertainty, and on the need for information technology to adapt work in the classroom. The third cluster, in dark blue, is composed of six words and focuses on teacher stress, resources and coping strategies, with parameters including "coping strategies," "resources," "burnout" and "stress."

The fourth one, in yellow, with eight words, refers to the use of new technologies in the classroom. There are also connected concepts such as "online learning" and "support." A fifth violet network contains four items ("health," "mental health," "technology," and "COVID-19"), referring to health and focusing on mental health. Once again, technology stands out in this grouping. The last network, in light blue, is made up of three words and refers to the anxiety suffered by teachers as a result of lockdown and related to education and work ("anxiety," "education," and "work").

3.3.2. Strategic thematic analysis

Finally, the strategic diagram of the thematic area analyzed is presented below (Figure 10). The size of the spheres represents the number of occurrences of these keywords. The upper right quadrant shows driving themes, the upper left quadrant niche/very specialized themes, the lower right quadrant core themes and the lower left quadrant emerging or disappearing themes. The themes in the upper right quadrant are "achievement," "adjustment," "classroom," "impact," "burnout" and "job-satisfaction," all of which are relevant and well developed for the structuring of this research field. The topics in the upper left quadrant, which are "children," "meta-analysis," "school," "reliability," and "validity" are relevant but underdeveloped, and should therefore be researched further. We can see how the latter refer to statistical aspects and this diagram therefore shows the desirability of further research of this nature.

The topics in the lower left quadrant are underdeveloped, and mainly represent emerging or disappearing topics. In this case, the term "technology" (together with "labor") is undoubtedly an emerging theme in teaching, and its development will therefore increase considerably. The topics in the lower right quadrant are essential for this research field, and focus on the health of teachers with problems such as anxiety. As a result, the basic cross-cutting and general themes of "health," "anxiety," "determinants," and "antecedents" appear in this quadrant. The thematic analysis shows that the term "technology" is increasing in importance in the field of teaching, and shows highly relevant topics that are not being sufficiently developed, and therefore need greater focus.

3.4. Analysis of the main results

The main results are presented below, grouped according to the methodologies used and the main thematic groups.

3.4.1. Main methodological results

The majority of the research articles (55.3%) were quantitative. A total of 4.2% were triangulated, providing both quantitative and qualitative results. Meanwhile, 17% of the studies selected were qualitative in nature. Finally, 17% were literature reviews.

3.4.2. Main thematic results

There are two thematic areas in relation to job insecurity. One deals with the causes, and the other with the consequences.

The causes include the following sub-themes:

- Changes in the working environment. Abandonment of a traditional model and the emergence of online learning and all that this entails. Challenges presented by online learning, lack of skills, inexperience, rapid transition without training resources, physical isolation. 36% of the publications referred to these issues (43, 80–86).
- Changes in working conditions. Increased workload with development of new materials, time devoted to training, new organization of the teaching-learning process, curricular adaptations to the new environment, among others. 30% of the publications referred to these issues (29, 30, 33, 82, 86–90).

The second thematic block focused on consequences included the following:

- Factors that modulate the consequences of insecurity. Perceived self-efficacy, social support, sense of belonging, motivation, coping strategies, resilience, interpersonal relationships, emotional intelligence and organizational support. 22% of the publications referred to these topics (20, 34, 35, 87, 90–94).
- Work-related health and attitudes: burnout, depression, stress, job dissatisfaction, fear, perceived vulnerability, uncertainty. 12% of the publications referred to these topics (19, 34, 62, 95, 96).

As has been shown, there is clearly a teaching challenge experienced when moving from traditional teaching to an online environment. The workload increases considerably, and the work demands and effort required to perform the job increases exponentially. The resources and training do not meet the requirements and as an immediate cause, teachers are subjected to stress, exhaustion and depression. In addition, fear of this new situation and working environment influences the teacher's perception of self-efficacy. Their confidence in their abilities is undermined by their lack of training and knowledge of new technologies and the tools related to them. All of this has a

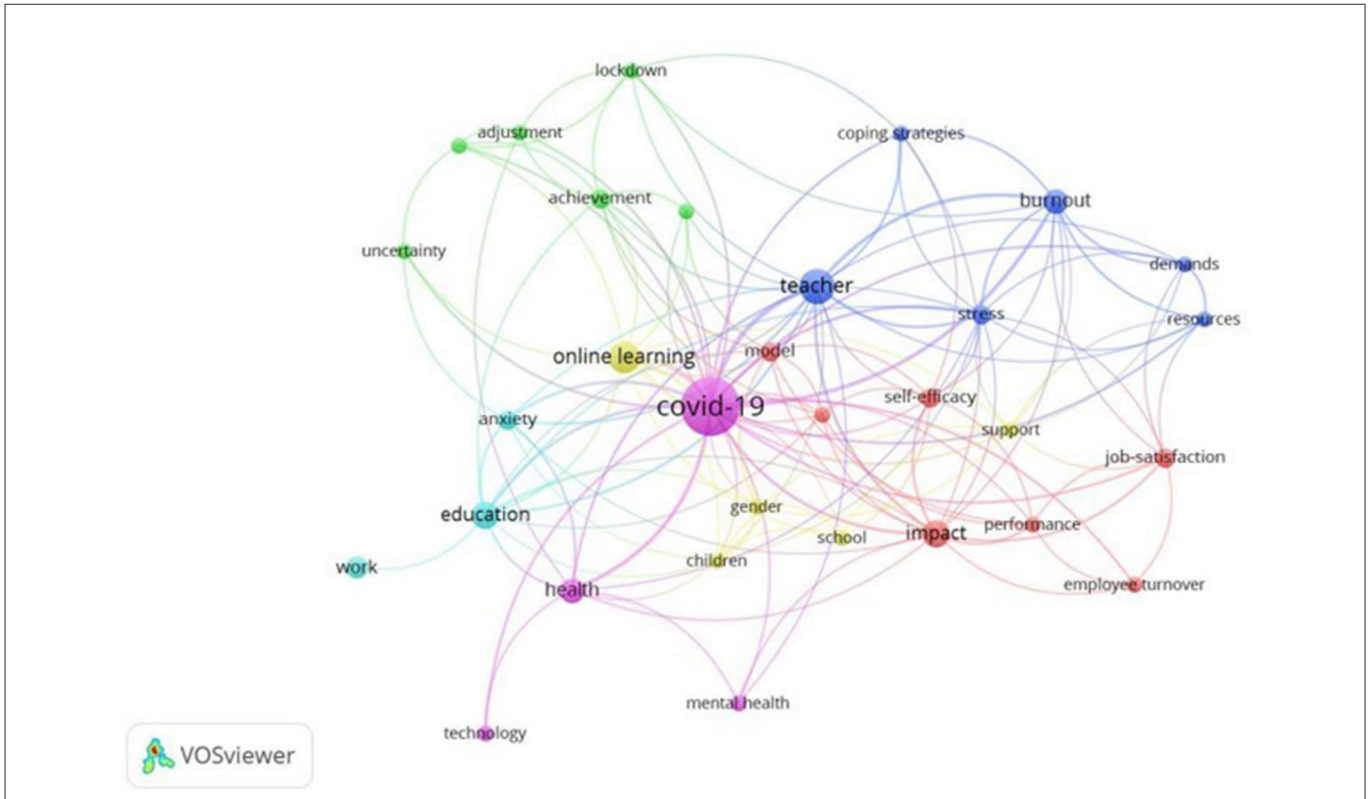

FIGURE 9
Bibliographic coupling analysis for co-word networks (≥2 co-word networks).

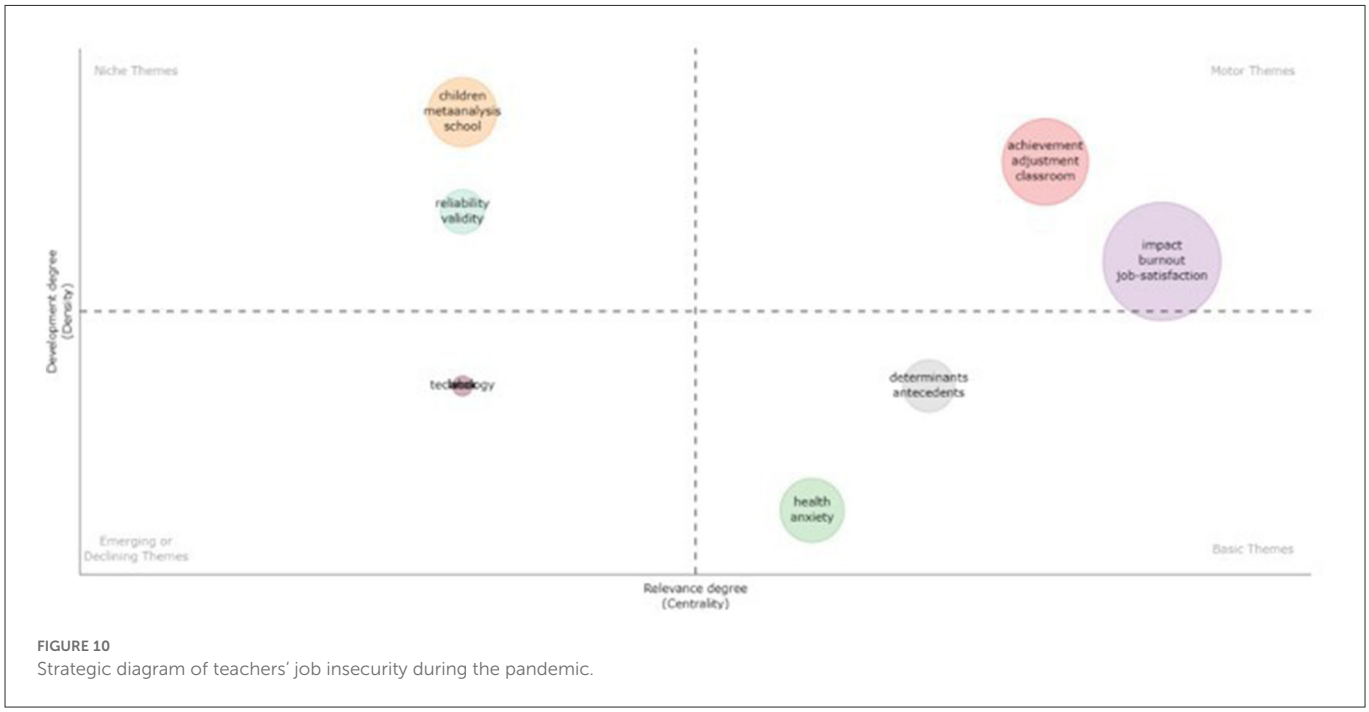

FIGURE 10
Strategic diagram of teachers' job insecurity during the pandemic.

clear impact on fear of the new working conditions and of being unable to carry them out adequately. Some articles present job insecurity and its influence on teachers' health. Emotions such as fear, uncertainty, perceived vulnerability, make coping strategies difficult, so some publications propose techniques to improve emotional states, such as mindfulness, mindfulness and ways to enhance resilience.

Another important topic due to its relevance in education is the educational response to students with special educational needs (93, 97, 98), which is addressed in three articles. This type of student

requires direct and individualized attention. Personal contact with these students is necessary, and online teaching does not enhance this aspect. Their learning and development are clearly impaired in this new working environment.

Finally, several authors stress the importance of the permanence of online methodologies in teaching (33, 42, 43). The advantages of online teaching require schools to assume that they will continue and with it, the need to promote the use of educational platforms and materials for online learning (29, 33, 34, 87, 92).

4. Discussion

This article analyzes the importance of job insecurity among teachers since the beginning of the pandemic. It also performs a critical assessment of the publications on this subject in order to evaluate the impact of COVID-19 on the work environment of teachers, and how it has affected their psychosocial risks and their job security in particular.

Interesting data can be extracted from the analysis carried out. Since the subject matter is related to the COVID-19 pandemic, the first article was published in 2020. There were six publications in that year, and there was a significant increase in the number of publications in a single year, to 26 in 2021. In 2022, despite the time elapsed since the start of the pandemic and a decline compared to 2021, this topic continued to be of interest, with 12 publications up to the time of the search. The most prolific institutions, with two publications each, were *Miami University*, the *University of the Basque Country* and the *University of York*. In terms of global citations, the *University of York* has the most global citations, with a total of 102, followed by the *University of the Basque Country* with 40. Although the number of publications is low, the number of citations is high, which shows the interest the articles attract. The most prolific countries are the United States with 13 publications, followed by Germany and Spain with 4. The United Kingdom was the country with the most citations, with 102 global citations, followed by the United States and Spain, with 62 and 50 respectively. The United States was the country with the most collaborations, followed by China and the United Kingdom. This rate of collaboration is positive, as this is a pandemic that affects the whole world, and sharing information can be highly beneficial (99).

A total of 149 authors have published articles related to this issue, with Asbury K, Kim LE, Mishra R, Mondragón NI, Ozamiz-Etxebarria N and Santamaria MD being the most prolific authors with two papers each. The most collaborative authors are in two groups: Santamaria, Mondragon, Ozamiz-Etxebarria, and another group formed by Beaudry, Deschenaux and Aguir. The most common fields to which the authors interested in the question belong are Public Environmental Occupational Health with eight authors, followed by Education Educational Research with seven authors. It should be noted that although the number of publications is not excessively high, the number of global citations is high, rising to 102 in the case of Asbury K and Kim LE and 40 in the case of Mondragón NI, Ozamiz-Etxebarria and Santamaria MD. This shows the growing interest in the subject. The review carried out shows that some authors focus on the causes that have led teachers to perceive job insecurity, analyzing the changes in working conditions that have appeared since the pandemic.

The results show that changing working conditions and lack of confidence in the ability to adapt to the new environment will increase the perception of job insecurity. This perception is due not only to a loss of employment, but also to the fear that it may occur (32, 61, 80). These results are consistent with the general literature on job insecurity (12–16). This psychosocial risk will cause stress in teachers and if sustained over time, lead to burnout, various psychosomatic disturbances and health problems (37). One of the recurring points addressed in the articles by the researchers (20, 29, 33–35, 42, 43, 80, 82, 83, 87, 88, 100, 101) is the perception of being unable to adapt to the use of the technologies needed to meet new labor demands. Adapting to this new context requires time and effort in training, the use of innovative resources, the creation of new materials and the provision of space, which must be combined with every day and family life (20, 29, 30, 34, 42, 87). Other articles discuss the transition from traditional teaching to online teaching, focusing on the consequences such as increased workloads (29, 30, 82, 88). Teachers have to adapt to the new online context by creating materials, interactive activities, new forms of assessment and providing adequate resources (42). This workload and its changing nature sometimes leads to a decline in perceived self-efficacy (20, 30, 44). This has an impact on job security, and leads teachers to suffer from burnout and even leave the profession (34). The closure of schools during the health emergency period led to the need to adapt to this new work context. This situation causes technostress (80) as the worker perceives that they are unable to adequately handle the demands made of them (102).

One author, Koç and Fidan (81), sees significant distinctions between teachers in private and public sector institutions. According to this author, teachers in public schools are more likely to acquire digital competences in order to adapt to the new situation. Job insecurity also moderates the relationship between technostress and teachers' willingness to use online modalities, with temporary contract workers being more likely to use new technologies (80). Other studies, such as the one by Ozamiz-Etxebarria et al. (62), show that teachers with temporary contracts of less than 3 months have the highest levels of depression and anxiety, with the percentages of pre-school, primary and secondary school teachers being higher than among university teachers (23). Meanwhile, there are articles that point out the factors that modulate the impact of job insecurity and psychosocial risks on teachers' health (44). These factors include peer emotional support and the establishment of significant support structures (61, 91, 92). These were undermined by the social isolation that occurred at the height of the pandemic. Another modulating factor is the provision of skill-building resources that enhance perceptions of self-efficacy (32, 81, 87). One such resource is the provision of support for remote learning (90). Another protective factor is fostering organizational support (30, 34). Involving teachers in school decisions is one of the measures that contributes to an increased sense of control (98) and lowers levels of insecurity and stress. All these factors contribute to alleviating emotional exhaustion and promote coping strategies (103) that help to improve stress levels and mental health.

These results imply progress in the field of non-university teachers who currently lack bibliometric studies on job insecurity in general (104) and on conditions in a health emergency such as COVID-19 in particular. However, the study is not without its limitations. The first one concerns using a single WoS database even though it is a controlled and verified quality source (105). The second

is the limited number of publications that make direct reference to the job insecurity experienced by teachers as a result of the pandemic. As a proposal for the future, we suggest that a more extensive compilation covering other databases should be carried out, grouped and evaluated using a methodological quality tool such as a meta-analysis. Furthermore, it would be interesting to extend the study to other psychosocial risks, and to determine the significance and relationship between them and job insecurity. This study would make it possible to propose strategies to improve the health and working conditions of teachers, and to mitigate the effects of the psychosocial risks they experience.

5. Conclusion

This bibliometric analysis provides an objective measurement of the topics of most interest to researchers, collaborations between researchers, citations, the impact factor of journals, and the countries and institutions most interested in the issue. The impact of COVID-19 on the job insecurity of teachers is of interest to researchers but needs further investigation.

The results focus mainly on the causes and consequences of job insecurity, as well as on the moderating variables (social support, interpersonal relationships, organizational support, etc.) that make it possible to mitigate the effects of this psychosocial risk. As well as on the existence of job insecurity determinants such as organizational justice, organizational support or perceived self-efficacy. These findings indicate that school administrators and policymakers can intervene to address the job insecurity of their non-university teachers by fostering organizational support, involving teachers in school decisions, and helping to increase their sense of control. All these factors contribute to alleviating emotional exhaustion and promote coping strategies to improve the level of stress and mental health of non-university teachers, thereby benefiting society as a whole.

Author contributions

Conceptualization: VG-D and DN-M. Methodology and formal analysis: MdCG-E and TG-D. Software and project administration: VG-D. Investigation: DN-M. Resources and writing—review and editing: VG-D and MdCG-E. Writing—original draft preparation and visualization: DN-M, VG-D, and TG-D. Supervision: MdCG-E. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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

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Born or not: A moderated mediation model of the relationship between work-family conflict and female employees' wellbeing based on fertility intention during the COVID-19 pandemic

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The previous academic research on work-family conflict mainly focused on the relevant elements in the work field. This study concludes that elements of the family domain have a significant impact on the relationship between work-family conflict and employee wellbeing. Female employees' perceptions of wellbeing largely depend on their willingness to have children when they take on family roles. During COVID-19, employees had more time to fulfill both work and family roles in the family sphere due to the epidemic blockade, the contribution of the female employee's significant other (husband) in family matters had a significant impact on Fertility intention. This study using SPSS 24.0 AMOS 20.0 and M plus 7.4 statistical analysis tools to test the proposed hypotheses. In the paired data of 412 working female employees and husbands of Chinese dual-earner families with different occupational backgrounds, hypothesis testing results support that female employees' work→family conflict is negatively related to female employees' fertility intentions, and female employees' fertility intentions are positively related to wellbeing; female employees' family→work conflict is negatively related to female employees' wellbeing; husband's flexible work stress is negatively related to husband's share of housework; husband's share of housework moderated the front, rear and overall mediating effects by the fertility intention. When formulating policies, the managers should consider not only the direct effects of policies, but also the indirect effects that policies may have on other family members of employees. Managers should develop management policies during an epidemic that are more responsive to the actual needs of employees during an epidemic. The management of female employees should give due consideration to the family status of female employees and the enterprises should recognize the importance of childcare for female employees.

KEYWORDS

work-family conflict, wellbeing, fertility intention, husband's share of housework, husband's flexible work pressure

1. Introduction

Employees are an important part of the organization. Although both work and family aspects are of great importance to employees, research on work aspects has always occupied an important place in the study of organizational behavior, while research on employees' family aspects has lacked attention. However, the goal of organizations is not only to focus on performance improvement, but also on the wellbeing of individual employees and their families, so certain characteristic factors at the employee family level, such as the impact of fertility intentions on the relationship between work-family and wellbeing, have unique research value.

In the past 30 years, China has maintained rapid economic growth under the socialist system, which is mostly based on China's demographic dividend. However, according to the data released by the National Bureau of Statistics of China, the birth rate of China in 2020 was 8.52 per thousand, which is lower than 1%, a new low in more than 40 years. The number of people born in 2021 was dropped by 1.38 million compared with 2020. The decline of the fertility rate will first lead to the slowdown of economic development and the transformation of economic growth (from labor-intensive production to technology intensive production). At the same time, this study believes that the decline in fertility will also lead to changes in family wellbeing, more specifically, it will affect the wellbeing of women in the family, because women have traditionally assumed more family responsibilities than men. Meanwhile, China's fertility policy has undergone many major changes. The attitude and understanding of Chinese female employees toward fertility are also changing significantly with social development and economic growth.

China has adopted epidemic control measures different from those of other western countries. From the outbreak of COVID-19 epidemic in December 2019 to December 2022, the Chinese government has always adopted the policy of combining nucleic acid detection with double code identification of health code and journey code, and implementing regional blockade and dynamic zero clearing of "confirmed patients" in epidemic areas (communities). This series of control measures made the flexible work frequency of Chinese employees in home isolation much higher than that of employees from other countries in the same period. This is why this study should consider the impact of the husband's flexible work pressure on the husband's housework in the context of the epidemic. Especially after the outbreak of the COVID-19 epidemic, China is one of the few countries in the world that took the lead in recovering from the epidemic. As a special sample of the global economy, China has attracted many scholars' attention and research, especially in the field of human resources and organizational behavior. In recent years, many scholars have paid attention to how the Chinese government and enterprises can effectively organize and manage human resources under the major global public health crisis, so as to achieve efficient recovery of economic production.

The COVID-19 epidemic has caused heavy damage to the global economy and people's production and life. Against this historic background, all countries are trying to do their utmost to control the epidemic and let the country and people get rid of the negative impact of the COVID-19 epidemic as soon as possible. From a macro perspective, investment, consumption and export, the troika driving China's economic growth, have weakened during the epidemic. From the government's standpoint, whether it is to stimulate investment, promote consumption or expand domestic demand, it is inseparable from human resources to provide production, construction and product services. People are an important factor of production. Under the background of the normalization of the epidemic situation, the government and enterprises are eager for employees to participate in social labor and drive economic recovery and enterprise revenue growth. From the micro level, first of all, the large-scale shutdown caused by COVID-19 has led to the unemployment of most employees in a country without a source of income, which has seriously affected the quality of life of individual employees (1). During the epidemic, employees will be unemployed, but their housing and car loans for living still need to be repaid continuously. Life is still going on, and all daily expenses need to be sustained by continuous income, even when employees are isolated at home. Secondly, the social isolation during the prevention and control of COVID-19 epidemic led to the lack of basic offline social activities and communication among employees, which caused mental stress on individual employees and affected their individual health to a certain extent (2). Some data show that at the beginning of the liberalization of the isolation measures in different cities in China, people will generally have a wave of retaliatory consumption (3). Some studies have pointed out that retaliatory consumption is a release of mental pressure (4). Based on the above, individual employees in the context of COVID-19 epidemic have a strong desire to return to social production and commercial activities. Therefore, work is particularly important to employees, both male and female. In modern society, men, as the main source of family income, dominate the family economy. At the same time, women have contributed more value to all aspects of social and economic activities—production, service, circulation and other fields than in any previous human historical period. But at the same time, women's responsibilities in the family have not changed at all. They give birth to children, raise children, and become the most important partner and learning mentor of children. Nowadays, elite education is prevailing in China, The demands of female employees on childcare in their families—whether from the social competitive environment or from the improvement of their own education level—are increasing. According to the Global Gender Gap Report 2020 (5) released by the World Economic Forum, in 2019, China's female education score has risen to 0.973 points, ranking first in the world with an indicator score close to 1.00 which is full equality. Based on the principle of limited individual resources of the conservation of resource theory, the multi role pressures and conflicts encountered by female employees in the new era from job requirements, childcare requirements, household requirements and other requirements will inevitably lead to further intensification of the scarcity of female employees' individual resources, which will cause changes in female employees' expectations for fertility. From the 1970s and 1980s when Chinese wanted to be born but policy restrictions could not, to the present when people do not want to be born but the national policy has been born, China's population policy has undergone a major change. Specifically, China implemented a comprehensive two child policy in 2016, completely abolishing the family planning policy implemented since 1978. China's population issue has always been a global, long-term and strategic issue. In 2021, the report on the work of the Chinese government at the two sessions of the National Congress and the Chinese People's Congress again emphasized optimizing the birth policy to cope with the aging of the population. At the meeting of the Political Bureau of the CPC Central Committee, it was decided to implement the three child birth policy. This series of population policy adjustments is a concrete manifestation of the self-evolution and evolution of China's human resources in terms of quantity and quality brought about by China's economic growth and rapid social development.

China's population is about to enter the era of negative growth, and the continuous decline of the birth rate will further restrict China's economic growth from the supply side and the demand side (6). On the one hand, the shift of economic growth momentum to innovation driven may aggravate the asymmetry between employment creation and employment destruction, the imbalance between human capital supply and demand, and increase the natural unemployment rate dominated by structural and frictional factors; on the other hand, insufficient employment and low quality are not

conducive to the reasonable improvement of workers' remuneration, and will also hinder the full play of China's economic growth potential from the demand side.

Based on the conservation of resource theory, this study constructs a two-stage mediated model with the husband's share of housework as the moderating variable, fertility intention as the mediating variable, and examines the relationship between work-family conflict and their wellbeing encountered by female employees in Chinese society. The mechanism and boundary conditions of its generation, taking COVID-19, China's two-child and three-child fertility policy as the background. A questionnaire was used to collect paired data from 412 working female employees with different occupational backgrounds in Chinese dual-earner families and their husbands, and data analysis was conducted using SPSS 24.0 AMOS 20.0 and Mplus 7.4 statistical analysis tools to test the proposed hypotheses.

The findings not only deepen the understanding of work-family conflict and wellbeing research, but also clarify the mechanism of work-family conflict on wellbeing at the family level, expand the research field of work-family conflict, highlight the important influence of work-family conflict on wellbeing in the family context, and provide theoretical guidance and practical insights for managers to comprehensively understand the influence of work-family conflict on employees.

2. Review of relevant studies

Role conflict may occur when working employees occupy multiple roles in the work and family domains and are unable to handle demanding work and family roles at the same time. Work-family conflict is defined as "an inter-role conflict in which role pressures from the work and family domains are incompatible in some way" (7). Work-family conflict is a two-way street; work→family conflict refers to work-role interference with the family role, while family→work conflict refers to family-role interference with the work role (8). The concept of work-family conflict provides a useful theoretical perspective on the declining fertility of employed women. Previous research has shown that female employees experience more work→family conflict than male employees due to unequal division of labor in the family, which is considered to be the main influencing factor for the low fertility rate of female employees (9). That is, to increase female employees' fertility intentions, work-family conflicts caused by gender inequality in the family domain should be addressed (10). Becoming a parent is both rewarding and hard, and both parents feel happy and take responsibility for raising their children (11). Parenting requires sustained energy, and the time and energy taken up requires working parents to correct their daily behaviors or perceptions (12). Working parents tend to experience particularly high levels of parenting stress as the burden of childcare increases and as roles conflict between the work and family spheres (13). Abidin's (14) model of parenting stress suggests that barriers to parent-child interaction, perceived difficulties in child communication, and parents' expressed complaints about life in their daily lives can negatively impact parenting. As with work-family conflict, parenting stress is considered an indicator of reduced fertility intentions among working female employees (15). Parents with jobs are more likely to be discouraged from having a second child if parenting stress continues at a high level and is accompanied by negative emotions such as depression and anxiety (16). Considering that high levels of parenting stress among working mothers who already have one child may reduce their willingness to have a second child, understanding how to reduce parenting stress among working women employees is an important issue in low-fertility countries (17). Work→family conflict and childcare stress are considered to be the main reasons for low fertility among working female employees in European countries (13), but few studies have examined these associations in Chinese samples. In addition, mothers' parenting experiences at the time of their first child, including the amount of "parenting support" they received from their husbands, and their work status upon returning to the workplace (work-family conflict) are strongly associated with their second childbearing intentions. Given that parenting support from working fathers helps to alleviate work-family conflict and parenting stress among working mothers (18), if working fathers can spend more time and energy at home and support working mothers (female employees) by engaging in family activities such as housework, this may reduce work-family conflict and parenting stress among working mothers This in turn increases their motivation to have a second child.

In previous studies, control variables such as socioeconomic status (e.g., age, educational background, income) of working female employees were found to be strongly associated with their intention to have children. Younger female employees have higher intentions to have children than older female employees, and these results may be related to biological reproductive capacity (19). Increased education of female employees also somewhat reduces female employees' intention to have children, due to the fact that highly educated female employees are more likely to be economically active and have a strong desire for self-fulfillment (20). Other studies take the opposite view, arguing that more educated female employees tend to have more children than less educated female employees because educated women are likely to marry men of higher socioeconomic status (21). In addition, researchers found that female employees' income was positively associated with fertility intentions (22).

During the continuous crisis pandemic of COVID-19 period, policy makers and organizations should focus on formulating and implementing policies to promote family friendly workplaces, so as to enhance employees' sense of corporate belonging (23). The implementation of flexible work arrangements (FWA) provides opportunities for organizations to reduce staff mobility and promote employee development through work life balance plans (24). During the epidemic, the organization continuously strengthened its online psychological support for employees through the use of communication technology, which was also achieved through smart phone applications that could provide effective intervention functions (25). In addition, the results of a study taking German families as a sample show that various control measures against COVID-19 pose a more common threat to the quality of relationships between couples within the family and the healthy family functions (26). Some scholars believe that the work life conflict of employees has decreased in general during the epidemic, but these changes are also limited by the age of the youngest child in the family and the degree of work family integration (27). At present, the research on the work-family relationship of employees has not yet involved how the fertility intention is affected by family support related factors in the context of COVID-19. Based on the COVID-19 background and China's unique fertility policy changes, how does fertility intention affect the relationship between work-family conflict and female employees' wellbeing. In conclusion, based on

the background of the COVID-19 and China's unique fertility policy changes, this paper intends to study how fertility desire affects work family conflict relations and the well-being of female employees, to supplement the research gaps in this area.

Based on the above, this study developed a scale to investigate the fertility intentions of female employees in the context of the "comprehensive two-child" and "three-child" policies and in the epidemic environment, based on the quantitative study of fertility intentions conducted by Miller (28) and Zheng (29). Based on the work stress scale compiled by Price and Spence (30), we developed a stress scale for flexible work situations during the epidemic to investigate the stress of flexible work (WFH) for husbands during the epidemic, including work-related stress and work-related stress (e.g., the need to punch in daily health codes and trip codes, and to complete nucleic acid tests on time). Five hundred dual-earner couples were invited to participate in the study, with husbands completing the husband's flexible work stress Scale and questions on the husband's time spent on housework; wives mainly completed the questionnaire's answers to the scale items on work-family conflict, family-work conflict, fertility intention, and wellbeing of female employees. The willingness of one of the spouses to participate was mainly solicited through an online WeChat group, and then the scales were sent separately after obtaining the consent of both parties through internal coordination between the spouses. The screening of a couple is identified by one spouse identifying the other's WeChat name.

3. Theoretical basis and research hypothesis

3.1. Work-family conflict and fertility intentions

Role conflict arises when individuals are unable to balance the rationing of resources between different roles. Unlike role conflict within the work domain (e.g., an employee acting as a leader or organizer of one project while acting as a performer of another), work-family conflict is a conflict that results when an employee is unable to reconcile the allocation of energy, time, and behavior between work and family, and is unable to achieve a balance between these two compartmentalized domains. Conservation of resource theory (COR-Conservation of Resources) (31) proposes that individuals are motivated to acquire, maintain, and protect resources, such as self-esteem, socioeconomic status, and employment, in order to manage work and family demands. Based on resource preservation theory, female employees who experience work-to-family conflict (being too busy at work to go home rarely to care for their sick father) or experience family-to-work conflict (being unable to accept a promotion offered by their supervisor because of the amount of time and energy required to care for their young children, because the promotion means more work tasks and more work pressure), their efforts to protect available resources (such as job opportunities or family relationships) will reduce the behaviors associated with continuing to generate this conflict, along with lower behavioral motivation, such as willingness to have children. Ma and Jin (32) concluded that work-family conflict has a significant effect on nurses' willingness to have a second child during their reproductive years. In summary, according to conservation of resource theory, childbirth threatens or consumes individual employees' time, energy, and personal resources, and due to the limited resources, female employees, based on their existing work-family conflict, will reduce their "willingness to have children" that may lead to increased work-family conflict in order to mitigate that conflict and protect the work-family relationship. Therefore, this study proposes hypotheses for a broad group of female employees in a wide range of occupational types based on their willingness to have children regardless of whether they have one, two, or three children. Therefore, the following hypotheses are proposed based on the female employees' fertility intention as shown in Figure 1.

Hypothesis 1. Work-family conflict among female employees is negatively associated with fertility intention.
Hypothesis 1a. Female employees' work→ family conflict is negatively associated with fertility intention.
Hypothesis 1b. Female employees' family→ work conflict is negatively associated with fertility intention.

3.2. Fertility intention and wellbeing

Fertility intention is the manifestation of fertility desire of individuals or families taking into account constraints, including specific dimensions such as the desired number of children, gender, and timing of childbirth (33). Fertility intention is a necessary but not sufficient condition for generating fertility behavior, and there is a definite link between the two. This study focuses on the expected number of children to examine fertility intentions and its impact on female employees' wellbeing.

Diener and Emmons (34) argues that "wellbeing" or "subjective wellbeing" refers to "people's evaluation of their lives," including "cognitive judgments of satisfaction" and "affective evaluations of emotions and moods." Cognitive judgments of satisfaction" and "affective evaluations of emotions and moods." Boehm and Lyubomirsky (35) considers "happy people" to be "people who regularly experience positive emotions," such as "wellbeing" such as "joy," "wellbeing," and "contentment." Although wellbeing is important for both individuals and organizations (36), there is limited research on employee wellbeing (37). In this paper, people build on previous work, this study defines female employees' happiness as a comprehensive feeling of subjectively perceived wellbeing of female employees by integrating various experiences in the personal, family and work domains. Although the work role is one of the important social roles of female employees, their non-work roles (wife and mother) are also an important part of their lives. Excellent family roles also bring happiness to female employees.

It has been suggested that good family relationships have an important impact on individuals' perceived wellbeing (38). In family relationships, childbearing and the number of children are important aspects in reconciling family relationships (39). Studies point out that people with children are generally happier than those without children (40); having two or more children is happier than having only one child (41). In addition, the higher the number of children, the higher the individual's life satisfaction (42), and the number of children is positively related to the mother's wellbeing (43). At the same time, the wellbeing of the elderly is in an inverted U-shaped relationship with the number of children (44). Based on the logic that fertility outcomes are generated by fertility intentions, and based on the theoretical and empirical foundations of the above literature,

this study proposes the hypothesis that. Based on the theoretical and empirical basis mentioned above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 2. Fertility intention is positively related to female employees' wellbeing.

3.3. Work-family conflict and wellbeing

For employees, life and work are two inseparable and important aspects. Since employees have limited energy and time, their energy and time consumption in one situation (e.g., work situation) will crowd out and spill over to the energy and time consumption needed in another situation (e.g., family situation). Based on the segmentation theory (45), it is commonly believed that work and family are conflicting fragmented in individuals. Work-family conflict is divided into two directions: "work→family conflict" and "family→work conflict" (46). The "work-family conflict" refers to the work stress, time and energy occupation generated by the work field, which adversely affects the family field. For example, a male employee has no time to take care of his wife during her illness and hospitalization due to high work pressure and heavy workload, so much so that it affects his family life, such as leading to the weakening of the couple's relationship and deterioration of the couple's relationship. "Family→work conflict" refers to the negative impact on employees' performance in the workplace due to the time and energy they need to pay for their family responsibilities. For example, a female employee cannot accept a business trip because she has to take care of her mother who is paralyzed at home all year round. Wellbeing is a measure of employees' survival status, and in the past literature its mostly related to job satisfaction and family satisfaction. With the development of economy and social progress, organizations are paying more and more attention to improving employee wellbeing, i.e., wellbeing, especially high-tech companies are doing a better job of humanistic care for their employees (47). Companies expect to attract and retain talents by improving employees' wellbeing and forming "word of mouth" and talent gathering effect in the industry (48). Regarding the relationship between work-family conflict and wellbeing, some scholars point out that work→family conflict is significantly negatively related to wellbeing, and family→work conflict is also significantly negatively related to wellbeing (49). Based on the above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 3. Work-family conflict of female employees is negatively related to the wellbeing of female employees.
Hypothesis 3a. Female employees' work→ family conflict is negatively related to female employees' wellbeing.
Hypothesis 3b. Female employees' family→ work conflict is negatively related to female employees' wellbeing.

3.4. Mediating role of fertility intentions

In conservation of resource theory, individuals lose resources in one domain, and out of the initial desire to protect resources and prevent their continued depletion, individuals take steps to reduce their continued investment of resources in that domain and instead invest them in other alternative domains that may yield resource gains (50). When female employees navigate between work and family and find that the behaviors, time, and stress generated by the family domain create significant conflicts in the work domain, female employees may reduce their resource investment in the family domain to reduce the conflicts, thus achieving the goal of reducing further resource depletion. In China, female employees' childbirth is one of their important matters in the family domain (51). Reducing the resource investment in the family domain means that female employees may be less willing to have children and reduce their reproductive behavior. And based on traditional Chinese values, the main social duty fulfillment and social value of women is to pass on the family line and bear children. The decrease in resource input at the family interface resulting from work-family conflict and the resulting decrease in fertility intention will prevent female employees from gaining recognition of traditional social universal values and reduce self-worth recognition, which will ultimately have a negative impact on the subjective wellbeing they may experience. Based on the above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 4. Female employees' fertility intentions mediate the relationship between female employees' work-family conflict and female employees' wellbeing.
Hypothesis 4a. Female employees' fertility intention mediates the relationship between female employees' work→ family conflict and female employees' wellbeing.
Hypothesis 4b. The mediating role of female employees' fertility intention between female employees' family→ work conflict and female employees' wellbeing.

3.5. Husband's flexible work pressure and husband's share of housework

Segmentation theory suggests that work and family are two separate domains, so the more time and energy employees spend and take up in the work domain, the less time and energy they must allocate to the family domain (45). During the epidemic, many husbands were required to work from home or work in isolation in hotels due to the local epidemic control measures because they were in a high outbreak area or their health code was red or yellow. Flexible work is a system in which employees can flexibly and autonomously choose their own work schedules in lieu of uniform, fixed commuting hours, provided that they complete their required tasks or work a fixed length of time (52). Regarding the work stress in flexible work status, Yue (53) believes that flexible work can reduce commuting stress for employees. At the same time, since supervisors cannot supervise employees' work completion progress on site, in order to avoid situations such as slacking off, supervisors may ask employees to complete their work tasks within more demanding working hours during flexible work, which may make employees' perception of stress stronger. When a husband experiences flexible work treatment during an epidemic, he is likely to redistribute his work and household time based on different perceptions of stress based on segmentation theory. Based on the above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 5. Husband's flexible work stress is negatively associated with the husband's share of housework, i.e., the higher the husband's flexible work stress, the lower the husband's share of housework.

3.6. Moderating effect of the husband's share of housework

It has been shown that context has a significant moderating effect (54). The family environment is one of the contexts that female employees encounter at home. When the home environment, presents a good family atmosphere, female employees can feel supported by the family. Talukder (55) found in his study that the work-family climate effectively moderates the relationship between family-supportive supervisory behavior and work-family balance. Family support includes family behaviors made by all other family members that can reduce the stress, time loss, and energy loss experienced by female employees in the family interface. For example, grandparents helping with child care and husbands having more time at home to help with child care or housework are considered typical family supports. Grandparent child care can shorten the birth interval between second children for women of childbearing age (53). In the context of the three-child policy, family support can alleviate work-family conflicts between the sexes (47). Husband's responsibility for housework is a typical form of family support, and since the literature supports that "context has a significant moderating effect," the following hypothesis is proposed. Based on the above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 6. The relationship between female employees' work-family conflict and female employees' fertility intentions is negatively moderated by the husband's share of housework, i.e., the higher the degree of husband's share of housework, the weaker the effect of female employees' work-family conflict on female employees' fertility intentions.

Hypothesis 6a. The relationship between the husband's share of housework negatively moderates the relationship between female employees' work→family conflict and female employees' fertility intentions, i.e., the higher the degree of husband's share of housework, the weaker the effect of female employees' work→family conflict on female employees' fertility intentions.

Hypothesis 6b. The relationship between female employees' family→work conflict and female employees' fertility intentions is negatively moderated by the husband's share of housework, i.e., the higher the degree of husband's share of housework, the weaker the effect of female employees' family→work conflict on female employees' fertility intentions.

Based on the conservation of resource theory, individuals always try to protect and maintain existing resources and continuously acquire more new resources based on existing resources to reduce the net loss of resources (50). Since individuals will acquire resources through different channels and different resources affect individuals simultaneously, the magnitude of the effect of female employees' work-family on female employees' wellbeing depends on whether the resources lost in the process of generating the desire to have children and the resources acquired through other channels can be balanced when they offset each other. When husbands take up a certain proportion of housework, the loss of resources such as energy and time sacrifice that female employees should traditionally make in the family is compensated by their husbands' behavior. Female employees feel stronger resource support psychologically and get more time and energy resources in reality. Therefore, the greater mental pressure carried by female employees due to the desire to have children will be reduced, and the time and energy loss (resource loss) in the work interface and family interface due to the desire to have children will be reduced, and the resulting resource balance will strengthen the wellbeing of female employees to some extent. Based on the above, the following hypotheses are proposed as shown in Figure 1.

Hypothesis 7. Husband's share of housework negatively moderates the indirect effect of female employees' work-family conflict on female employees' wellbeing through fertility intention, i.e., the higher the degree of husband's share of housework, the weaker the mediating effect of fertility intention on work-family conflict and female employees' wellbeing.

Hypothesis 7a. Husband's share of housework negatively moderates the indirect effect of female employees' work→family conflict on female employees' wellbeing through female employees' fertility intentions, i.e., the higher the degree of husband's share of housework, the weaker the mediating effect of female employees' fertility intentions on work→family conflict and female employees' wellbeing.

Hypothesis 7b. Husband's share of housework negatively moderates the indirect effect of female employees' family→work conflict on female employees' wellbeing through female employees' fertility intentions, i.e., the higher the degree of husband's share of housework, the weaker the mediating effect of female employees' fertility intentions on family→work conflict and female employees' wellbeing.

Based on the conservation of resource theory, individuals must invest more resources in the matters they undertake in order to prevent further depletion of resources to compensate for the loss of resources (50). Female employees may experience greater time and energy depletion in the process of generating fertility intentions due to concerns about the birth of future children, thus generating more stress. However, different family contexts give different resource allocations to female employees, and when the family context is in a supportive state, i.e., family support behaviors are generated, such as the husband assumes a higher proportion of housework, female employees receive a certain replenishment of time and energy resources in the family interface. When the husband takes up a high proportion of housework, the incremental resources given to the female employee may offset or even surplus the resources depleted by the female employee's desire to have children, which ultimately affects the relationship between the female employee's desire to have children and the wellbeing she experiences. Based on the premise that contexts (e.g., family support contexts) have a moderating effect (54), the following hypothesis is proposed as shown in Figure 1.

Hypothesis 8. The relationship between female employees' fertility intentions and female employees' wellbeing is positively moderated by the proportion of husbands taking up housework,

i.e., the higher the proportion of husbands taking up housework, the stronger the effect of female employees' fertility intentions on their wellbeing.

4. Research methods

4.1. Object and characteristics of the study

This study was based on the classical work-family conflict scale and improved according to the requirements of the research elements. The reliability and validity of the scales met the expectations in the pre-small-scale pre-testing phase. In the large sample testing phase, the validity of the scale in this cross-sectional study was 412. They had different occupational backgrounds (Teachers, finance, lawyers, government employees, etc.) and came from eight provinces (Hunan, Guangdong, Fujian, Shanxi, etc.) in China. They were all working married female employees (age range 24–44 years) in dual-earner households in China. The participants were recruited through different WeChat (which is the most popular social software in China) communities which have been joined by researchers in previous social activities. When selecting the sample, the female interviewees were initially interviewed and collected information such as work status, marital status and fertility. Women who are not currently working, have no husband (whether widowed or divorced), and have no plans to have children are excluded from the final interview list. The researcher sent online questionnaires to those who agreed to participate in the study and asked the respondents to send the questionnaires to the other spouse to obtain the required research data. Data were collected for 1 month from early to late January 2022, and participants who completed the survey received an online cash envelope of 10 RMB as a reward.

Dual-earner couples each completed the questionnaire, and the data from both spouses were matched by marking each other's microsignals for data screening at a later stage. Husband-completed scales included personal information (used as a control variable for data processing at a later stage).

4.2. Measurement tools

This study involved data collection on the dimensions of work-family conflict, fertility intentions, work stress, and employee wellbeing, mainly by developing scale items based on established domestic and international scales. The Work-Family Conflict Scale and the Conflict Coping Strategies Scale used in this study were both English scales, which were translated by a graduate student in English and an associate professor in English, and the translation results were exchanged for back translation. The scale was scored on a 5-point Likert scale from 1 to 5, with a score of 1 for strongly disagreeing and 5 for strongly agreeing.

4.2.1. Work-family conflict scale

Referring to the Work-Family Conflict Scale (WFCS) compiled by Carlson et al. (56), the scale consists of two main dimensions: work-family conflict (WFC) and family-work conflict (FWC), with a total of 18 items. The work-family conflict dimension in this study includes a three-factor model based on time, stress and behavior, including nine items such as "I have to miss family activities because I have to spend a lot of time at work," and the Cronbach's alpha of this dimension is 0.975. The family-work conflict dimension includes a three-factor model based on time, stress, and behavior, including nine items such as "The amount of time I spend on family responsibilities often prevents me from fulfilling my work responsibilities," with a Cronbach's alpha value of 0.959. The work-family conflict dimension was measured in this study. The Cronbach's alpha for the overall scale was 0.967; the KMO spherical test coefficient was 0.958, $p < 0.05$. The results of the validation factors for this scale were $\chi^2/df = 2.473$, CFI = 0.972, TLI = 0.958, RMSEA = 0.051, and SRMR = 0.026. In summary, the reliability indicators and model fit indicators of the overall scale and subscales of work-family conflict were as expected, indicating that the scale has good reliability and validity and is suitable for further research analysis.

4.2.2. Fertility intention scale

Based on Miller (28), Bailey (57), and Zheng (29) quantitative studies on fertility intentions, a scale was developed to investigate female employees' fertility intentions in the context of the "comprehensive two-child" and "three-child" policies and the epidemic situation. The scale was developed to investigate the fertility intention of female employees in the context of the "comprehensive two-child" and "three-child" policies and the epidemic. The scale consists of three dimensions: the number of desired children, the gender of desired children, and the intensity of desire, with 14 questions. In this study, the number of desired children dimension includes "I think I need to have 2 or 3 children to make my life complete and my family happy." The Cronbach's study also included three questions. The Cronbach's alpha value of this dimension is 0.948, the dimension of desire for children's gender contains 4 items such as "I want to have both children," and its Cronbach's alpha value is 0.976, and the dimension of intensity of desire contains "The Cronbach's alpha value was 0.976". The Cronbach's α value for the 7 question items such as "I will postpone my childbirth plan if the epidemic continues" was 0.965. The Cronbach's α value for the overall scale of female employees' desire to have children measured in this study was 0.963; the KMO spherical test coefficient was 0.985, $p < 0.05$. The test results for the validation factor of this scale were $\chi^2/df = 3.216$, CFI = 0.968, TLI = 0.948, RMSEA = 0.025, and SRMR = 0.041. In summary, the reliability indicators and model fit indicators of the overall scale and sub-scales of work-family conflict were as expected, indicating that the scale has good reliability and validity and is suitable for further research analysis.

4.2.3. Wellbeing scale

The scale consists of five dimensions: psychological stress, intention to leave, job satisfaction, family satisfaction, and leisure satisfaction, with 22 questions. In this study, the psychological stress dimension includes "I always feel very stressed when there are uncertainties or problems to be solved in my work or life." The Cronbach's alpha value for this dimension was 0.962. The intention to leave dimension included "I am now looking for other jobs or job opportunities offered by other companies." The Cronbach's alpha for this dimension is 0.957; the job satisfaction dimension includes "I am satisfied with the current working atmosphere and colleagues' relationship." The Cronbach's alpha value was 0.971 for 3 items, and the family satisfaction dimension included "I feel satisfied with the relationship between my family members." The Cronbach's alpha

value was 0.966 for the 4 questions, and the leisure satisfaction dimension included "I currently have quality leisure." The Cronbach's alpha value for the overall work-family conflict scale was 0.965; the KMO spherical test coefficient was 0.952, $p < 0.05$. The results of the validation factor of the scale were $\chi^2/df = 3.482$, CFI = 0.979, TLI = 0.961, RMSEA = 0.049, and SRMR = 0.038. In summary, the reliability indicators and model fit indicators of the overall scale and sub-scales of work-family conflict were as expected, indicating that the scale has good reliability and validity and is suitable for further research analysis.

4.2.4. Working pressure gauge

Based on the work stress scale compiled by Price and Spence (30), a flexible work stress scale was developed for conducting work stress research during the epidemic. The scale consists of four main dimensions: work load, role conflict, role ambiguity, and lack of resources, with a total of eight questions. In this study, the workload dimension includes "During the epidemic, my workload did not exceed my ability to cope." The Cronbach's alpha value for this dimension was 0.955. The role conflict dimension included "During the epidemic, my work demands from different supervisors were often in conflict." The Cronbach's alpha for this dimension was 0.979. The role ambiguity dimension included "During the epidemic, I often did not know what my job entailed and the steps I needed to take to complete it." The Cronbach's α value for the two questions was 0.950; the under-resourced dimension included "During the epidemic, I had a high degree of time freedom to complete my work." The Cronbach's α value for the overall work-family conflict scale measured in this study was 0.966; the KMO spherical test coefficient was 0.974, $p < 0.05$. The results of the validation factor for this scale were $\chi^2/df = 2.594$, CFI = 0.931, TLI = 0.970, RMSEA = 0.024, and SRMR = 0.036. In summary, the reliability indicators and model fit indicators of the overall scale and sub-scales of work-family conflict were as expected, indicating that the scale has good reliability and validity and is suitable for further research analysis.

Response options were scored on a five-point Likert scale ranging from "strongly disagree" 1 to "strongly agree" 5. High scores indicate that couples in dual-earner households are more stressed about childcare, and a few reverse items require shifting of the data to assess their scores. The age, education, job type, and monthly income of wives in dual-earner families were included as control variables in the analysis for data processing.

4.2.5. Control variables

In this study, age, education level, type of work, and monthly income were put into the model as control variables to exclude their interference with the results.

4.3. Descriptive statistics

According to the statistics of this study, the average age of female employees interviewed is 34.48 years old, and 74% of the interviewees are aged 25–45 years old, which indicates that female employees are at a high age of work-family conflict. The education level is mostly "college" and "bachelor's degree," accounting for 69.47% of the total number, indicating that the interviewed female employees generally have a higher education level. The difference in monthly income of female employees is obvious, with the main samples distributed in two classes: below RMB 4,000 and RMB 4,000–8,000, accounting for 68.13% of the total number of employees, and 7.42% of the total number of employees earning more than RMB 15,000. Regarding the work pressure of husbands during the epidemic, those who got 4 points and above after reversing the reverse question accounted for 20.83% of the respondents, which means that more husbands still suffered from greater work pressure during the epidemic. The proportion of housework undertaken by working husbands is relatively scattered, with the highest proportion being 26.48% who "undertake a medium (30%−50%) proportion of housework." The number of years of working experience of female employees was mainly distributed in the range of "6 to 10 years" and "11 to 15 years," accounting for 65.73% of the total number of employees.

4.4. Homologous deviation test

Although the questions of this scale were divided into two parts and answered by female employees and their husbands separately,

TABLE 1 Results of validation factor analysis.

Results of validation factor analysis (Models)	χ^2/df	CFI	TLI	RMSEA	SRMR
Six factors (WFC, FWC, WEB, INT, PRE, HOU)	1.863	0.991	0.987	0.038	0.025
Five factor (WFC + FWC, WEB, INT, PRE, HOU)	3.256	0.903	0.878	0.046	0.077
Five factors (PRE + HOU, WFC, FWC, WEB, INT)	3.197	0.924	0.914	0.054	0.079
Four factors (WFC + FWC + INT, WEB, PRE, HOU)	4.265	0.917	0.906	0.062	0.071
Four factors (WFC + FWC + WEB, INT, PRE, HOU)	4.378	0.902	0.895	0.069	0.076
Three factors (WFC + FWC + INT, PRE + HOU, WEB)	5.261	0.851	0.827	0.073	0.085
Three factors (WFC + FWC + WEB, PRE + HOU, INT)	6.342	0.836	0.819	0.077	0.088
Two-factor (WFC + FWC + WEB + INT, PRE + HOU)	7.115	0.788	0.765	0.081	0.083
Two-factor (WFC + FWC + WEB + INT + HOU, PRE)	8.647	0.673	0.651	0.085	0.094
Single factor (WFC + FWC + WEB + INT + PRE + HOU)	9.336	0.665	0.649	0.104	0.112

WEB, women employees' wellbeing; INT, women employees' willingness to have children; PRE, husband's flexible work pressure; HOU, husband's share of housework; WFC, women employees' work-family conflict; FWC, women employees' family-work conflict.

which reduced the probability of homophily to a certain extent, it is not known whether the data were actually answered by female employees and their husbands separately because the data were obtained by filling out the questionnaire online during the epidemic period in this study, so homophily may still exist. To test for homoscedasticity bias, Harman's one-way analysis of variance was used. The results showed that the unrotated first principal component analysis factor explained 36.741% of the variance, which was <40%, i.e., indicating that there was no serious homozygosity bias in this study.

4.5. Analysis methods

Descriptive and correlation analyses were performed in this study using SPSS 24.0 software to examine the means, standard deviations, and correlations among the study variables and hypothesis testing. Path analysis was conducted using AMOS 20.0 software to assess the model fit, and this study used the comparative fit index (CFI; values >0.95 indicate adequate model fit) and root mean square error of approximation (RMSEA; values <0.06 indicate adequate model fit). In addition, to improve the reliability of the mediating effect findings, Mplus 7.4 was used to estimate confidence intervals (CIs) to test the mediating effects assumed in this study using Bootstrap method with bias correction. The mediating effect was significant at the 0.05 level if the 95% CI did not contain zero (58). To account for missing values (0–2% of each variable), this study used maximum likelihood estimates as default values in the path analysis (59).

5. Empirical analysis

5.1. Discriminant validity test

The validated factor analysis (CFA) was used to test the discriminant validity. As shown in Table 1, the fitted data of the six-factor model (χ^2/df = 1.863, CFI = 0.991, TLI = 0.987, RMSEA = 0.045, SRMR = 0.021) were significantly better than the other competing models, thus indicating that the six variables had better discriminant validity among them and could be analyzed in the next step of the test.

5.2. Descriptive statistics

The correlation coefficients of the six variables were analyzed by SPSS 24.0 and the correlation coefficients between the variables are shown in Table 2. According to the Table 2, age was significantly and positively correlated with monthly income (R = 0.134, p < 0.01); education level was significantly and positively correlated with monthly income (R = 0.241, p < 0.001); flexible work pressure during husband's epidemic was significantly and negatively correlated with husband's share of housework (R = −0.491, p < 0.01); husband's share of housework was significantly positively correlated with fertility intention (R = 0.046, p < 0.001), significantly negatively correlated with female employees' work→ family conflict (R = −0.113, p < 0.01), significantly negatively correlated with female employees' family→ work conflict (R = −0.134, p < 0.01), and significantly negatively correlated with female employees' wellbeing

TABLE 2 Correlation of variables.

Variables	M	SD	1	2	3	4	5	6	7	8	9	10
1. Age	34.481	7.258	-									
2. Education level	2.339	0.658	0.081	-								
3. Working years	8.155	8.426	0.272	0.175	-							
4. Monthly income	4,239.167	8.164	0.134**	0.241***	0.185**	-						
5. Flexible work pressure during the husband's epidemic	2.683	0.912	−0.015	−0.023	−0.082	0.023	-					
6. Husband's share of housework	3.124	0.815	−0.016	0.096	−0.055	0.042	−0.491***	-				
7. Female employees' willingness to give birth	2.631	1.031	−0.198	−0.027	0.076	0.034	−0.092	0.046***	-			
8. Female employees work→family conflict	2.825	1.208	−0.082	0.052	0.028	0.015	0.123	−0.113**	−0.142**	-		
9. Female employees' family→work conflict	2.967	1.156	−0.027	0.018	0.063	−0.036	0.014	−0.134**	−0.103**	0.457***	-	
10. Wellbeing of female employees	3.082	1.112	0.063	0.074	0.021	0.017	−0.136	0.228**	0.255**	−0.233***	−0.421***	-

** p < 0.01; *** p < 0.001.

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TABLE 3 Results of the test for mediating effects of fertility intention.

Category		Fertility intention				Wellbeing			Wellbeing		
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Independent variable	Work→ Family conflict		−0.317**			−0.283**			−0.185**	
	Family→ Work conflict			−0.288**			−0.279**			−0.196**
Intermediate variables	Fertility intention							0.328*	0.276**	0.261**
Control variables	Age	0.065	0.054	0.071	0.128	0.147	0.138	0.136	0.141	0.139
	Level of education	−0.039	−0.043	−0.047	0.243	0.184	0.176	0.173	0.166	0.171
	Working years	0.032	0.038	0.035	0.047	0.053	0.043	0.044	0.051	0.048
	Monthly income	0.121	0.134	0.129	0.133**	0.128**	0.137**	0.131**	0.129**	0.125**
R^2		0.031*	0.142**	0.118**	0.049*	0.175**	0.158**	0.168**	0.188**	0.179**
ΔR^2			0.111**	0.087**		0.126**	0.109**	0.119**	0.020**	0.011**

The above work→ family conflict, family→ work conflict, childbirth intention, age, education level, job type, and monthly income are all data of female employees.
*$p < 0.05$; **$p < 0.01$.

(R = 0.228, $p < 0.01$) was significantly negatively related to female employees' wellbeing (R = 0.228, $p < 0.01$). Fertility intention was significantly negatively related to female employees' work-family conflict (R = −0.142, $p < 0.01$), significantly negatively related to female employees' family-work conflict (R = −0.103, $p < 0.01$), and significantly positively related to female employees' wellbeing (R = 0.255, $p < 0.01$). Work-family conflict of female employees is significantly and positively related to family-work conflict of female employees (R = 0.457, $p < 0.001$) and significantly and negatively related to wellbeing of female employees (R = −0.233, $p < 0.001$). Female employees' family→ work conflict was significantly and negatively related to female employees' wellbeing (R = −0.421, $p < 0.001$). The above results are consistent with expectations and lay a good foundation for the follow-up study.

5.3. Hypothesis testing

5.3.1. Mediating effect test

This study first used SPSS to conduct cascade regression of variables to validate the relationship between work→family conflict for female employees, family→work conflict for female employees, fertility intentions of female employees, and wellbeing of female employees, with fertility intentions of female employees as the mediating variable. After that, the robustness of the mediating effect of the model was again verified using the suggestion of Hayes (60), using Mplus7.4 with 5,000 put-back sampling through Bootstrap.

In the first step, we take female employees' fertility intention as the dependent variable and put control variables in model 1 to exclude the interference of control variables on female employees' fertility intention and other variables; in the second step (i.e., model 2), we put female employees' work-family conflict in model 1 to examine the influence of female employees' work-family conflict on female employees' fertility intention; in the third step (i.e., model 3), we put female employees' family-work conflict in model 1 to examine the influence of female employees' family-work conflict on female employees' fertility intention. Step 4 (i.e., model 4) puts female employees' wellbeing as the dependent variable and puts control variables in the model to exclude their interference with female employees' wellbeing and other variables; Step 5 (i.e., model 5) puts female employees' work-family conflict on the basis of model 4 to examine the effect of female employees' work-family conflict on fertility intention. conflict on female employees' wellbeing; the sixth step (i.e., model 6) puts female employees into family→work conflict on the basis of model 4 to examine the impact of female employees' family→ work conflict on female employees' wellbeing; the seventh step (i.e., model 7) puts female employees' fertility intention variable on the basis of model 4 to examine the direct impact of female employees' fertility intention on female employees' wellbeing; the eighth step (i.e., model 8). Put the variable of female employees' work→family conflict on the basis of model 7 to examine the mediating effect of female employees' work→family conflict on female employees' wellbeing through fertility intention; Step 9 (i.e., model 9): put the variable of female employees' family→work conflict on the basis of model 7 to examine the mediating effect of female employees' family→ work conflict on female employees' wellbeing through fertility intention (as shown in Table 3—the results of the mediating effect test are shown in the graph).

The results of model 2 show that the regression coefficient of female employees' work→ family conflict on fertility intention is −0.317, $p < 0.01$, which indicates that there is a significant negative relationship between female employees' work→ family conflict and fertility intention, and H1a is verified. This proves the reality that female employees feel more work-to-family conflict in the workplace and have lower fertility intentions, which is in line with the current social reality in China. For example, work takes up a lot of time and there is no time to get pregnant; work is too intense and there is no intention to get pregnant; workplace competition is fierce and female employees want to hold on to their hard-earned workplace status, while pregnancy will cause female employees to withdraw from the workplace for a short time to the point of losing their workplace advantage.

The results of model 3 show that the regression coefficient of female employees' family→ work conflict on female employees' fertility intention is −0.288, $p < 0.01$, indicating that there is a significant negative correlation between female employees' family→ work conflict and female employees' fertility intention, and H1b is verified. However, the absolute value of this correlation coefficient is smaller than H1a, which indicates that the impact of family life conflict on work on female employees' fertility intention is smaller compared to the impact on female employees' fertility intention due to work-to-family conflict. For example, female employees have to spend a lot of time and energy to take care of the elderly at home after work, and this situation will make female employees exhausted or tired in work, which will affect her willingness to get pregnant and have children, because pregnancy and children will intensify the above conflicts and make female employees feel stressful in work and life.

Model 5 shows that after controlling for the effect of relevant demographic variables on female employees' wellbeing, the regression coefficient of work→family conflict on female employees' wellbeing is −0.283, $p < 0.01$, indicating that the effect of work→ family conflict on female employees' wellbeing is negatively and significantly correlated, and H3a is verified. This hypothesis is also consistent with the actual situation. When female employees often work overtime so much that they have no time to enjoy spending time with their children and husbands, and when female employees are under too much work pressure and have negative emotions overflowing to bad-mouth family members to the extent that it affects family relationships, all of these situations will affect female employees' feelings and experiences of wellbeing.

Model 6 shows that the regression coefficient of family-work conflict on female employees' wellbeing is −0.279, $p < 0.01$, indicating a negative and significant relationship between family-work conflict and female employees' wellbeing, which is verified by H3b. This hypothesis is confirmed by the reality that when female employees need to spend a lot of time and energy to take care of young children at home so that they cannot accept and challenge the promotion opportunities given by their leaders at work, this will affect the perception of wellbeing of female employees.

Model 7 shows that when controlling for the effect of demographic variables on female employees' wellbeing, the regression coefficient of fertility intention on female employees' wellbeing is 0.328, $p < 0.05$, i.e., fertility intention significantly and positively affects female employees' wellbeing, which is verified by H2. This may be because, based on Chinese social ethics, most women subconsciously perceive that having children is an important aspect to prove their family value or social value. In Chinese society, a woman who is married and delays having children will be under pressure from her neighbors and friends; the difference between male and female births can create a huge disparity in women's family status in some areas. Therefore, most female employees have the idea that having a strong fertility and a healthy and smart baby can prove their value and gain recognition and respect from their families and society. Even the idea of "even if you have three children, you must have a boy" is deeply rooted in the minds of many female employees, especially those from rural areas.

Model 8 shows that after adding female employees' work→ family conflict to model 7, the effect of female employees' fertility intention on female employees' wellbeing is still significant, with a regression coefficient of 0.276, $p < 0.01$. However, the regression coefficient of female employees' work→ family conflict on female employees' wellbeing changes from −0.283, $p < 0.01$ in model 5 to −0.185, $p < 0.01$, with lower absolute value. Based on the above analysis, it can be seen that fertility intention plays a partially mediating role in the relationship between female employees' work→ family conflict and female employees' wellbeing, and H4a was verified.

Model 9 shows that after adding female employees' family→ work conflict to model 7, the effect of female employees' fertility intention on female employees' wellbeing is still significant, with a regression coefficient of 0.261, $p < 0.01$. However, the regression coefficient of female employees' family→ work conflict on female employees' wellbeing changes from −0.279, $p < 0.01$ in model

TABLE 4 Test results of direct effect of husband's elastic stress and the husband's share of housework.

	Category	Husband's share of housework	
		Model 1	Model 2
Independent variable	Husband's flexible work pressure		−0.335**
Control variables	Age (husband)	0.121	0.173
	Level of education (husband)	0.329**	0.277**
	Working years (husband)	0.058	0.046
	Monthly income (husband)	−0.147	−0.138
R^2		0.079**	0.263**
ΔR^2			0.184**

**$p < 0.01$.

6 to −0.196, $p < 0.01$, with lower absolute value. Based on the above analysis, it can be seen that fertility intention plays a partially mediating role in the relationship between female employees' family→ work conflict and female employees' wellbeing, and H4b is verified.

Next, as suggested by Hayes (60), in order to further confirm the mediating effect, this study continued to use Bootstrap multiple sampling method with 5,000 put-back samples of the sample data. If the 95% confidence interval does not contain 0, the mediation effect is again proven to exist. The results showed that the indirect effect value of female employees' work→family conflict through fertility intention on female employees' wellbeing was 0.121 with a standard error of 0.032 and a 95% confidence interval of (0.040, 0.182), which did not contain 0. H4a was again verified. The indirect effect value of female employees' family→family conflict on female employees' wellbeing through fertility intention is 0.116, standard error is 0.035, 95% confidence interval is (0.051, 0.213), does not contain 0, and H4b is verified again.

5.3.2. Moderating effect test

By placing the control and independent variables into the model in steps, when controlling for the effect of demographic variables on the proportion of husbands who undertake housework, we obtain the results in Table 4. From the results, we can see that the regression coefficient of husband's flexible work pressure on the husband's share of housework is −0.335, $p < 0.01$. It shows that husband's flexible work pressure has a significant negative correlation on the husband's share of housework, and H5 is verified.

In Table 5, Model 12 examines the moderating effect of husband's share of housework on the relationship between work-family conflict and fertility intention. Model 14 examines the moderating effect of husband's share of housework on the relationship between family-work conflict and fertility intention. Model 17 test the moderating effect of husband's share of housework on the relationship between fertility intention and female employees' wellbeing.

The results of model 12 showed that the interaction term of work→ family conflict and husband's share of housework had a significant negative effect on female employees' fertility intentions, $\beta = -0.105$, $p < 0.01$; the results of model 14 showed that the interaction term of family→ work conflict and husband's share of housework had a significant negative effect on female employees' fertility intentions, $\beta = -0.117$, $p < 0.01$; model 17 results showed that the interaction term between the husband's share of housework and Fertility intention had a significant positive effect on female employees' wellbeing, $\beta = 0.265$, $p < 0.01$.

Next, the moderating effect of husband's share of housework was plotted based on the suggestion of Aiken and West (61) to classify the level of husband's share of housework as the mean plus or minus one standard deviation. The moderating effect of husband's share of housework on the relationship between work-family conflict and female employees' fertility intentions is shown in Figure 2, and the moderating effect of husband's share of housework on the relationship between family-work conflict and female employees' fertility intentions is shown in Figure 2. The negative effect of female employees' work→family conflict on fertility intention is not significant when the proportion of husbands taking up housework is high, $\beta = -0.069$, $p =$ n.s.; when the proportion of husbands taking up housework is low, the negative effect of female employees'

TABLE 5 Test results of direct effect of husband's elastic stress and the husband's share of housework.

Category		Fertility intention				Female employee wellbeing			
		Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17
Main effect	Work→ Family conflict		−0.305**	−0.248**					
	Family→ Work conflict				−0.276**	−0.313**			
	Fertility intention							0.344*	0.689**
	Husband's share of housework		0.068	0.087	0.070	0.195		0.218	0.204
Moderating effects	Work→ family conflict × husband's share of housework			−0.105**					
	Family→ Work conflict × husband's share of housework					−0.117**			
	Husband's share of housework × fertility intention								0.265**
Control variables	Age	0.065	0.052	0.041	0.162	0.153	0.128	0.134	0.143
	Level of education	−0.039	−0.042	−0.04	−0.044	−0.041	0.243	0.172	0.169
	Working years	0.032	0.035	0.033	0.031	0.025	0.047	0.041	0.055
	Monthly income	0.121	0.13	0.122	0.126	0.111	0.133**	0.199**	0.134**
R^2		0.031*	0.147**	0.199**	0.124**	0.149**	0.049*	0.170**	0.186**
ΔR^2			0.116**	0.052**	0.093**	0.025**		0.121**	0.016**

*$p < 0.05$; **$p < 0.01$.

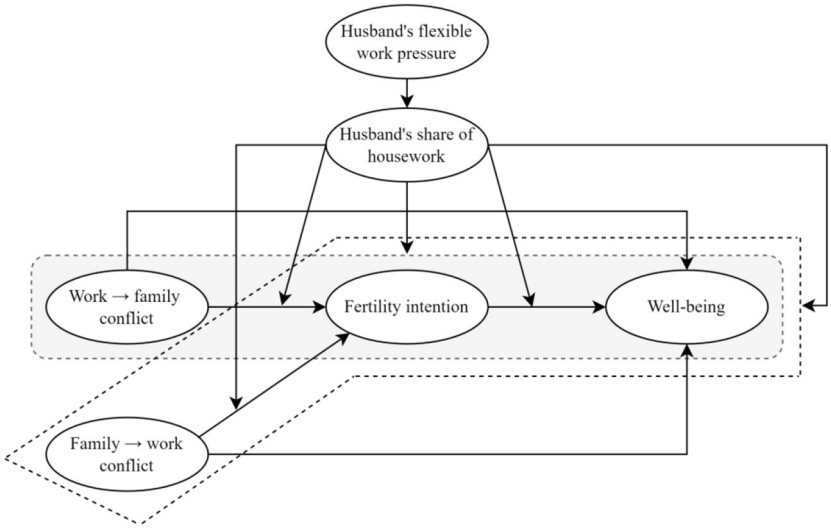

FIGURE 1
Hypothetical model.

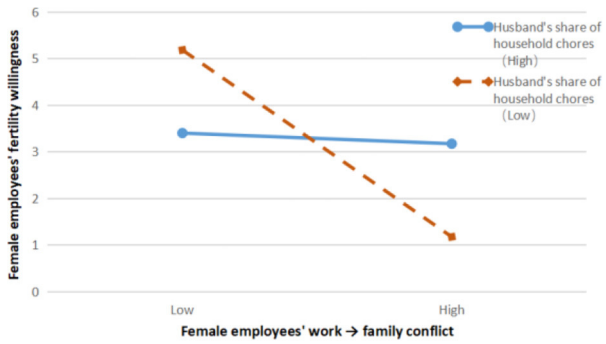

FIGURE 2
Moderating effect of husband's share of housework on the relationship between work→ family conflict and fertility intention of female employees.

FIGURE 3
Moderating effect of husband's share of housework on the relationship between family→ work conflict and fertility intention of female employees.

work→family conflict on fertility intention is stronger, $\beta = -0.473$, $p < 0.001$, and H6a is verified. This is consistent with the social experience, when the husband takes on a higher proportion of housework, female employees even if they experience higher work→ family conflict, for example, mothers are unable to fulfill their duties as parents to take their children to and from school because of the long commute to and from work and the long work commute, but because the husband takes on a higher proportion of housework, picking up and dropping off children can be done by the husband when the wife is unable to do so, which makes mothers who feel guilty about their first-born children will still have a higher desire to have another child.

In Figure 3, the negative effect of female employees' family→ work conflict on female employees' fertility intentions is not significant when the proportion of husbands taking up housework is high, $\beta = -0.071$, $p > 0.1$; when the proportion of husbands taking up housework is low, the negative effect of female employees' family→ work conflict on female employees' fertility intentions is strong, $\beta = -0.486$, $p < 0.001$, H6b was verified. This validation is also consistent with reality. For example, female employees suffer from workplace marginalization and even salary adjustment because their children are weak and sick at home and they often have to take time off during working hours to take their children to the doctor, while their husbands have a lower proportion of family responsibilities and obligations because they are always away on business trips, so that female employees have a stronger intention not to have children again.

In Figure 4, the positive effect of fertility intention on female employees' wellbeing is significant when the proportion of husbands taking up housework is high, $\beta = 0.492$, $p < 0.001$; when the proportion of husbands taking up housework is low, the positive effect of fertility intention on female employees' wellbeing is not significant, $\beta = 0.113$, $p > 0.1$, and H8 is verified. Reflecting to the reality, in Chinese society, it is generally believed that marriage must be for the purpose of childbearing, and couples should have at least one child as the family fertility goal. Therefore, there is a

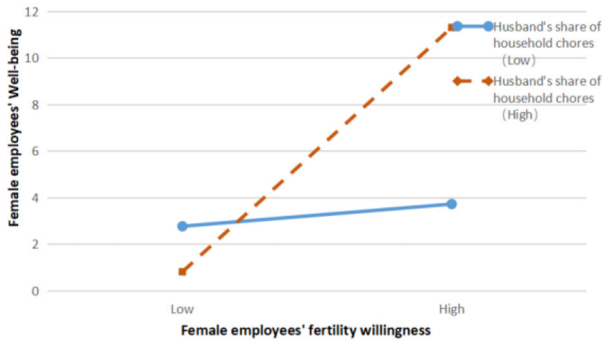

FIGURE 4
Moderating effect of husband's share of housework on the relationship between female employees' fertility intention and wellbeing.

certain primitive willingness motivation for female employees to have children, whether due to social pressure or pressure from elders within the family. The strong willingness to have children gives hope to the family, so much so that many couples improve their relationship during pregnancy preparation, couples move together toward one family goal—having children, and female employees' wellbeing in the family field is enhanced. At the same time, due to the spillover effect, the good mood of female employees at home with their husbands will also be brought to the workplace, which will to a certain extent optimize the workplace work status and workplace socialization of female employees, and their wellbeing in the workplace will be enhanced to a certain extent. When the husband takes a high proportion of family responsibilities at home, it generally means that the husband has a strong sense of family responsibility and family belonging. This will make the female employee think that having children is not her business alone, and the stronger her willingness to have children, the stronger the wellbeing she feels in a situation where her husband takes on a higher proportion of household duties.

In order to test the mediating effect of the two stages of husband's share of housework being moderated, this study used Bootstrap method for 5,000 put-back sampling of the sample data to estimate the confidence intervals for the indirect effect values under high and low husband's share of housework and the difference between the indirect effect values under high and low husband's share of housework. This is shown in Table 6. As shown in Table 6, the indirect effect value of female employees' work→ family conflict affecting female employees' wellbeing through fertility intention is −0.003 with a standard error of 0.026 and a 95% confidence interval of [−0.080, 0.036], including 0, when the husband's share of housework is low; when the husband's share of housework is high, the indirect effect value of female employees' work→ family conflict affecting female employees' wellbeing through fertility intention The indirect effect value of female employees' work→ family conflict through fertility intention is 0.171, standard error is 0.058, 95% confidence interval is [0.042, 0.277], which does not contain 0. The difference between the indirect effect at high and low levels is −0.174, standard error is 0.064, 95% confidence interval is [−0.298, −0.033], which does not contain 0, indicating that the indirect effect at high and low levels. The difference is significant. The above results suggest that the proportion of husbands taking up housework positively moderates the indirect effect of female employees' work→ family conflict on female employees' wellbeing through fertility intention, and H7a is verified.

As shown in Table 7, the indirect effect of family-work conflict affecting female employees' wellbeing through fertility intention is −0.008 with standard error 0.031 and 95% confidence interval [−0.076, 0.029], including 0, when the proportion of husbands taking up housework is low; the indirect effect of family-work conflict affecting female employees' wellbeing through fertility intention is 0.169 with standard error 0.055 and 95% confidence interval [0.038, 0.280], when the proportion of husbands taking up housework is high. The difference between the indirect effects at the high and low levels is −0.177, with a standard error of 0.068 and a 95% confidence interval of [−0.302, −0.041], which does not contain 0. The difference between the indirect effects at the high and low levels is −0.177, with a standard error of 0.068 and a 95% confidence interval of [−0.302, −0.041], which does not contain 0. The difference is significant. The above results suggest that the proportion of husbands taking up housework positively moderates the indirect effect of family→work conflict on female employees' wellbeing through female employees' fertility intentions, as verified by H7b.

6. Conclusion

Based on the conservation of resource theory, this study constructs a two-stage mediated model of female employees' work-family conflict affecting female employees' wellbeing being regulated. The results show that work-family conflict (work-family conflict and family-work conflict) negatively affects fertility intention; fertility intention positively affects female employees' wellbeing; fertility intention mediates the relationship between female employees' work-family conflict and female employees' wellbeing; the proportion of husbands taking up housework moderates the relationship between female employees' work-family conflict and fertility intention The relationship between fertility intention and female employees' wellbeing is positively moderated, which in turn moderates the mediating role of fertility intention in the relationship between female employees' work-family conflict and female employees' wellbeing. According to the validation results, all hypotheses were supported by the data.

The results of this study on the impact of work family conflict on childbearing intention are similar to those of Minello et al. (62) on the impact of work family conflict on childbearing of academic teacher mothers. The conclusion of this article on the impact of fertility on female employees' wellbeing confirms Liu and Zhou (63)'s view in the research on the positive relationship between Chinese mothers' second child birth and their wellbeing. The conclusion on the direct effect of work family conflict on happiness in this paper is consistent with that of Carnevale and Hatak (64). Based on the unique evolution of fertility policy in China's national conditions and the public crisis background of the COVID-19 epidemic in a special period, this study takes Chinese female employees as samples, selects variables from the family level, considers the intermediary effect of fertility desire on the relationship between work family conflict and happiness, and takes the proportion of husband's share of household chores as a moderator variable (at the same time, considers the impact of the epidemic background on husband's work pressure under flexible

TABLE 6 Results of the test for mediating effects of being moderated at two stages (work-family conflict for female employees as independent variables).

Regulated variables husband's share of housework	Female employees' work-family conflict (X)→ Fertility intention (M)→ Women employees' wellbeing (Y)			
	Indirect effects	Standard error	95% confidence interval	
			Lower limit	Upper limit
Low husband's share of housework	−0.003	0.026	−10.080	0.035
High husband's share of housework	0.171	0.058	0.042	0.277
Difference	−0.174	0.064	−0.298	−0.033

TABLE 7 Results of the test for mediating effects of being moderated at two stages (family-work conflict for female employees as independent variables).

Regulated variables husband's share of housework	Female employees' family-work conflict (X)→ Fertility intention (M)→ Women employees' wellbeing (Y)			
	Indirect effects	Standard error	95% confidence interval	
			Lower limit	Upper limit
Low husband's share of housework	−0.008	0.031	−0.076	0.029
High husband's share of housework	0.169	0.055	0.038	0.280
Difference	−0.177	0.068	−0.302	−0.041

working conditions). This innovative research is a supplement and improvement to the previous research on the relationship between work family and happiness.

6.1. Theoretical contributions

First, this study broadens the research perspective of the work-family interface. In recent years, in order to gain a more comprehensive understanding of the impact of work-family relationships on employees, an important trend in work-family conflict research from a work perspective is to examine the negative effects of work resources (e.g., social support, schedule control, etc.) and work demands (e.g., work overload, job insecurity, role conflict, time pressure, etc.) on employees in the workplace based on the conservation of resource theory (65–70). However, work-family conflict does not only originate from the work interface, but also from the family interface (71). Therefore, exploring work-family relationships should consider not only work elements but also family elements (72). In this study, we shift the perspective of the study to explore the influencing factors from the family perspective and find that an important indicator of the family element, fertility intention, is affected by work-family conflict and thus affects female employees' wellbeing. This finding contributes to a more comprehensive understanding of the influencing mechanism of work-family conflict, and also enlightens researchers on work-family relationships to examine the role of employee characteristics or behaviors from both work and family perspectives in a dialectical and comprehensive manner.

Second, it enriches the elements of work-family interface research. Previous studies examined the negative effects of work-family conflict on individual wellbeing of one spouse alone (73), ignoring the possible positive effects of their interaction. The conservation of resource theory suggests that individuals will adopt defensive resource strategies to reduce their resource investment in other domains when facing resource loss (74). Both spouses provide resources to the family in a complementary manner, and when the wife needs to consider whether "childbearing" in the family will lead to a loss of family resources, the husband immediately gives more resources—providing more time and energy for housework—as a supplement to family resources, the wife does not feel the loss of family resources at this time and does not adopt a defensive resource strategy, i.e., she does not reduce her resources in other areas outside the family—"work" resource investment.

Third, the impact mechanisms and mitigation conditions of work-family conflict in the context of the COVID-19 new crown epidemic were explored, expanding the application of the conservation of resource theory. Previous studies have less considered the impact of the epidemic on work-family conflict (65). In particular, the impact of the epidemic on work family conflict is seldom considered from the perspective of family factors. This study found that the impact of the epidemic on the husband's work status will further affect the female employee's (wife's) work family conflict, in other words, the flexible work mechanism under the epidemic exposes husbands to a different kind of work stress than before—flexible work stress. According to the conservation of resource theory, individuals always act out of a code of conduct to protect their existing resources from further losses (75). The flexible work stress experienced by husbands causes husbands to feel the depletion of their time and energy resources and affects their time and energy investment in family matters. The results of this study suggest that the interaction between husband and wife attenuates the negative effects of each and thus enhances the overall effectiveness of the family, providing empirical support for the application of the conservation of resource theory to the work-family interface in the context of the epidemic. Furthermore, all data of this study were collected during the epidemic, this makes all sample characteristics have epidemic attribute, so this paper expands the work family research during the epidemic period to a certain extent.

6.2. Practical insights

First, managers should consider not only the direct effects of policies when formulating policies, but also the indirect effects that policies may have on other family members of employees. Most studies have focused on the direct effects of corporate policies on employees' work status and work-family conflict, but based on the conservation of resource theory, the employment policies that male employees encounter in the company will affect their resource allocation in the family domain and thus their family performance. As the family is a business place where both spouses share the same goals, both spouses need to work together to ensure that no loss of total family resources occurs, so the treatment male employees receive in the firm will affect their wives' contribution to the family and further affect their wives' workplace performance. There is ample evidence that a positive work-family relationship not only fits with the organization's social responsibility to focus on employee wellbeing, but also has a positive impact on employee performance in the organization.

Second, managers should develop management policies during an epidemic that are more responsive to the actual needs of employees during an epidemic. In the post-epidemic era, the epidemic will probably coexist with humans for a long time. Unlike the management patterns in other countries, China has adopted dynamic clearance measures to track the epidemic. A typical practice of this management measure is to take the form of restricting the movement of people to block the virus transmission channels and control the spread of the virus. Public health management policies have posed new challenges to business management. Many companies adopted a flexible work system during the epidemic, where employees completed their work targets at home and their performance was assessed on the corporate line. Flexible work stress, an exogenous influence indicator in this study, has been verified in this study for its impact on employees' work at home during the epidemic. Therefore, this paper suggests that under the normalization of the epidemic, it is necessary for enterprises to adopt diverse supervision mechanisms, work patterns, and assessment methods to urge employees to complete their established performance during the implementation of flexible work office, such as online live office, online live meetings, and online approval of daily work content, in order to improve employees' work efficiency and motivation, so as to ensure employees' work performance while optimally easing employees' relationship with family members.

Third, the management of female employees should give due consideration to the family status of female employees. For example, if female employees of marriage and childbearing age have demands for childbirth, they can be recruited to balance the ratio of female employees and stagger the maternity leave of female employees by age staggering to avoid the shortage of labor caused by the concentration of female employees in childbirth. When enterprises can flexibly deal with the problems of female employees' work absence due to their family and social responsibilities, female employees of enterprises will be respected and treated favorably by enterprises and put more enthusiasm into their work, and enterprises will get more benefits and output from female employees, and finally realize the win-win situation of improving employees' wellbeing and increasing enterprises' performance.

Fourth, enterprises should recognize the importance of childcare for female employees. Most employed women in childbearing age (25–39 years old) may withdraw from the labor market due to marriage and raising children (76). At the same time, enterprises can improve the employment competitiveness of female employees and attract high-quality female employees for re-employment through training and re-employment, so as to make up for their skills decline when they leave the labor market. In this regard, the maternity leave policy promoted by China in recent years, that is, 158 days of maternity leave is available for all children who give birth to one or two children while on duty, and 15 days of maternity leave is added for normal and difficult childbirth (cesarean section or twins). At the same time, wages and salaries during the leave are paid by maternity insurance. However, business executives may not support this policy (especially in terms of the length of leave for female employees) due to the shortage of staff. Therefore, human resource managers can consider holding regular symposiums or meetings with supervisors of different business departments in the enterprise to coordinate employees' work family conflicts, so as to help supervisors gain insight into employees' work and life trends, solve employees' work family conflicts, and ultimately have a positive effect on the organization's retention of valuable employees who have been recruited and trained. In addition, improve the organization's employee care policy, for example, to accommodate employees who occasionally have to leave school to pick up their children or take their elderly parents to the hospital in advance, which may also reduce the work family conflict of female employees.

6.3. Research limitations and future research directions

Although this paper has some theoretical and practical merits, there are still some limitations that can continue to be improved in subsequent studies, and there are some valuable questions and research directions that can continue to be advanced in subsequent studies.

First, homology bias was controlled by optimizing the procedure of data collection. The data used in this study were cross-sectional data, and considering the epidemic factor, this study collected data through the Internet, and there were certain industry and regional differences in the samples obtained, while this study collected research scales from female employees and their husbands separately by means of marker matching. However, due to a certain time lag in the relationship between the antecedent variables and the mediating, moderating and outcome variables, the use of data collection between two time points is more likely to avoid Homology bias. Also adopting a follow-up study can further test how the dynamic process of relationship change between couples affects one partner's work-family conflict to further deepen the understanding of the conservation of resource theory at the work-family conflict interface. In addition, future studies can use various means of data acquisition, such as experimental methods, to enhance the external validity and internal validity of the results.

Second, other strategic relationships that exist between work-family conflict and wellbeing can be explored. This study only explored female employees' fertility intentions as a factor influencing female employees' family roles, but there are many factors in the family domain that may influence work-family conflict, such as the health status of family members, widowed or divorced family status,

etc. Conducting research and examining different family factors can help to understand the influence mechanism of work-family conflict more comprehensively. In addition, research on how male employees' family role behaviors are influenced by female employees' work factors is also a direction for future researchers to study in depth.

Third, the positive factors of work-family conflict on work are not explored enough. Previous studies have focused on the negative effects of work-family conflict on employees' work, but neglected to explore its positive effects. Chinese people are traditionally known as a hard-working and kind working people. After experiencing work-family conflict, Chinese employees find that they cannot achieve excellence in work or take care of their families by investing their time and energy in work and family in a balanced way. From this perspective, the more intense the work-family conflict is, the more likely it is that employees will devote more enthusiasm and energy to their work, helping the company to achieve growth and efficiency. Fully examining the positive consequences of work-family conflict in either the work domain or the family domain has practical implications for enriching theory and guiding practice, and warrants more in-depth research by future researchers.

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

ZZ and JM contributed to conception and design of the study. DL organized the database. YS performed the statistical analysis. ZZ wrote the first draft of the manuscript. JM and YM wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

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

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Work from home or office during the COVID-19 pandemic: The different chain mediation models of perceived organizational support to the job performance

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With the coronavirus pandemic in 2019 (COVID-19), work from home (WFH) has become a frequent way of responding to outbreaks. Across two studies, we examined how perceived organizational support influences job performance when employees work in office or work from home. In study 1, we conducted a questionnaire survey of 162 employees who work in office. In study 2, we conducted a questionnaire survey of 180 employees who work from home. We found that perceived organizational support directly affected job performance when employees work in office. When employees work from home, perceived organizational support could not affect job performance directly. However, it could influence job performance indirectly through the separate mediating effects of job satisfaction and work engagement. These findings extend our understanding of the association of perceived organizational support and job performance and enlighten enterprises on improving employees' job performance during the COVID-19 pandemic.

KEYWORDS

perceived organizational support, job satisfaction, work engagement, job performance, work from home, COVID-19

1. Introduction

On March 11, 2020, the World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) outbreak a pandemic; this pandemic has had major impacts around the world (1, 2). Forced closure of enterprises and industries around the world to curb the spread of the virus has brought a series of unique challenges to employees and employers (3). This change forced companies and employees to quickly adapt to work-from-home (WFH) policies (4). Gartner's survey of 229 HR departments revealed that about half of the companies had more than 80% of their employees working from home in the early stages of the COVID-19 pandemic, and estimated a large long-term increase in working from home after the pandemic (5).

Yet as many employees and employers had to suddenly work from home for the first time and without any preparation (6), and this sudden shift changed work arrangements and negatively impacted employees' physical and mental state as well as their work (2), which ultimately reduced job performance (7–9). WFH can lead to employees' loneliness, difficulties in team communication (10) and cooperation, and decreased job performance (11). For example, online communication lacks nonverbal cues, which increases loneliness (12) and is strongly negatively correlated with employees' affective commitment, affiliative behavior and job performance (13); online communication can lead to anxiety, confusion and communication errors among employees (14), and may even reduce the level of trust in teams (15). During a pandemic WFH prevent social connections and quality social interactions, which can also take a toll on employees' physical and mental health, further reducing job performance (16). Therefore, how to improve the job performance when the employees work from home is an urgent problem.

There are many important effects could improve the job performance, perceived organizational support, as a common variable in management and organizational behavior, is one of the most important ways for improving job performance (17–19). However, WFH has various negative impacts, such as increased loneliness, poor team communication and reduced trust, which may affect the mechanism of perceived organizational support.

Therefore, this study aims to compare how perceived organizational support influence employees' job performance when employees in WFH and work in office. In addition, many other factors might play a role in this mechanism, such as individual qualities, motivation, psychological capital, job satisfaction, we also put them into our considering model.

1.1. Relationship between perceived organizational support and job performance

Employees' job performance consists of a range of different activities that contribute to the organization in different ways; it is "employee behaviors that are relevant to the goals of the organization" (20). Job performance is also defined as the result of the function or indicator of a job or an occupation in a certain period of time (21).

Eisenberger proposed the concept of perceived organizational support, which referred to employee perceptions of how the organization views their contributions and cares about their interests. In short, perceived organizational support reflects the support employees feel from their organization (22). According to organizational support theory (OST), perceived organizational support is a valuable resource that will elicit norms of reciprocity in the process of social exchange, which will lead to greater employee efforts on behalf of the organization because of perceived indebtedness or perceived obligation and expected reward. Perceived organizational support also meets socioemotional needs, leading to greater identification and commitment to the organization, increased desire to help the organization succeed, and improved mental health (23–25). In addition, if an employee receives adequate training, resources, and support from their organization, he or she is more likely to expect the organization to achieve its goals and more likely to help the organization achieve its goals.

Some researchers have proposed that perceived organizational support can increase extra-role behaviors and reduce harmful behaviors to the organization; thus, they regard perceived organizational support as a predictor of job performance (17–19), which confirmed by several recent empirical studies (26–29). And perceived organizational support is positively correlated with job performance (30, 31), as demonstrated in previous studies. For example, a meta-analysis of 167 studies found that perceived organizational support has a moderate, positive effect on job performance (32). Shanock and Eisenberger (33) also found that perceived organizational support reduces behavior detrimental to the organization. Based on these studies, we believe that perceived organizational support has an undeniable positive impact on job performance.

However, the exact relationship between perceived organizational support and job performance remains controversial. Chen and Chen (34) discussed the degree of agreement between direct and indirect effects and empirical data, with results favoring a direct (rather than indirect) effect of perceived organizational support on job performance. However, recent research has suggested that perceived organizational support affects employees' job performance by generating positive emotions and gratitude based on social exchange processes (35). WFH due to the pandemic increased employee loneliness and socioemotional needs. Therefore, we believe that, for employees who work from home, the impact of perceived organizational support on job performance is more likely to occur through meeting employees' emotional needs, such as job satisfaction and work engagement. Based on these theories and empirical findings, we hypothesize the following: (a) In the condition of working in office, perceived organizational support directly affects job performance; (b1) In the condition of WFH, perceived organizational support indirectly affects job performance.

1.2. The relationships among job satisfaction, perceived organizational support, and job performance

Job satisfaction is a positive emotion that encompasses emotions such as joy, happiness, passion, enthusiasm and love (36). Others define job satisfaction as a positive emotional attitude toward work (37). Such positive emotions are generated when employees strongly feel that their organization cares for them and supports them. Meta-analyses and qualitative reviews of the literature on perceived organizational support have shown positive relationships between perceived organizational support and job satisfaction (17, 19, 24). This finding has been confirmed by recent empirical studies. A study with 127 school teachers found that perceived organizational support had a positive effect on both job and life satisfaction (38). A study of cement workers in Iran reached the same conclusion (39).

According to organizational support theory, when employees feel strongly supported by the organization, their socioemotional needs will be satisfied, which leads to increased job satisfaction. These employees will reciprocate by caring for the organization and doing their job well. A meta-analysis of 100 articles revealed a significant moderate positive relationship between job performance and job satisfaction (40). Dinc et al. (41) conducted a study on the job performance of nurses in hospitals and found that improvements in job satisfaction had a significant impact on nurse job performance. According to a study on 104 school principals and 313 teachers (42), a one-unit increase in job satisfaction of teachers led to a 10% increase in job performance. The support employees receive from the organization creates a positive impression and leads to positive results for both employees and the organization. Based on these findings, we hypothesize that (b2) in the condition of WFH, job satisfaction mediates the impact of perceived organizational support on job performance.

1.3. The mediating role of work engagement

Work engagement is defined as "a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (43) and is characterized by a high level of energy and strong identification with one's work (44).

According to the job demands-resources (JD-R) model, we suggest that perceived organizational support provides socioemotional support and is positively related to work engagement. When employees feel valued and supported by their organization, it enhances self-esteem and increases job satisfaction, thereby reinforcing their ability to manage work stress (45). Perceived organizational support also conveys the organization's evaluation of employee efforts and satisfies the employee's need for positive feedback and approval, which can also promote the intrinsic interest of employees and thus improve their work engagement (25). Other studies have also found that perceived organizational support is positively correlated with work engagement (46, 47).

In regard to the consequences of work engagement, numerous studies have linked work engagement to better health and positive emotions (48–52). Bakker (53) suggested that employees with higher levels of work engagement have higher job performance because (a) they experience positive emotions, which helps them to generate new ideas and resources, and (b) their health is improved, providing them with energy to work. Additionally, work engagement is regarded as a reasonable predictor of job performance because employees who most identify with their jobs tend to focus their thoughts on their jobs (54, 55). These findings have been empirically supported. Halbesleben and Wheeler (56) analyzed a sample of U.S. employees ($n = 587$), their supervisors, and their closest colleagues from a variety of industries and occupations and found that work engagement predicted not only higher self-reported in-role performance 2 months later but also higher in-role performance as rated by superiors and peers. Tisu et al. (57) analyzed a sample of Romanian workers and found that work engagement has positive effects on mental health and job performance. Based on these findings, we hypothesize that (b3) in the condition of WFH, work engagement mediates the impact of perceived organizational support on job performance.

1.4. The chain mediating effect of job satisfaction and work engagement

According to social exchange, employees and their organization form a positive emotional connection after a long-term successful exchange relationship and employees are more willing to improve the performance of the organization and make their own efforts to maintain such a social exchange relationship (58). While material reciprocity leads to temporary pleasure, spiritual reciprocity can bring long-term benefits. Organizational support includes not only material support but also spiritual support, such as attention, concern, encouragement and respect for employees. Recent research suggests that gratitude or other positive emotions generated by perceived organizational support may also help improve employees' job performance based on social exchange processes (35).

When perceived organizational support is high, employees are (under certain conditions) more likely to exhibit higher job performance and reduced absenteeism. However, some studies have shown different results. Stamper and Johlke (59) reported that perceived organizational support was not related to salespeople's task performance. In addition, some studies have suggested that perceived organizational support mediates multiple types of organizational experience variables and thus may not directly affect job performance (19, 30, 59).

An empirical study of 744 police officers in China found a nonsignificant direct effect of perceived organizational support on work engagement, but a significant indirect relationship of these variables mediated by job satisfaction (60). We discussed the mediating effects of job satisfaction and work engagement in the above section. According to social exchange theory, perceived organizational support, job satisfaction and work engagement meet the needs of employees; thus, these factors affect employees' job performance. Based on these findings, we hypothesize that (b4) in the condition of WFH, job satisfaction and work engagement exert a chain mediating effect on the relationship between perceived organizational support and job performance.

1.5. Overall hypothetical model

In conclusion, the research hypotheses were as follows:

(a) In the condition of working in office, perceived organizational support directly affects job performance;
(b1) In the condition of WFH, perceived organizational support indirectly affects job performance;
(b2) In the condition of WFH, job satisfaction mediates the impact of perceived organizational support on job performance;
(b3) In the condition of WFH, work engagement mediates the impact of perceived organizational support on job performance;

(b4) In the condition of WFH, job satisfaction and work engagement exert a chain mediating effect on the relationship between perceived organizational support and job performance.

To test these hypotheses, this study used two questionnaire surveys (one is in employees of working in office, one is in employees of WFH) to compare the different models of perceived organizational support and job performance.

2. Study 1

2.1. Subjects

This study was conducted online through a survey website. The survey website sent the link to the questionnaire to the email address of full-time employees who work in office, and the completed questionnaire was collected through the survey website. In this study, a screening question was included in the questionnaire to identify and exclude participants who did not answer carefully. One hundred sixty-two valid questionnaires were returned, with an effective recovery rate of 93.10%. All participants signed informed consent prior to filling out the questionnaire. They were paid 10 yuan for participating after completing the questionnaire. Among the participants, 67 were male (41.4%), and 95 were female (58.6%). The study was reviewed and approved by Ethics Committee of Hubei Normal University. All participants signed informed consent prior to filling out the questionnaire.

2.2. Materials

2.2.1. Perceived Organizational Support Scale

This study used the Perceived Organizational Support Scale (POSS) developed by Ling et al. (61). The scale consists of 24 items scored on a 5-point Likert scale and is divided into three dimensions: work support, value identification and interest concern. The higher the total POSS score is, the better the respondent's perceived organizational support. The POSS demonstrates high reliability and suitable for the Chinese population. In this study, the internal consistency coefficient was 0.934.

2.2.2. Minnesota Satisfaction Questionnaire

The Minnesota Satisfaction Questionnaire (MSQ) developed by Weiss et al. (62) was used to measure job satisfaction. The MSQ consists of 20 items with responses given on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the total score is, the higher the respondent's job satisfaction. The internal consistency coefficient for this study was 0.914.

2.2.3. Utrecht Work Engagement Scale-9

The Utrecht Work Engagement Scale-9 (UWES-9) developed by Schaufeli et al. (63) is widely used; it was later revised by Zhang and Gan (64) to accommodate the cultural background of China. The UWES-9 consists of nine items scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the total score is, the higher the respondent's work engagement. The internal consistency coefficient for this study was 0.899.

2.2.4. Job Performance Scale

The job performance scale (JPS) developed by Li et al. (65) was used in this study. This scale contains two dimensions: task performance and relationship performance, with a total of nine items. Among them, task performance is evaluated with five items, such as "I rarely make mistakes when completing work." Relationship performance is evaluated with four items, such as "I treat my colleagues fairly" and "I offer to help my colleagues." The nine items are scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the total score is, the higher the respondent's job performance. The internal consistency coefficient for this study was 0.763.

2.3. Statistical analysis

SPSS Statistic 26.0 (IBM SPSS Statistics, New York, United States) was used to perform general descriptive statistics and Pearson correlation analysis (two-sided $p < 0.05$ was considered significant). To ensure the accuracy of the results, the variance inflation factor (VIF) method was used to assess collinearity (VIF $>$ 10 indicates serious collinearity between the variables, and the corresponding variables should be eliminated). Model 6 in the process plug-in compiled by Hayes (66) was used for chain mediating effect analysis, and the bias-corrected percentile bootstrap method was used to evaluate the significance of the mediating effect. If the 99% confidence interval (CI) did not contain 0, the effect was considered statistically significant (67). In addition, Harman's one-factor test was used to test for common method bias before analyzing the data (68).

2.4. Results

2.4.1. Common method bias test

Because this study used self-report scales to collect data, which can lead to common method bias, the Harman single-factor method of exploratory factor analysis including perceived organizational support, job satisfaction, work engagement, and job performance was conducted. Only 34.847% of the variance was explained by the largest factor, which is less than the critical value of 40%, indicating that there was no significant common method bias in this study.

TABLE 1 Descriptive statistics and correlation matrix for each variable.

	M	SD	Perceived organizational support	Job satisfaction	Work engagement	Job performance
Perceived organizational support	3.619	0.651	1			
Job satisfaction	3.810	0.609	0.871**	1		
Work engagement	3.583	0.771	0.806**	0.774**	1	
Job performance*	4.265	0.378	0.638**	0.593**	0.573**	1

*$p < 0.05$.
**$p < 0.01$.

2.4.2. Correlations among perceived organizational support, job satisfaction, work engagement, and job performance

Table 1 presents the means (*M*), standard deviations (SD) and correlations. The highest mean is job performance (4.265). Pearson's product-moment correlation analysis was used to analyze relationships among perceived organizational support, job satisfaction, work engagement, and job performance (see Table 1). The results showed that ① perceived organizational support was significantly positively correlated with job satisfaction, work engagement and job performance ($r = 0.871$, $p < 0.01$; $r = 0.806$, $p < 0.01$; and $r = 0.638$, $p < 0.01$, respectively); ② work engagement was significantly positively correlated with job performance and job satisfaction ($r = 0.573$, $p < 0.01$ and $r = 0.774$, $p < 0.01$, respectively); and ③ job satisfaction was significantly positively correlated with job performance ($r = 0.593$, $p < 0.01$).

2.4.3. Relationship between perceived organizational support and job performance: A chain mediation model

The above analysis showed significant correlations among the variables and the presence of possible collinearity.

Therefore, before testing the chain mediating effect, the predictive variables in the equation were standardized, and collinearity diagnostics were performed. The results showed that the VIF values (5.050, 4.419, and 3.038) of all of the predictors were <10. Therefore, there was no serious collinearity in the data used for this study, indicating that these data were suitable for further mediation analysis (see Figure 1).

The process plug-in developed by Hayes was used to evaluate the 95% CI of the mediating effects of job satisfaction and work engagement on the relationship between perceived organizational support and job performance (the bootstrap sample size was 5,000). The results showed that perceived organizational support significantly positively predicted job performance, job satisfaction and work engagement ($\beta = 0.09$, $p < 0.05$; $\beta = 0.67$, $p < 0.001$; and $\beta = 0.24$, $p < 0.001$, respectively); that job satisfaction significantly predicted work engagement ($\beta = 0.16$, $p < 0.001$) but did not significantly predict job performance ($\beta = 0.03$, $p > 0.05$); and that work engagement did not significantly predict job performance ($\beta = 0.06$, $p > 0.05$).

Further testing of the mediating effect showed that the bootstrap 95% CI of the total indirect effect of job satisfaction and work engagement on the relationship between perceived organizational support and job performance was −0.0323 to 0.1134. This interval included 0, indicating that the chain mediating effect of job satisfaction and work engagement on the relationship between perceived organizational support and job performance was not significant. Thus, a chain mediation model was not established and Hypothesis (a) was supported.

3. Study 2

3.1. Subjects

Study 2 adopted the same online survey method as Study 1 and took place during the same period. However, unlike those in Study 1, the participants in Study 2 were full-time employees who work from home. A total of 189 questionnaires were distributed, and 180 valid questionnaires were returned, for an effective recovery rate of 95.23%. All participants signed informed consent forms prior to filling out the questionnaire. Participants were paid 10 yuan after completing the questionnaire. The study was reviewed and approved by Ethics Committee of Hubei Normal University. All participants signed informed consent prior to filling out the questionnaire.

3.2. Materials

Study 2 adopted the same four questionnaires as Study 1: the POSS, MSQ, UWES-9, and JPS.

3.3. Statistical analysis

Study 2 used the same statistical analysis approach as Study 1.

3.4. Results

3.4.1. Common method bias test

With the Harman single-factor method, perceived organizational support, job satisfaction, work engagement, and job performance were included in an exploratory factor analysis. Only 35.140% of the variance was explained by the largest factor, which was less than the critical value of 40%, indicating that there was no significant common method bias in this study.

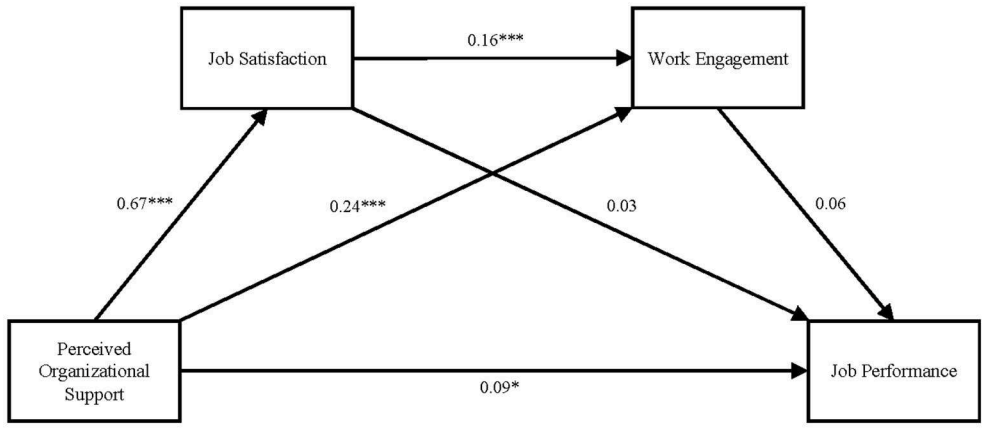

FIGURE 1
The chain mediation model of working in office. *$p < 0.05$ and ***$p < 0.001$.

TABLE 2 Descriptive statistics and correlation matrix for each variable.

	M	SD	Perceived organizational support	Job satisfaction	Work engagement	Job performance
Perceived organizational support	3.719	0.665	1			
Job satisfaction	3.899	0.574	0.806**	1		
Work engagement	3.621	0.791	0.674**	0.751**	1	
Job performance*	4.215	0.400	0.552**	0.605**	0.549**	1

*$p < 0.05$.
**$p < 0.01$.

3.4.2. Correlations among perceived organizational support, job satisfaction, work engagement, and job performance

Table 2 presents the means (*M*), standard deviations (SD) and correlations. The highest mean is job performance (4.215). Pearson's product-moment correlation analysis was used to analyze perceived organizational support, job satisfaction, work engagement, and job performance (see Table 2). The results showed that ① perceived organizational support was significantly positively correlated with job satisfaction, work engagement and job performance ($r = 0.806$, $p < 0.01$; $r = 0.674$, $p < 0.01$; and $r = 0.552$, $p < 0.01$, respectively); ② work engagement was significantly positively correlated with job performance and job satisfaction ($r = 0.549$, $p < 0.01$ and $r = 0.751$, $p < 0.01$, respectively); and ③ job satisfaction was significantly positively correlated with job performance ($r = 0.605$, $p < 0.01$).

3.4.3. Relationship between perceived organizational support and job performance: A chain mediation model

The above analysis showed that there were significant correlations among the variables and the presence of possible collinearity. Therefore, before testing the chain mediating effect, the predictive variables in the equation were standardized, and collinearity diagnostics were performed. The results showed that the VIF values (2.949, 3.688, and 2.364) of all of the predictors were <10. Therefore, there was no serious collinearity in the data used for this study, indicating that these data were suitable for further mediation analysis.

The process plug-in developed by Hayes was used to evaluate the 95% CI of the chain mediating effect of job satisfaction and work engagement on the relationship between perceived organizational support and job performance (the bootstrap sample size was 5,000), and a chain mediation model was established (see Figure 2). The results showed that perceived organizational support significantly positively predicted job satisfaction and work engagement ($\beta = 0.58$, $p < 0.001$ and $\beta = 0.09$, $p < 0.05$, respectively) but did not significantly predict job performance ($\beta = 0.03$, $p > 0.05$); that job satisfaction significantly predicted work engagement and job performance ($\beta = 0.35$, $p < 0.001$ and $\beta = 0.10$, $p < 0.05$, respectively); and that work engagement significantly predicted job performance ($\beta = 0.12$, $p < 0.05$).

Further mediation analysis (see Table 3) showed that the bootstrap 95% CI of the total effect of job satisfaction and work engagement on the relationship between perceived organizational support and job performance was 0.0975–0.1538. This interval did not include 0; thus, job satisfaction and work engagement mediated the relationship of perceived organizational support and job performance. These two factors had a total indirect effect of 0.095, accounting for 75.18% of the total effect. This mediating effect was mainly composed of the following three paths: (1) perceived organizational support → job satisfaction → job performance [95% CI = (0.0072, 0.1111), standard error (SE) =

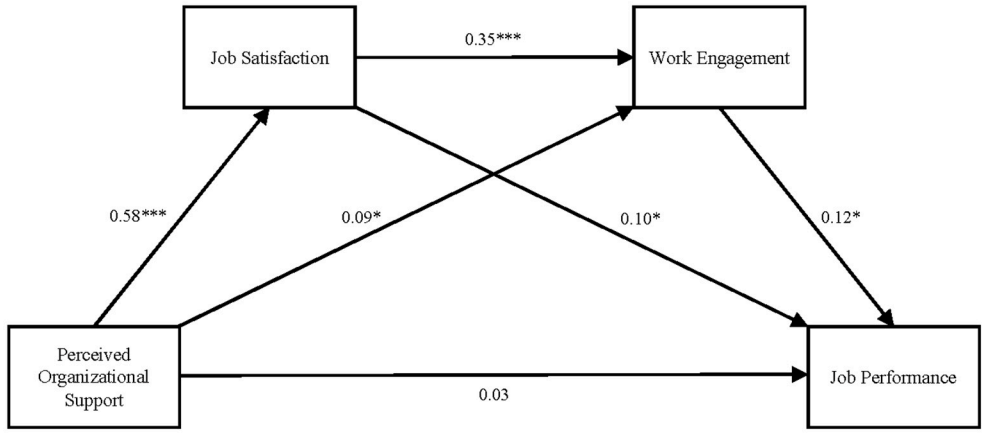

FIGURE 2
The chain mediation model of WFH. *$p < 0.05$ and ***$p < 0.001$.

TABLE 3 Bootstrap analysis of the mediation analysis.

	Effect	Bootstrap SE	Bootstrap CI	Bootstrap CI
Indirect effect 1	0.0604	0.0262	0.0072	0.1111
Indirect effect 2	0.0106	0.0076	0.0006	0.0297
Indirect effect 3	0.0235	0.0108	0.0035	0.047

0.0262], under which the mediating effect is 0.0604, accounting for 48.05% of the total effect, and Hypothesis (b2) was supported; (2) perceived organizational support → work engagement → job performance [95% CI = (0.0006, 0.0297), standard error (SE) = 0.0076], under which the mediating effect was 0.0106, accounting for 8.43% of the total effect, and Hypothesis (b3) was supported; and (3) perceived organizational support → job satisfaction → work engagement→ job performance [95% CI = (0.0035, 0.0470), standard error (SE) = 0.0108], under which the mediating effect was 0.0235, accounting for 18.70% of the total effect, and Hypotheses (b1) and (b4) were supported.

4. Discussion

This study explored the effect of perceived organizational support on job performance and the mediating effects of job satisfaction and work engagement. The results indicated that WFH influenced the relationship between perceived organizational support and job performance. In the condition of working in office, perceived organizational support directly affected job performance. In the condition of WFH, perceived organizational support indirectly affected job performance. In addition, in the condition of WFH, our results confirmed the separate mediating effects of job satisfaction and work engagement; moreover, job satisfaction and work engagement exerted a chain mediating effect on the relationship between perceived organizational support and job performance.

In our study, perceived organizational support was significantly positively correlated with organizational behavioral variables such as job performance, job satisfaction and work engagement, similar to previous research results. Thus, perceived organizational support is an important psychological variable that merits special attention in research and work applications.

Additionally, WFH influenced the relationship between perceived organizational support and job performance. The mechanism of action by which perceived organizational support influences job performance is controversial. Some researchers believe that perceived organizational support mainly affects job performance in a direct manner (30, 69). Other researchers believe that perceived organizational support influences job performance mainly through mediating factors such as job satisfaction, positive affectivity, affective commitment, organization-based self-esteem and organizational citizenship behavior (70–72). Different from previous research results, the conclusion of this study shows that the effect path of perceived organizational support on job performance is not fixed, which is affected by work mode. This study enriches the gap of research on WFH.

Regardless of this debate, perceived organizational support has a significant impact on job performance according to the principle of reciprocity. We believe that employees who work in office tend to regard organizational support as beneficial for organization. Based on the principle of reciprocity, when employees feel supported by their organization, they will be willing to make efforts to repay the organization for this perceived support, such as by improving job performance and increasing organizational citizenship behaviors. This exchange is more straightforward. Chen and Chen (34) uses affective support and instrumental support to explore the impact of perceived organizational support on job performance, and draws the conclusion that the direct effect is greater than the indirect effect, which is consistent with the conclusion of this study. In the condition of working in office, the direct effect of perceived organizational support on job performance is greater than in the condition of WFH.

However, employees believed that the organizational support experienced while working from home was more real than that experienced during working in office. On the one hand, employees who work from home are unable to communicate with their supervisors or colleagues in an informal and face-to-face manner due to their separate work location; thus, they usually rely on

regular formal online meetings to exchange and share information and opinions. However, online communication can lead to information loss and low communicative efficiency (12). The above factors make it difficult for employees who work from home to achieve high-quality communication and objective exchanges, which may explain why there was a greater indirect effect of perceived organizational support on job performance than the direct effect. On the other hand, due to the lack of daily face-to-face interaction and communication with supervisors and colleagues, employees who work from home may experience social isolation or even envy of their colleagues (73, 74). In addition to limiting the freedom of movement, COVID-19 lockdowns are also associated with a variety of emotional challenges, including concrete fears of infection, frustration, and anger, as well as more generalized and severe symptoms of anxiety, depression, and posttraumatic stress (75, 76). The research of Armeli et al. (77) on 308 police patrolmen showed a nonsignificant correlation between perceived organizational support and job performance in subjects with weak socioemotional needs, which indicates that positive emotions may affect the relationship between perceived organizational support and job performance. Zhou and Bao (78) measured the perceived organizational support and only investigated the affective support, and concluded that the impact of perceived organizational support on job performance is mostly through indirect effects. Therefore, we believe that in the context of COVID-19, employees who work from home have greater emotional needs that can be met by perceived organizational support to increase job satisfaction and work engagement, thereby indirectly improving job performance.

During the COVID-19 pandemic, WFH is an effective governmental implementation to prevent further spread of disease; however, WFH impact both organizations and employees. It is urgent to identify ways to maintain job performance of employees who work from home. According to our results, perceived organizational support positively impacts employees' job performance in different work scenarios. This study explored the possible factors influencing job performance and validates and extends previous findings. Additionally, this study provides insight into the mechanism by which job satisfaction and work engagement influence the relationship between perceived organizational support and job performance and provides a possible direction for future to improve employees' job performance.

However, the current study has some limitations. First, its cross-sectional nature prevents. However us from drawing any conclusions about causal relationships. ThereforeHowever, the direction of relationships among perceived organizational support, job satisfaction, work engagement, and job performance cannot be determined. Future longitudinal studies should use cross-lagged analysis to examine bidirectional associations among these variables. Second, only two mediating variables, job satisfaction and work engagement, were examined in the present study. Future researchers should consider more mediating mechanisms, such as stress, anxiety, and leadership style, that influence the relationship between perceived organizational support and job performance. Finally, due to the limitations of data collection during a pandemic, all studied variables were derived from the same source. The scope and sources of data collection should be expanded in future studies.

5. Conclusions

In the condition of working in office, perceived organizational support directly affected job performance. In the condition of WFH, perceived organizational support indirectly affected job performance. And perceived organizational support affected job performance through the separate mediating effects of job satisfaction and work engagement. Additionally, in this condition, perceived organizational support affected job performance through the chain mediating effect of job satisfaction and work engagement. These findings extend our understanding of the association of perceived organizational support and job performance and enlighten enterprises on improving employees' job performance during the COVID-19 pandemic.

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 Hubei Normal University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

Conceptualization and writing—original draft: XL and YS. Data curation: XL. Funding acquisition and methodology: YJ. Project administration, supervision, and validation: YS. Writing—review and editing: XL, YJ, and YS. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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Teachers at risk: Depressive symptoms, emotional intelligence, and burnout during COVID-19

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Background: Previous studies indicated that depressive symptoms are common among teachers due to job stress and difficulty in managing emotions. The aim of this research was to determine the levels of depressive symptomatology in a sample of secondary school teachers who worked during the COVID-19 pandemic and to analyze the relationships with their levels of burnout and emotional intelligence.

Methods: The study involved 430 secondary school teachers residing in Madrid (Spain) who worked during the COVID-19 pandemic. Participants' age was between 25 and 60 (M = 41.40; SD = 11.07) and the gender distribution was 53.72% men and 46.28% women. We used the Spanish version of the Patient Health Questionnaire (PHQ-9), the Maslach Burnout Inventory Educators Survey (MBI-ES) and the Trait Meta-Mood Scale (TMMS-24).

Results: The main results indicated that teachers presented high means of depressive symptomatology, with women obtaining higher scores than men. Significant relationships were also observed between the levels of depressive symptomatology and the dimensions of burnout and emotional intelligence. Finally, the three dimensions of emotional intelligence would contribute to the depressive symptomatology of teachers, while of the burnout dimensions only Emotional Exhaustion would make a contribution.

Conclusion: The possible consequences of depressive symptomatology in teachers during the pandemic are discussed, as well as the need to enhance protective factors such as emotional intelligence and to study burnout levels.

KEYWORDS

teachers wellbeing, depressive symptoms, emotional intelligence, burnout, COVID-19

Introduction

The COVID-19 pandemic, one of the greatest challenges faced by humanity this century, has had negative consequences on the psychosocial wellbeing of the world's population (1–3). Multiple studies highlight that one of the population groups that was most affected by the appearance or increase of symptoms that could be associated with stress is the teachers one (4–6). Different researches carried out during the last years confirms that, within the multiplicity of existing professional groups, teachers are one of the most exposed to occupational stress (7–9) and to different common mental disorders associated with it (10, 11). One aspect that characterizes teaching, and is shared by health and social care

professions, is the high level of "work emotion" required (4, 12, 13). That is, workers are expected to manage their feelings according to the norms and guidelines defined by the organization, place and type of work (14, 15). In the particular case of teachers, a large part of their work involves direct interaction with students and their families or legal representatives, an action that requires an adequate emotional education to be able to manage and express emotions diligently during the different encounters (16). Such contextual conditions coupled with unsustainable work environments, as well as personal characteristics (17), can make teaching challenging and lead to prolonged episodes of stress and physical and emotional exhaustion (7, 18).

Teaching is one of the professions in which there are high levels of sick leave. Teachers are vulnerable to physical ailments, such as headaches, but also to psychological conditions such as anxiety, stress and depressive symptoms (19). Such conditions can lead to sick leave, decreased professional commitment and absenteeism as a result of prolonged stress (20, 21). In the case of Spain, figures from the Confederación Salud Mental España (CSME) (22) show that one of the most affected professional fields is the educational one, with a higher prevalence of stress, anxiety and depressive symptomatology caused or aggravated by work. According to the CSME report (22), 90% of the teaching staff suffered sleep disturbances due to the pandemic, 89.5% feel more irritable and 42.7% feel depressed or unhappy at work. In the same line, a study carried out by Affor Prevención Psicosocial (23), 54% of teachers show symptoms of anxiety and depression caused by COVID-19 and the return to the classroom. According to the consultancy firm, the impact of COVID-19 has caused psychological imbalances in the working population, as they are immersed in an unknown and hostile environment such as the one generated by the pandemic. In addition, the education sector has traditionally been one of the most exposed to pathologies associated with the workplace. The COVID-19 pandemic highlighted the need to develop sustainable policies and work environments that provide wellbeing to teachers in different aspects (7), which would be reflected both in higher performance—even in borderline scenarios—, as in the case of job performance during the COVID-19 pandemic (3, 24, 25). It would also be reflected in the reduction of physical ailments such as sore throat or headache for which teachers are part of the vulnerable working population, as well as mental health problems (9) that can cause sick leave, disengagement and even absenteeism as some of its consequences (21). With the start of a new school year, education departments and schools should reinforce the monitoring of psychosocial risks and mental health problems associated with prolonged stress (7, 26) among teachers, to avoid its persistence over time. This phenomenon is known as Burnout—recently recognized as a disease by the World Health Organization (27) in the 11th revision of the International Classification of Diseases (ICD-11) (28)—and its incidence can lead not only to a decrease in the effectiveness of professionals, but also to depressive symptoms (10).

Different studies and theoretical approaches developed during the last decades (29, 30) show how different crises, regardless of whether they are economic (31), health (5), war (32–34), etc., affect people's mental health (35). In Spain, the recent health crisis due to COVID-19 seems to have negatively affected the mental health of its residents, generating or increasing depressive symptomatology-particularly secondary school teachers. According to CSME reports (22), this group of professionals would require a more accurate assessment and diagnoses for adequate care and intervention, due to depression is one of the main causes of disability.

International guidelines recommend the assessment of depressive symptomatology from primary care centers (36), however, some authors also raise concerns about mass assessment, not only because of the overestimation of symptomatology, but also because of the number of existing assessments (37). In this regard, one of the most reliable assessments is the Patient Health Questionnaire (PHQ-9) (38–40), a tool that makes it possible to establish a provisional diagnosis of major depressive disorder on the basis of the answers to the questions in the questionnaire.. According to the Diagnostic and Statistical Manual of Mental Disorders (41), major depressive disorder is likely to be present if at least five of the nine symptoms "during the same period within 2 weeks and represent a change from previous functioning." At least one of the symptoms is (1) depressed mood or (2) loss of interest or pleasure (41) in performing activities (questions 1 and 2 of the PHQ-9)—suicidal ideation should also be taken into account in this criterion. The symptomatology should also lead to elevated distress and loss of operability. Also, symptoms should not be further defined by substance use or another medical or psychiatric condition. "Other" depression is diagnosed if there is significant wasting or discomfort in core areas of functioning, but not all criteria for any specific depressive disorder are met. While the PHQ-9 can be used to diagnose major depressive syndrome, additional information is also required on the occurrence of manic episodes, other mental disorder, medication side effects, among others (39).

Another ailment that most afflicts teachers is prolonged stress or burnout. Burnout syndrome is defined (21) as a persistent negative emotional state, which is characterized by low self-esteem, decreased motivation and professional commitment, and generalized psychological discomfort. This is a consequence of the long-term stress caused by the working environment (42). Burnout syndrome is characterized by three dimensions: depersonalization, Emotional Exhaustion and reduced personal accomplishment. The first dimension refers to an apathetic or numb response to professional commitments (43). Emotional exhaustion refers to extreme feelings of emotional and physical exhaustion. The last dimension refers to the worker's self-perception of his or her ability to cope with professional challenges (2, 42), which can lead to feelings of failure, worthlessness and low self-esteem.

Studies on burnout syndrome in teachers determine the convergence of different factors related to individual differences (4, 14) and emotional exhaustion, caused by the increase and level of stressors—as may be the case of increased workload—(44, 45). In the educational setting, teachers may go through periods of burnout due to changes in their professional conditions—as is the case of the change of circumstances due to the COVID-19 pandemic—(46). Teachers experienced the increase or appearance of stressors such as decreased professional autonomy (9, 47), interpersonal disputes with co-workers and relatives (5, 48) due to the inability to distinguish work hours from leisure or rest hours (49), among others. Such changes can lead to fluctuations in motivation,

causing burnout and decreasing the capacity to regulate internal emotional reactions (50), leading over time to the appearance of depressive symptomatology (51). However, not all people present symptomatology at the same level (52, 53). What happens so that under the same working conditions some individuals suffer extreme stress or present depressive symptomatology and others do not? It is clear that not all people respond in the same way (54). The evaluation that each person makes to respond to the same events could be influenced, among other factors, by emotional intelligence as a skill, which would function as a coping mechanism, a protective factor (55) that allows people to develop resources to protect themselves from deviant behavior (56–58). Therefore, the lack or poor development of emotional intelligence could generate or increase vulnerability to the consequences of Burnout (59, 60).

As a coping mechanism against the negative effects of burnout, emotional intelligence has been reported to have a high effect on people's ability to cope with it (59, 61). Emotional intelligence is the collection of skills involved in the processing of emotions and affective information (62–65), which are divided into three major dimensions: emotional clarity, mindfulness and repair (66). On the one hand, *Emotional Clarity* has to do with the way in which people perceive their emotions. Teachers' unstable moods would be related to low levels in this dimension. Such moods would lead to harmful thoughts and result in situations of significant stress (59, 63, 67). The psychological inability to modify emotional states would result in negative consequences at the work level (18, 42), such as inappropriate teaching practice, burnout or abandonment, as psychosocial wellbeing would be affected (50, 63). On the other hand, *Attention* dimension refers to the degree of attention that people believe they pay to their moods. Being affected would mean a decrease in performance and an increase in distracters, leading teachers to neglect daily tasks. The third dimension is *Repair*, or people's belief in their ability to regulate their emotional states, prolonging positive ones and interrupting negative ones. When this dimension is affected in teachers, there is a decrease in the strategies and capacity to regulate stress, leading to burnout (59, 68). The repair dimension, at high levels, would lead to intellectual and emotional growth of teachers. High levels in the three dimensions would function as a protective measure against burnout experienced by teachers in stressful and complex situations, as in the case of the COVID-19 pandemic (21, 59, 66).

Given that teaching-specific stressors are mainly related to emotional factors (69), and the significant increase in interventions aimed at teachers' emotional learning in recent years (49, 59, 70, 71), an investigation was carried out to find out the levels of depressive symptoms in secondary school teachers associated with prolonged stress caused by the COVID-19 pandemic containment. The role of emotional intelligence as a regulatory mechanism or protective shield against the appearance or increase of such symptomatology was investigated.

The aim of this work was to analyze whether teachers felt that their work performance was affected by the COVID-19 pandemic, to know their depressive severity indexes and to analyze their levels of stress and emotional intelligence as possible obstructive-protective factors.

In this sense, the following research hypotheses are proposed: H1. Teachers' levels of depressive symptoms are medium; H2. There are differences in depressive symptomatology according to gender, but not according to the age and years of experience of the teachers, H3. Depressive symptomatology is related to the burnout and emotional intelligence dimensions. H4. The burnout and emotional intelligence dimensions (Attention, Clarity and Repair) influenced participants' depressive symptomatology.

Materials and methods

Participants

We conducted a cross-sectional study, with a sample of 430 secondary school teachers from Madrid (Spain) who worked during the COVID-19 Pandemic in 2020/2021. The age of the participants was 25–60 years ($M = 41.40$; SD = 11.07) and the distribution on the gender was 231 males (53.72%), and 199 (46.28%) females.

Measures

Patient Health Questionnaire (PHQ-9)

The Spanish version of the Patient Health Questionnaire scale was used, which consists of nine items that evaluate the presence of depressive symptoms present in the last 2 weeks. The items has a severity index corresponding to: 0 = "never," 1 = "some days," 2 = "more than half of the days" and 3 = "almost every day." According to the scores obtained on the scale, the following classification is obtained: (1) Normal (scores from 0 to 4), (2) Mild (scores from 5 to 9), (3) Moderate (scores from 10 to 14), and (4) The reliability reported by the Cronbach's alpha for the instrument was adequate ($\alpha = 0.88$).

Maslach Burnout Inventory Educators Survey

Burnout levels were evaluated with the Maslach Burnout Inventory Educators Survey (MBI-ES) adapted for teachers (19). The MBI-ES has demonstrated adequate reliability and validity of the three-factor structure in different research reports. Cronbach's alpha for the MBI-ES scales ranged from 0.88 to 0.90 for Emotional Exhaustion, 0.74 to 0.76 for Depersonalization, and 0.72 to 0.76 for Personal Accomplishment. Adequate convergent and discriminant validity of the original MBI was established as the measure was developed (72). The scale has 22 items with answer choices on a six-point Likert-type scale (from 0 = never to 6 = always/every day), on three scales: Emotional Exhaustion (feeling of not being able to do more, finding oneself physically and emotionally exhausted), Depersonalization (an unfeeling and impersonal response toward recipients of one's instruction), and Personal Accomplishment (feelings of competence and successful achievement in one's work). The reliability reported by the Cronbach's alpha for the three dimensions was adequate ($0.77 \leq \alpha \leq 0.82$).

Emotional intelligence (TMMS-24)

We use the TMMS-24, the Spanish version (62) of the TMMS-48 (63, 64). The TMMS-24 is original composed of 24 items that make up three dimensions: Attention, Emotional Clarity and

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Emotional Regulation, with a five-point response format Likert-type scale (1 = strongly disagree, to 5 = strongly agree). The original Spanish version of the scale analyses the descriptive statistics of the items, and the internal consistency of the three dimensions ($0.77 < \alpha < 0.82$), as well as the construct validity was adequate. Regarding the psychometric properties of our study, we observed an adequate reliability (Attention: $\alpha = 0.80$; Clarity: $\alpha = 0.79$ and Regulation: $\alpha = 0.78$).

Sociodemographic data

We use an *ad-hoc* questionnaire to ask age, gender, and years of experience as a teacher.

Procedure

The data was collected on an online survey delivered *via* social media to several groups of teachers in Madrid (Spain). The inclusion/exclusion criteria for being able to participate in our study was that the teacher had given classes in secondary schools during 2020 and 2021. Before completing the questionnaire, teachers were provided with the appropriate instructions and their participation was optional and anonymous. The average time estimated to complete the questionnaire was between 10–15 min.

Data analysis

The statistical analysis was carried out with SPSS 24 (73). First, to test H1, the descriptive statistics of teachers' PHQ9 levels were analyzed (frequencies and percentages). Subsequently, to test the H2 about gender differences in depressive symptomatology a set of student's *t*-test was applied (as well as the Cohen's *d* for effect size). Likewise, Person's correlations were used to study the relationships between age and years of teaching experience of the participants with their depressive symptomatology. Regarding H3, a series of Pearson's correlations was conducted to find out whether there were differences between PHQ9, the burnout dimensions according and emotional intelligence dimensions. Finally, linear regressions were used to analyse the extent to which burnout and emotional intelligence dimensions (Attention, Clarity, and Repair) influenced participants' PHQ9 levels. In all cases, the normality criteria and the outliers of the structured variables were calculated to perform the parametric analyses.

Results

First, we analyzed the extent to which teachers felt that their work performance was affected by the COVID-19 pandemic. Only 9% of the participants indicated that they had not been affected, while 29% reported feeling somewhat affected, 44% quite affected, and 18% very affected.

According to the PHQ9 results, Table 1 shows the percentages of teachers who do not have symptoms of severity and those who have mild depression. Likewise, when adding the percentages of moderate, moderate to severe and severe depression, 16.2% is observed (Table 1).

TABLE 1 Level of severity of PHQ9 in the sample of teachers.

Degree of severity	Range	%
Normal	0–4	44.1
Mild	5–9	39.7
Moderate	10–14	6.7
Moderate to severe	15–19	7.3
Severe	20–27	2.2
Total		100.0

Female teachers ($M = 1.96$; $SD = 1.04$) had significantly more depressive symptomatology ($t = 2.275$; $p < 0.05$; Cohen's $d = 0.35$) than male teachers ($M = 1.62$; $SD = 0.88$). No differences were observed according to the age and years of teaching experience of the participants with respect to their depressive symptomatology.

Subsequently, we proceeded to analyze the relationships between the levels of depressive severity, burnout and emotional intelligence of the participants (Table 2).

As can be seen in Table 2, the levels of depressive severity ascertained through the PHQ are significantly related to the Clarity and Repair dimensions of emotional intelligence. That is, the higher the levels of these two dimensions of emotional intelligence, the lower the level of depression. Conversely, the higher the levels of the three dimensions of burnout, the higher the levels of depressive symptomatology, particularly the levels of Emotional Exhaustion, which has a medium-high strength.

Finally, the contribution of the dimensions of emotional intelligence and burnout on the levels of depressive severity was analyzed through a series of regressions (Table 3).

The three dimensions of emotional intelligence contribute to the levels of depressive severity, as can be seen in Table 3. With respect to the burnout dimensions, the only one that makes a significant contribution is Emotional Exhaustion, while depersonalization and Personal Accomplishment do not contribute to the PHQ9 levels.

Discussion and conclusions

Although an important part of the participants indicated that they had been significantly affected emotionally by the pandemic (91% indicated having been affected between a little and a lot), this percentage decreased in terms of the severity of depression assessed by the PHQ-9, since 39.7% presented indicators of mild depression, while 16.2% were between moderate and severe (the sum of both percentages results in 51.9%, also a significant number). This may be due to the *ad hoc* overestimation and generalization of depressive symptomatology by the participants. Most people experience transitory mood fluctuations, however, the pandemic brought with it extreme situations never before experienced by human beings (2, 4, 5, 9). Some authors (37) also posit that the overestimation of symptomatology could be due to the massive assessment, and also to the number of existing assessments.

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TABLE 2 Relationships between PHQ9, burnout, and emotional intelligence.

	1	2	3	4	5	6	7
1. PHQ9	–	0.086	−0.323**	−0.438**	0.525**	−0.287**	0.275**
2. TMMS attention		0.801	0.414**	0.367**	0.132	−0.050	0.007
3. TMMS clarity			0.887	0.533**	−0.259**	0.151	−0.349**
4. TMMS repair				0.825	−0.187*	0.254**	−0.155
5. Emotional exhaustion					0.930	−0.315**	0.509**
6. Depersonalization						0.832	−0.211**
7. Personal accomplishment							0.780

Cronbach's Alfa in the diagonal.
*p < 0.01.
**p < 0.001.

TABLE 3 Regression model results for the PHQ9.

Step	Predictor	β	R^2	ΔR^2
1	TMMS attention	−0.359***	0.242	0.259***
	TMMS clarity	−0.285**		
	TMMS repair	−0.345***		
2	TMMS attention	0.231***	0.374	0.143**
	TMMS clarity	−0.187*		
	TMMS repair	−0.262***		
	Emotional exhaustion	0.403***		
	Depersonalization	−0.075		
	Personal accomplishment	−0.047		

**p < 0.01.
***p < 0.001. The asterisk represents statistically significant differences.

Also, women presented higher levels of depressive symptomatology compared to men. These results are consistent with previous studies showing a higher incidence of depressive disorders in women than in men (74). These gender differences could be partly explained by women's greater exposure to adverse situations, risk factors within which include violence against women, structural gender inequality, among others (75). These risk factors were enhanced by the isolation decreed by the COVID-19 pandemic. According to multiple studies carried out during and post pandemic, the circumstances of confinement would have potentiated daily stressors, with women being the group most affected by health, work and personal measures both globally (76, 77) and in the case of Spain (78, 79). No differences were observed in other demographics (age, years of experience in teaching practice).

Regarding the relationships between the PHQ9 and the dimensions of emotional intelligence, negative relationships were observed with the Clarity and Repair dimensions, i.e., the higher the levels in these dimensions, the lower the depressive severity assessed through the PHQ9. No differences were observed with the Attention dimension. Regarding the relationships between the PHQ9 and the burnout dimensions, significant and positive relationships were observed with Emotional Exhaustion and Personal Accomplishment (i.e., the higher the levels of this variable, the greater the depressive severity) and negative relationships with Depersonalization (the higher the levels of these variables, the lower the levels of depressive severity). Taking into account the above information and results, and with the assumption that work environment is one of the main factors to be taken into account for the development of psychologically healthier teachers (7, 18), the promotion of teachers' wellbeing becomes a key factor for their own productivity and sustainability (3), helping to prevent pathologies like burnout and depressive symptoms associated with work and teaching environments (42). Much remains to be investigated and explored after a pandemic such as the one the whole world has experienced, although the efficacy of these protective factors has been extensively studied.

Regarding burnout, of the three dimensions (Emotional Exhaustion, Personal Accomplishment, and Depersonalization) only Emotional Exhaustion was significant. These results are consistent with previous studies on burnout symptoms (51, 80, 81) that showed that depressive symptomatology correlated more strongly with emotional exhaustion (82) considered the central dimension of the MBI-ES.

Finally, when we testing to what extent the dimensions of burnout and emotional intelligence contributed to the levels of depressive severity, it was observed that the three dimensions of emotional intelligence made a significant contribution. These results are consistent with previous research findings which showed that a high development of emotional skills could be considered a valuable resource in the prevention of mental illness (5, 83). This implies that emotional intelligence would function as a protective factor, indicating the need for training in each of its dimensions.

Taking into account previous literature and the results of this study, it is concluded that it is important for teachers to have training in emotional intelligence (10, 55), not only to be able to manage their own emotions, but also to provide support for the resolution of similar problems, both to the rest of the teaching staff and to the students (18). In this way, the knowledge, attitudes, training and educational models from which teachers work come into play (4, 5). With a view to the future, it is necessary to include in teacher training plans a perspective that includes instruction in emotional education and in the recognition of symptoms associated with exposure and situations of prolonged stress (84, 85). In this way, it will be possible to prevent and deal with different forms of socio-labor exclusion that teachers suffer in the educational

context as a consequence of burnout (19). Thus, education must participate at the institutional and professional level as an engine for transformation and improvement in terms of education and public health, seeking to achieve more inclusive and safer future societies for teachers and by extension for students.

Limitations

One of the main limitations of this study is that since it was a cross-sectional study, it was not possible to examine the trajectory of depressive symptomatology, nor the symptoms of Burnout. Another limitation would also be the size of the sample (72). Although the size of the sample allowed us to corroborate the hypotheses, it is not large enough, an aspect that will be taken into consideration for future studies. Therefore, it was not possible to analyze with certainty whether the depressive symptomatology observed in the participants is a product of burnout or vice versa. It is also uncertain whether the Burnout symptoms are a consequence of the change in working conditions due to the confinement decreed by the COVID-19 pandemic (9, 85), or whether it was a symptomatology that the participants could be carrying over from the work routine prior to the pandemic (17). Also, the participants did not have a previous diagnosis, therefore the results should be considered provisional, and it is necessary to continue to investigate empirically the relationships between the variables. Future studies could investigate through longitudinal studies the levels of PHQ9 in teachers, in order to know with greater certainty to what extent their levels of emotional intelligence are associated.

Practical implications

Beyond the limitations, this research provides evidence on the implications of burnout and emotional intelligence on the mental health and thus on the job performance of teachers (84). Teachers are one of the main assets in a society as they are in charge of transmitting knowledge and educating citizens (18). Therefore, the development of their emotional capabilities should be a priority. The implementation of programs that promote health in work environments, which have been shown to be an investment and not an expense, by having a positive return so, is posed as imperative. In the current global situation, every small contribution can make a big difference, so a useful solution to reduce the impact of burnout is to develop emotional skills. For this reason, training programs should aim not only to develop the emotional skills of professionals to prevent burnout problems, but also to promote individual outcomes (17). Also, this approach could help to improve the management of emotions, reducing the high impact that negative institutional and personal consequences—such as sick leave or constant rotations—have on the schools' competitiveness.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

LS-P, TG, EE, and DN conceived the study, participated in study design, data collection, interpretation of the result, drafting the manuscript, and revised the manuscript critically. 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.

Publisher's note

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Psychosocial work environment stressors for school staff during the COVID-19 pandemic: Barriers and facilitators for supporting wellbeing

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Introduction: After periods of remote and/or hybrid learning as a result of the COVID-19 global pandemic, the return to in-person learning has been beneficial for both students and teachers, but it has not been without challenges. This study was designed to assess the impact of the return to in-person learning on the school experience, and efforts made to ease the transition in furthering a positive in-person learning environment.

Materials and methods: We conducted a series of listening sessions with 4 stakeholder groups: students (n = 39), parents (n = 28), teachers/school staff (n = 41), and a combination of listening sessions and semi-structured interviews with building level and district administrators (n = 12), focusing on in-school experiences during the 2021–2022 school year amidst the COVID-19 pandemic. A primarily deductive qualitative analysis approach was employed to code the data followed by a primarily inductive thematic analysis, followed by thematic aggregation, thus providing depth and identification of nuances in the data.

Results: Three main themes emerged around school staff experiences: (1) increased levels of stress and anxiety manifested in key ways, including students' challenges with personal behavior management contributing to increased aggression and staff shortages; (2) school staff described key contributors to stress and anxiety, including feeling excluded from decision making and challenges with clear and consistent communication; and (3) school staff described key facilitators that supported their management of anxiety and stress, including adaptability, heightened attention and resources to wellbeing, and leveraging interpersonal relationships.

Discussion: School staff and students faced significant stress and anxiety during the 2021–2022 school year. Further exploration and identification of approaches to mitigate key contributors to increased stress and anxiety for school staff, along with increased opportunities for implementing key facilitators that were identified as important in managing and navigating the increased stress and anxiety offer valuable opportunities for helping to create a supportive work environment for school staff in the future.

KEYWORDS

COVID-19, teacher retention, qualitative analysis, psychosocial work environment, pandemic stress, teacher burnout, psychological resilience, school environment

1. Introduction

The coronavirus disease (COVID-19) pandemic significantly altered what it means to work in the field of education. As essential workers, school staff were on the frontlines of the virus and its impacts. Nearly overnight, they shifted their lesson plans and tools to accommodate virtual learning, often using platforms with which they and their students were unfamiliar; all while caring for themselves and their own household members during the early days of the pandemic in the United States. School staff have always played multiple roles beyond classroom management and lesson planning, serving as conduits for social-emotional development, family intervention and mediation, and connections to additional services for students and families.

In Missouri, all K-12 public schools (555 school districts and charter schools) closed for in-person instruction and activities on March 18th, 2020 (1, 2), for the remainder of the academic year in response to the pandemic, affecting almost one million students (3). However, such closures did not necessarily apply to teachers and other staff members, as some were still required to report to campus to provide academic instruction to their students who were learning remotely, as well as to support essential services like food distribution and childcare (3). School re-openings for the 2020–2021 school year varied by district in Missouri. St. Louis-area school districts varied widely, with some deciding on fully in-person instruction, some fully online, some hybrid (in-person and online), and some offering parents the choice between two or more of these models for students. Most school districts in the St. Louis area returned to a full schedule of in-person instruction for both students and staff by the by the fall semester of the 2021–2022 school year. Several Missouri schools were forced to abruptly close and temporarily return to virtual instruction due to a significant number of student absences and staffing shortages from COVID infections, exposures, and periods of quarantine, contributing to a sense of unpredictability in the school environment (4, 5). The 2020–2021 and 2021–2022 school years were marked by constant changes to methods of instruction and other rapid transitions. School leaders in Missouri and around the United States (U.S.) reacted in real-time to the best available data and recommendations as they worked tirelessly to keep the school community healthy while continuing to provide quality education (4, 5).

Teachers, students, and families experienced traumatic impacts due to the pandemic raising the likelihood of negative health outcomes, both psychological and physical (6). The return to in-person learning brought another period of transition for students and teachers. After becoming accustomed to often shortened school days while virtual, students had difficulty engaging in a full day of in-person instruction. Much of the preliminary research compiled by the U.S. Department of Education's Office of Civil Rights has shown the impact of the social-emotional and learning gaps displayed in students as they returned to in-person learning (6). As such, the mental health status of youth in the U.S. is currently recognized as a crisis and a national state of emergency was declared by the American Academy of Pediatrics (AAP), the American Academy of Child and Adolescent Psychiatry (AACAP), and the Children's Hospital Association (CHA) (7). Perhaps due to greater time spent at home as well as psychological and economic constraints, the number of gun-related homicides and suicides among youth increased after the pandemic and are nearly equivalent to the number of children who have died from COVID-19 (6). That equates to about one additional death per day as compared to pre-pandemic child mortality rates (8). In school, this resulted in negative impacts on students' behavior, classroom engagement, and social-emotional development. Teachers who work with such students have also reported experiencing emotional difficulties related to compassion fatigue or secondary trauma (9). In turn, teachers often bear the brunt of these impacts. This has further exacerbated the burden on teachers as they continue to have multiple responsibilities for the social, emotional, and academic success of their students.

Additionally, many COVID-19 leave policies in school districts differed from students to staff; due to their status as "essential workers," school staff were often limited in their ability to take time off work to care for others in the home who were sick or recovering from COVID-19 (10). This burden led to increased levels of anxiety, stress, and burnout for school staff, including many leaving the teaching profession. The field of education has seen a mass exodus throughout the course of the pandemic; there was a net loss of ~600,000 educators working in public education in the United States from January 2020 to February 2022, per the U.S. Bureau of Labor Statistics (11). Since 2015, teacher retention rates have declined; through 2021, the average attrition rate for Missouri public school teachers was 11%, higher than the national average of 8% (12).

The pandemic only exacerbated pre-existing stressors for school staff, and highlighted the influence of teachers on their students (9). Adequate teacher support is necessary to mitigate job-related stress, which can be attributed in part to teacher shortages, weakened teacher mental health, and low-performing students (7). Many teachers reported feeling high levels of concern for their students' academic and emotional wellbeing, partly due to the increasing educational inequities exacerbated by the pandemic as well as a heightened sense of responsibility to meet their students' educational needs (9). Additionally, students' home life could have further contributed to teacher stress whereby trauma experienced at home while isolating during the pandemic may have contributed to increasing disruptive behaviors and declining academic performance among students (13).

Listening sessions discussed in this article were conducted as part of a study funded by the National Institutes for Health's initiative to support the Rapid Acceleration of Diagnostic Testing for Underserved Populations (RADx-UP), which focused on increasing access to COVID-19 testing for underserved and vulnerable populations (14). Researchers from Washington University in St. Louis partnered with five local school districts with predominately Black/African-American student populations to help increase access to testing as a strategy to reduce the spread of COVID-19. This Safe Return to Schools (SR2S) study sought to assess the best testing strategy to limit COVID-19 transmission in 16 St. Louis-area middle and high schools by providing frequent and free saliva-based COVID-19 testing through both weekly screening testing and symptomatic testing programs. Designed with a health equity lens, the SR2S study sought to decrease racial and health disparities related to COVID-19 among underserved

and vulnerable populations, whose percentages of hospitalizations are higher than their population percentages (15).

One goal of the qualitative component of the study was to assess perceptions of the COVID-19 pandemic and the COVID-19 testing programs offered in these school districts at two different time points through listening sessions (focus groups) with students, parents, and school staff, and a combination of listening sessions and interviews with administrators. This article focuses on teachers' experience with returning to in-person school and shares findings from T2 to present considerations for fostering a supportive school environment.

2. Methods

A group of qualitative methodologists of the Safe Return to Schools (SR2S) research team conducted a series of listening sessions with students, parents/caregivers, and school staff at two timepoints to better understand their perspectives and experiences with COVID-19 testing, in-person school participation, and vaccinations. A combination of individual interviews and listening sessions were also conducted with building- and district- level administrators. Demographic information was collected from listening session participants. Data collection from time point 1 (T1) of the study took place from July to December of 2021 and examined perceptions around whether frequent testing would provide additional benefit, beyond current school strategies (i.e., distancing, masking, hand sanitizing, isolating) to prevent COVID infections. With the increased availability of COVID-19 vaccines, data collection for time point 2 (T2) occurred between April 6 and May 26 of 2022 and also included a focus on vaccine uptake with emphasis on understanding various facilitators and barriers to vaccination. The Washington University Institutional Review Board approved this study (IRB Approval #202104013).

2.1. Participants

School staff, school and district administrators, students, and parents/caregivers from five urban and suburban school districts in St. Louis, Missouri, were invited to participate in listening sessions. Listening session participants were recruited through distribution of flyers within various networks amongst community organizations and a community advisory board (CAB), which was comprised of students, parents/caregivers, school representatives (i.e., teachers, district leaders, nurses, school board members). Assembled to guide the design and implementation of the SR2S project, CAB members were selected for their proximate relationship to partnering school districts. Members participated in monthly virtual meetings and provided ongoing feedback on study activities such as reviewing project materials (e.g., listening session question guides, recruitment materials), helping to interpret and contextualize findings, and suggesting community resources to address study participants' needs and requests. Recruitment flyers were sent to school administrators and then sent electronically directly to parents/caregivers and staff through the schools existing communication modalities (e.g., *via* email, PeachJar—a school messaging application).

Participation in listening sessions was voluntary. Participants were given documents outlining the project overview and consent information. Verbal consent was provided at the beginning of each session for those who were 18 years and older. For students under 18, their parent/guardian electronically signed consent forms prior to the session. Participants were asked to provide their demographic information including gender, age, race, ethnicity, and highest level of education completed using a Qualtrics online tool. Additionally, participants were asked about their vaccination/booster status and if they had ever been tested for and/or tested positive for SARS-CoV-2. 70.83% (n = 85) of participants provided their demographics data (Table 1).

2.2. Strengths and limitations

Pre-existing partnerships, familiarity, and trust between members of the research study team and the relevant school communities significantly supported the recruitment of participants whose racial and ethnic demographics approximated that of the districts' demographics as a whole. The research team utilized a strengths-based approach (16–18) to the data collection. For example, the team examined the phrasing of questions for the listening session and interview guides for opportunities to ensure they were not deficit-based but rather strengths-based (e.g., "What are the top 2–3 things your school did well that helped you in returning to school in person?"). The team also applied an empowerment lens to the way in which demographic information in the survey was collected, and left these fields open-ended to allow participants to share ways they felt best captured how they see themselves (19–21). As a result of this approach, our participants had 15 unique responses to race, 27 unique responses to ethnicity, and six to gender. Our team distilled these categories in the following ways: Black or African American (included African, African American, Afro-American, American of African descent, Black African, Black American, Black Female, and Caribbean American); White or Caucasian (including White, Caucasian, German, Western European, and Jewish); Asian (including Korean and Indian American); and Multiracial or Biracial (including Western European/First Nation). Participants described their gender in the following ways: Female, Male, and Non-binary (including non-binary and AFAB but prefer they/them pronouns).

The demographics of the participants reflect an approximation of the districts' demographics as a whole. That being said, recruitment was limited to materials being distributed only within the existing school information-sharing structure and the school-associated COVID-19 testing program sites. This could cause us to have missed potential participants who are less engaged with or able to access these school resources, along with potential participants at schools where promotion of the study was less robust than other sites. Additionally, potential participants who deliberately did not engage with school-associated COVID-19 communications and resources, and who did not learn of the study through word-of-mouth or other informal means, could be underrepresented in the participant sample.

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TABLE 1 Demographics of listening session participants.

	School staff ($n = 41$)		Parent/caregivers ($n = 28$)		Students ($n = 39$)	
	Number	%	Number	%	Number	%
Gender						
Male	4	9.8	0	0.0	8	20.5
Female	31	75.6	8	28.6	18	46.2
Non-binary	1	2.4	0	0.0	1	2.6
Missing	5	12.2	10	35.7	8	20.5
Age						
12–17	0	0.0	0	0.0	15	38.5
18–24	2	4.9	0	0.0	15	38.5
25–34	5	12.2	2	7.1	0	0.0
35–44	15	36.6	7	25	0	0.0
45–54	8	19.5	7	25	0	0.0
55–64	7	17.1	1	3.6	0	0.0
65+	0	0.0	1	3.6	0	0.0
Missing	4	9.8	10	35.7	9	23.1
Race						
White or Caucasian	21	51.2	2	7.1	11	28.2
Black or African American	12	29.3	15	53.6	18	46.2
Asian	1	2.4	0	0.0	1	2.6
Multiracial or Biracial	1	2.4	0	0.0	0	0.0
Prefer not to answer	0	0.0	1	3.6	0	0.0
Missing	6	14.6	10	35.7	9	23.1
Ever tested for COVID-19						
Yes	35	85.4	14	50.0	22	56.4
No	2	4.9	3	10.7	8	20.5
Missing	4	9.8	11	39.3	9	23.1
Ever tested *positive* for COVID-19						
Yes	12	29.3	5	17.9	2	5.1
No	22	53.7	10	35.7	18	46.2
Prefer not to answer	1	2.4	0	0.0	1	2.6
Missing	6	14.6	13	46.4	18	46.2
WUSM testing						
Yes (surveillance)	18	43.9	1	3.6	4	10.3
Yes (drive-up)	3	7.3	2	7.1	4	10.3
No	15	36.6	15	53.6	21	53.8
Unsure	1	2.4	0	0.0	0	0.0
Missing	4	9.8	10	35.7	10	25.6
Vax status						
Received all injections	35	85.4	13	46.4	13	33.3
Received some injections	0	0.0	1	3.6	5	12.8
Planning to get vaxxed	0	0.0	1	3.6	4	10.3
Not planning to get vaxxed	0	0.0	0	0.0	1	2.6

(Continued)

TABLE 1 (Continued)

	School staff ($n = 41$)		Parent/caregivers ($n = 28$)		Students ($n = 39$)	
	Number	%	Number	%	Number	%
Not sure about getting vaxxed	1	2.4	1	3.6	5	12.8
Prefer not to answer	1	2.4	2	7.1	1	2.6
Missing	4	9.8	10	35.7	10	25.6

2.3. Instrumentation

Objectives for the listening sessions were as follows: to understand the perceived risks of COVID-19 for students and staff when on campus; to understand the social, behavioral, and ethical facilitators and barriers to testing, attending in-person school, and vaccination among parents/caregivers, students, and staff; to identify information and resources that are needed to keep students and staff in school; and to understand what role, if any, testing and vaccination play in mitigating perceived risks.

Participants were asked to provide feedback about the barriers and facilitators to participating in COVID-19 testing and vaccination, as well as their school- and district-level supports to reduce COVID-19 transmission. Facilitation guides were developed for each participant group (i.e., district/building administrators, school staff, students, and parents). The CAB and SR2S workgroup provided feedback to inform the final versions.

TABLE 2 Listening sessions/interviews and participants.

	Sessions (n)	Participants (n)
Interviews		
District-level administrators	1	1
Building-level administrators	2	2
Listening sessions		
District-level administrators	1	4
Building-level administrators	2	5
Parents/caregivers	4	28
School staff	5	41
Students	6	39
Total	21	120

2.4. Procedure

We hosted a total of 21 listening sessions and interviews *via* Zoom with 120 participants–41 staff, 39 students, 28 parents/caregivers, and 12 administrators, lasting an average of 53 min (Table 2). Listening sessions and interviews were arranged by stakeholder group and took place virtually *via* Zoom (22). Text messages and two email reminders were sent prior to each session to those whom had signed up for a session. The team sent follow-up emails to no-show participants to offer future sessions for participation. Staff, students, and parents received a $50 electronic e-gift card for their participation. Administrators were not given an incentive for their participation. Listening sessions and interviews were recorded, with audio files sent to an external service for transcription. Transcripts were then formatted and edited in tandem with the audio files by research assistants.

2.5. Data analysis

Leveraging an existing codebook from T1 that was modified for T2, the analysis team performed a directed thematic content analysis (23). This codebook was iteratively developed using a primarily deductive approach, drawing its content from the facilitation guides and research questions, resulting in 35 descriptive codes. From this point, the overall data analysis process was guided by the grounded-theory approach, where recurrent findings and themes primarily originate from the data itself through inductive analysis, as opposed to identifying data which relates to pre-identified themes and expected findings, such as would be utilized under deductive analysis (24–26). The grounded-theory approach was selected for its utility in identifying retrospective changes in participants' attitudes over time. Another factor for this consideration was grounded-theory's emphasis on building substantive theories from the gathered data, which are tailored toward more specific situations. In this way, results from a grounded-theory approach were more useful to informing policy and procedure development, as opposed to broader grand or formal theories which focus on addressing larger questions or concerns.

The 35 descriptive codes and the transcripts were imported into NVivo, a qualitative data analysis software, for testing of the codebook (27). Codes were applied to individual text units in the transcripts. As outlined for this study's process, each text unit consisted of the facilitator's question and the responses of participants. Where possible, individual participant responses to each question were formatted in the transcripts into their own text units to simplify analysis, so that individual responses to a question could be coded separately. Each text unit could be assigned as many codes as was appropriate for the content. To test the codebook, two team members (LV, AM) trained in qualitative analysis, independently coded the same transcript and then compared their coding. Three rounds of coding and comparison, with one transcript coded per round, occurred before reaching an acceptable level of validity and veracity of the codebook. After coding, inter-rater reliability (IRR), as measured by Cohen's kappa coefficient and the percentage of agreement between the coders for each code, were calculated for the test transcripts in NVivo (28). For any codes where the $\kappa < 0.8$ or the % agreement <85%, the coders met to discuss discrepancies in code application and reach

a consensus on when to proceed. Coming to a consensus and resolving discrepancies on each round involved discussion between the coders of how they interpreted and applied the definition for any code whose individual IRR or percent agreement fell below the aforementioned thresholds, clarifying the definitions and inclusion/exclusion criteria for each such code, and coming to an agreement on their understanding of each code and how it should be applied. When the overall IRR reached the minimum of $\kappa = 0.85$ between the two coders' work, and the codebook was considered validated. The remaining 18 transcripts were split between the two team members and coded independently (29). All 35 descriptive codes could be applied to transcripts from any of the four stakeholder groups, although a few codes were more relevant to specific groups. Codes relating to questions on district-wide policies and procedures tended to be applied more frequently to transcripts from district-level administrators, for example. Upon completion of coding, no stakeholder group had at least one text unit coded to each of the 35 descriptive codes (administrators = 33, parents = 31, staff = 30, and students = 31).

From these coded transcripts, code reports were generated in and exported from NVivo. These code reports for each code were generated separately by stakeholder group and contained all text units which had been coded to an individual code. Each individual code report was then analyzed by a member of the study team (LR, AM, LV, NLD, AP, RB, RTB, and LN) to identify themes. Theme statements were created and accompanied with quotes which supported each theme, and grouped by code and stakeholder group. Theme reports were reviewed by a second team member and finalized through consensus between the writer and reviewers. A total of 532 initial theme statements across all stakeholder groups were identified (administrators = 143, parents = 135, staff = 131, and students = 123).

The 532 theme statements resulting from the aforementioned directed thematic analysis were analyzed in an iterative thematic aggregation process, where the aim was to identify theme statements at each level by highlighting points of convergence and divergence, which resulted in 146 revised and aggregated theme statements. All theme statements were analyzed together to identify commonalities and repetition of themes within and between stakeholder groups and across theme domains (e.g., school experience, mitigation strategies). This began with analyzing all theme statements from a given stakeholder group, identifying very similar theme statements that were developed from evidence in different code reports, and combining and revising the very similar theme statements within each stakeholder group. From the theme statements, ten overarching domains of themes were identified across all stakeholder groups. After assigning a domain to every theme statement, team members (AM, LR, LV, NLD) further analyzed each theme statements to synthesize and refine theme statements across codes and stakeholder groups, as well as identifying uniqueness and/or convergence. Theme statements were then combined into revised aggregated/synthesized theme statements, resulting in the total of 146 aggregated theme statements across ten domains. Almost half of these aggregated theme statements were themes that were supported by evidence from two or more stakeholder groups. The presence of support for an aggregated theme statement by members of two or more stakeholder groups demonstrates intergroup consistency of these aggregated theme statements (Figure 1).

3. Results

The COVID-19 pandemic increased stress and anxiety for many. In the school environment, staff (administrators, teachers, and support staff) experienced unprecedented levels of stress and anxiety throughout the pandemic due in part to the frequently changing school environment (30–37). Throughout our listening sessions, three main themes emerged about the experience of school staff. First, re-adjusting to in-person learning increased levels of stress and anxiety, which manifested in two primary ways: challenges with personal behavior management and coping skills which contributed to an increase in students' negative behaviors (e.g., physical aggression) and staff shortages. Secondly, school staff described key contributors to increased stress and anxiety in their work environment, including feeling excluded from decision making in school policies and challenges with clear and consistent communication. Finally, school staff described key facilitators that supported their management of the increased anxiety and stress they were experiencing. These strategies included: fostering adaptability (e.g., learning to successfully teach concurrently in multiple modalities; building flexibility into lesson plans to accommodate quarantine periods); increased frequency and transparency of communication; heightened focus, attention and resources to socio-emotional learning and wellbeing; and building and leveraging trusting relationships both within and outside the school community.

3.1. Increased stress and anxiety experienced by school staff during readjustment to in-person learning manifested in key ways

Participants identified significant contributors to feelings of stress, anxiety, and burnout amongst staff members when returning to in-person learning.

3.1.1. Challenges with personal behavior management and coping

Returning to in-person learning and instruction was a challenging transition for many. Upon the return to in-person learning, staff, students and parents/caregivers reported a significant decrease in personal behavior management and increases in physical aggression among students, particularly but not exclusively at the high school level. Examples of decreased student personal behavior management included excessive tardiness ("The amount of tardies that I mark every single day is just amazing. Or kids will just skip, and there's no remorse or apologies or anything like that. Kids are just, "It's fine. I don't really care." Even when I reach out to parents," per one teacher) and unapproved use of personal devices in class ("These cell phones to have become almost a norm. The Chromebooks, the

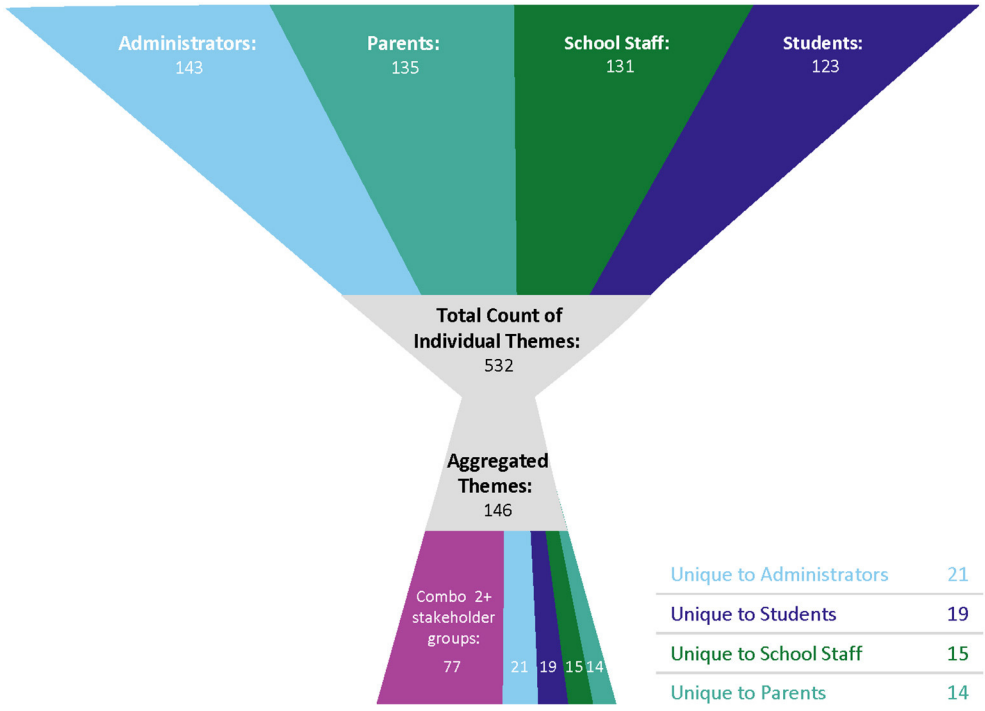

FIGURE 1
Theme statement count by stakeholder group.

kids can't seem to get off of it. They have really lacked that traditional learning and it's so hard for them to stay focused on what they're doing, because they're taking out their cell phones, they're texting each other, they're on the Chromebook, they want to listen to music, these little earbuds in their ears. That has been a big challenge."). Of particular concern to many staff and parent participants was a marked increase in physical aggression and fights, which at times led to on-campus arrests of involved or suspected students. As one teacher described the violence, "We have seen a huge uptick in physical aggression in our school and it's been very out of character for our population in our district. And very violent fights, we've had kids end up arrested and it's almost as if they've forgotten, their stress levels are so high that they don't know how to interact with each other anymore. It tends to be very physically aggressive." Staff and students alike felt stressed and emotionally challenged transitioning back to the in-person environment. For some staff, this was considered to be a powerful contributor to prompting themselves or their colleagues to leave or consider leaving the teaching profession. One teacher described their colleagues' experiences: "A lot of teachers I know are fed up, they're quitting and retiring, they had enough. We were dealing with behavior issues, more fights. I worked with kids as an educator for 20 years, I have never seen so many kids fight until this year. I don't know because of COVID, they stayed at home, what happened, they have no respect for teachers, no respect for other students. And I think it might be because of the pandemic." Parents also shared their concerns about the more aggressive environment their students were exposed to ("[By the third week of school, my son saw] up to 37 fights. A couple of security guards up there, one time I went up there one security guard had his arm in a brace, the other one had his leg in a brace and that comes from them breaking up fights.") and how the violence affected school staffing ("They say, because of all the fights, that [the schools] were short on staff.").

3.1.2. Staff shortages affect school environment

The staff shortage in St. Louis-area schools increased during the first two school years of the pandemic, as shown in early retirement and resignation rates and difficulties filling open positions (38). For participants we spoke with, school staff leaving the profession was perceived to have accelerated even further once students fully returned to in-person learning. The contributing factors to their departures were numerous, but many participants described an overwhelming sense of pressure and exhaustion, also referred to as burnout, as the primary factor. This sense of burnout was fueled by many different experiences and situations for individual participants, such as angry or aggressive behavior directed toward staff by both students and parents, and feeling that their schools supported them as best they could, but districts were unable to offer the extent of support they needed. This shortfall in staff support was noted by some parents, with one sharing that "all of [the school districts] are trying, but they're not supporting these teachers enough, the teachers shouldn't have to deal with kids fighting. [...] We got to get things together. I mean, we really are worried about [curriculum content] and the teachers are walking in and going to the hospital, because they getting a book thrown at them or something, that is nuts." One parent was particularly concerned about how the

school bus driver shortage made it more difficult to comply with social distancing guidelines, as "it was just too many kids on one bus."

As one would expect, staff shortages had a significant impact on the school environment, including student experience, prompting changes such as large class sizes, limited class offerings, increased deployment of inexperienced or long-term substitute teachers, and less access to individual support services (e.g., tutoring, afterschool activities). Partially due to the shortages, some school staff shared that they felt that they were unable to take paid time off (PTO), reducing their ability to rest and recover when needed. Staff shortages further increased burdens placed on colleagues who remained, and those we spoke with said this further impacted their ability or willingness to take PTO to care for themselves or family members. A teacher reflected on how staff shortages impacted other teachers, "Teacher staff is very short right now. Also, bus drivers, subs, we have none. We were told to come to work, try not to miss any days, basically sick and all because they had nobody to cover us which is ridiculous. I think the pandemic made teachers a dying career. A lot of people don't want to be teachers anymore. It's too stressful at this point." One teacher shared their decision to leave the field after the 2021–2022 school year due to this, describing their experience and choice as "I'll just say the burnout. I can say personally, I'm leaving education after this year. I never anticipated that for myself, and I am beyond burnt out with just everything that we have dealt with over the past couple years. I want to say if I took more days, it would've been better, or if I would've done different things, it would've been better, but I don't know if that's true. It's just being able to recognize that. Obviously, I love my students and all of those things but those things take tolls on us."

As a result of the pandemic, the school environment changed. The resources and supports school staff feel they need to feel healthy and well while at work evolved. As one teacher shared, "This is going to take a long time to recover… there's not a magic pill. There's not a magic formula or program. It's going to be a lot for not only our students, but for us as well. I think it's impacted me on not just a professional level but a personal level. And [if] all that veil between professional and personal went away during COVID and it's just changed the way that I view life now and what's important…where do we go from now? And trying to figure out what is the new path and the new normal because clawing at something that doesn't exist anymore is frustrating not to only our students, but I think to us as well. So, I think navigating that and finding the way forward is really hard and messy."

3.2. Key contributors to increased stress and anxiety in the work environment

Participants identified key contributors that increased stress and anxiety in the school work environment, including staff members feeling excluded from decision making, and challenges with clear and consistent communication between schools, districts, and stakeholders.

3.2.1. Feeling excluded from decision making and/or processes

Participants often discussed a desire for opportunities to be heard and included, whether in providing input on COVID-19 policies or feeling like a part of their school's community in general. When school staff felt excluded from being given chances to give input, it sometimes contributed to increased stress. For example, many participants, especially staff, felt excluded from involvement in contact tracing efforts. In particular, auxiliary staff, such as librarians and paraprofessionals, noted that they often found that they had been in contact with a student who had been quarantined within the contagious period through conversation with students and fellow staff, rather than being notified through their school's designated contact tracing protocol (per an auxiliary staff member, "They would follow the kids' schedules once they were positive to see where they were sitting, but they never checked in with the counseling office to see if I had met with anybody."). Others noted inconsistencies in determinations of who might have been exposed by an infected student, such as in the example one staff member described where "one person could be quarantined, but then the person directly next to them wasn't, but maybe the person in front of them was."

3.2.2. Challenges with clear and consistent communication

Challenges with ability of clear and consistent communication increased stress and anxiety of many participants. School staff and administrators alike noted that keeping up with changing public health recommendations and communicating out any changes was difficult. In the words of one administrator, "And so, it was just the lack of clear and consistent messages was very challenging for all staff involved, and kids involved too because things were constantly changing. And yeah, I think it was just a hard toll on emotional wellbeing of staff. I mean, we've got a large number of staff that are leaving this year. And it's not a surprise, to be honest. It's been a tough year."

A great deal of uncertainty was encountered by all throughout the pandemic. Many school staff experienced increased communication (through meetings, emails, etc.) from administrators, colleagues, and parents during this time. Increased communication provided comfort and connection and helped to reduce anxiety of some. Staff felt particular stress around the lack of communication when they had a potential exposure to COVID-19. One staff member commented, "We just didn't really find a rhythm for a while about being able to communicate... But also [COVID-19 status] being confidential, not really wanting to reveal who was the exposure, [where] exposure came from."

Some administrators discussed that their biggest lesson learned throughout the pandemic was the importance of clear, frequent communication with students and families using a variety of modalities, allowing families to choose how they wanted to engage. One example where this was made evident was in contact which included formal methods (e.g., town halls, surveys, weekly emails or videos) and informal methods (e.g., making themselves available daily for in-person interactions with the school community during drop-off and pick-up times). As one administrator recommended,

"Hindsight's always 20/20, but you make the best decisions you can based on the information you have, and try to be as open and honest with your community as possible, and provide the information you have, and what you know. And people seem to understand that, respect that if they think you're just being honest."

3.3. Key facilitators that supported navigating increased anxiety and stress of school staff

While acknowledging the complexity and messiness of the challenges of fostering a positive work environment, participants mentioned multiple examples of strategies and supports that aided them in navigating the stressful school environment during the pandemic. These approaches including fostering an adaptable mindset and work environment, heightening attention to and resources for socio-emotional learning and wellbeing, and building and leveraging trusting relationship both within and outside the school community.

3.3.1. Fostering adaptable mindsets and work environment

School environments were continually adapting amidst constant change and uncertainty throughout the pandemic. All stakeholder groups emphasized the importance of allowing for and fostering flexibility through policies and practices, especially those that aimed to facilitate the wellbeing and mental health of the entire school community. Throughout the pandemic, changes to public health guidelines and school-level recommendations were perceived by participants to become more frequent, particularly over fall 2021 and into the beginning of winter 2022. This made it exceedingly difficult for districts/schools to develop and implement consistent protocols. For school staff, this often required them to become adaptable and flexible in their ability to pivot between planned coursework and differing student attendance modes. As described by one teacher, "I might have all my kids on Monday, but on Wednesday I might have three or four kids in that class that are quarantined. Or by the end of the week, I might have five kids in a class that's quarantined. Now they all have different dates that they can return, so I had to learn to be flexible." Having experienced so much uncertainty and change within their schools, many participants shared that an important lesson they learned is how to adapt their minds, behaviors, and schedules to the unpredictable, particularly their schools' ever-changing pandemic policies (i.e., virtual learning, masking, social distancing, quarantining, sanitizing). One staff member described their adaptability as such: "At first there [was] masks or no mask or shots or no shots, or some people were sick. Sometimes we needed to shut down. Sometimes we needed to clean. You just got to be open to the different things because everybody is still learning." Some students also learned to be more flexible and responsive to changes in school policies and mitigation guidelines, with one noting "The biggest thing that I have learned is adaptation and balance just within myself and also within the school, because the guidelines are constantly changing. Seems like almost every other month we have a new variant. So as for the school, they're trying to juggle all of this. We have a lot of schools within the district, so they're trying to juggle it and accommodate everyone, keep students and families informed."

3.3.2. Heightened attention and resources given to social emotional learning, sense of security, and wellbeing

School staff shared that to alleviate some of the stress and anxiety felt within the school environment, it was helpful to see increased focus, attention, and resources given to socio-emotional learning and wellbeing. Some administrators worked within their schools to provide mental health resources specifically to teachers, such as counseling referrals, reading materials, and space to talk with their peers. In the words of one administrator: "So go easy on yourself, give yourself a pat on the back because students are not the only ones stressed out, staff is stressed out as well. So not just providing, those services for our students, but having professionals available to support staff as well. I think that helps because if a staff member is stressed out or traumatized, we know what that does to a student who's already traumatized. So I think one of the big takeaways is providing those supports for our staff so that they are being well in order to do well." This contributed to staff prioritizing and focusing on their own mental health needs and outlets, setting boundaries, and being empathetic toward themselves and others, which aided in developing their psychological resiliency As described by a staff member: "Mental health is everything, and if you need to take some time away you need to take that time and not feel bad about it and realize that if you're not healthy, you're not going to be able to do the job that's put before you."

In the school environment, the attention and care of strong student-teacher relationships in supporting students' academic and socioemotional growth was particularly prominent for all stakeholder groups. "This year has been bar none one of the best years of my teaching career. I would say just because the students kind of had an emotional growth mindset. They were willing to create, and latch onto relationships with me and with each other, and because their openness to build those relationships, [. . .] I've never had a year like this in my 18 years of teaching. In that respect, they were so hungry for relationships, and they were so open it was magical." Some teachers discussed the time and effort they spent incorporating socioemotional lessons, activities, and connections to resources into both their planned courses and informal conversations with students. One teacher encouraged empathy as a positive coping skill: "I think for me bringing that social, emotional learning piece into the classroom with the kids has been one of the things teaching them to have empathy. That's one of things that we really focused on teaching the kids to deal with their emotions, because believe it or not it has affected our kids greatly." These efforts were discussed as endeavors that staff determined were worthwhile to integrate into their lesson plans, independent of district instructions. Teachers, staff, and administrators alike noted how important it was to extend grace, empathy, and compassion to their students and colleagues, acknowledging the impact and trauma the pandemic had on staff. Students responded in kind, and some recognized and appreciated how much value they now

placed on getting to know their teachers, and how their teachers were working to support them in re-adjusting to the return to the in-person environment. As one student said of their school environment, "I understand the world is different right now, considering the current situation of the virus and everything, so we just have to look out for one another and take care of [each other]." Some administrators even incorporated efforts targeting general health and wellness in plans for school staff, such as offering Zumba classes to help relieve stress and support physical health. These efforts were considered valuable by our participants across stakeholder groups, some of whom noted that they were in response to the difficulties some students faced in re-adjusting to in-person learning and the school environment. Students noted and appreciated these efforts by school staff and administrators, as one student described: "They understand that it will take time for us to adapt back to the physical class system. So they try to move along with us and help us adapt back to the physical class system."

Physical resources—whether cleaning and sanitation wipes, signage to encourage social distancing, or other supplies—were seen by school staff as an indication of school- and district-level leadership responding to their staff's wellbeing needs. One administrator noted that resources leveraged within various procedures to promote social distancing, hallway spacing, and accessible sanitation supplies helped meet staff members' needs to improve their sense of security and stability on campus: "And so by taking time and really spending a lot of time developing and then teaching, and practicing all of those procedures that we put in place, it assisted people with allaying their fears because in my experience, when you have systems in place and people know that the systems are going to be reliable and they learn to trust those systems, it can create a level of comfort for everyone." As students began returning to in-person learning either fully or partially during the 2020–2021 school year, sanitation supplies (e.g., Lysol wipes, hand sanitizer stations) were abundant and enforcement of mitigation measures (e.g., masking and social distancing) was noted as strict in many schools. Many school staff perceived these resources as facilitators to increasing their comfort with being in-person at school. As one teacher noted, "I just feel like they were trying to give us everything they could possibly give us to try to help ease our worries." Many participants across all stakeholder groups shared that these practices had a positive impact on morale and comfort levels for staff (particularly teachers), students, and parents in returning to campus. Administrators described their commitment to ensuring staff had the physical resources they needed to feel safe and secure. These efforts were noted and appreciated by staff, students, and parents.

3.3.3. Building and leveraging trusting relationships both within and outside the school community

Efforts to support positive mental health and reduce stress and anxiety among school staff often focused on the human connections found within a healthy school community. As one school administrator stated, "…just the human connection. I think we took for granted the importance of being in community in school… school is about community. And the core of what we do was stripped away and forced to happen over a screen. And that was just, in my opinion, just devastating for our families and students." For those we spoke with, the time spent in virtual learning highlighted the importance and value of interpersonal relationships and human interaction. As one teacher shared, "The biggest thing is to always remember is that, I don't want to say this in a super cheesy way, but just never forget the people, the actual students that they're there, to connect with them on a personal level. Because it's like just remembering to hold onto that, the humanity of it, the connection was something that just to cherish that." For one school, an administrator focused on communication, human connection, and wellness in their efforts: "But also we did a lot of what I consider reading and just studying just how everyone else was feeling. Because human nature thinks that I'm the only one going through this. But as we were engaging teachers around, all teachers are feeling this way. So we were bringing in articles, we were bringing in certain books, we were having certain discussions. And I think that supported some of our mental and... I'm not going to say physical, but a lot of our mental. And we did a lot of, I call it community. We'd get lunch and we'd have staff meeting with all, or we bring doughnuts in the morning. So we worked on what's called community." These efforts were noted and appreciated by some staff members and some shared a desire to see such offerings sustained or even increased in the future.

Building close interpersonal relationships within the school community helped many navigate and/or alleviate stress and anxiety of the ever-evolving school environment. Equally important became the building and leveraging of interpersonal relationships with others traditionally seen as outside the school environment, such as medical professionals and public health officials in the region. School administrators around the country were put in the position to make difficult decisions about school openings and closings, policy changes, and mitigation strategies throughout the pandemic. The vast majority of administrators with whom we spoke did not have public health expertise, but valued data-driven decision making, and so turned to local and national experts to inform their decision-making processes. School and district administrators made a point of ensuring that their schools' mitigation measures, particularly their quarantine protocols, complied with CDC guidance, and that such protocols were updated as the guidance changed. In the words of one school administrator regarding the district administrator in charge of mitigation policies for the district, "He wasn't making this stuff up as we went along He was real in touch with [local physician], the CDC, medical professionals…He used people who were experts at this, and he used their expertise to guide his decision. We were working from a place of science." Staff, parents, and students were often appreciative of the fact that their schools' protocols were based on expert consensus, and adapted according to published research and recommendations.

In addition to collaborating with public health and medical experts, school administrators often connected with other administrators in the region to get feedback and share their plans. The difficulties in developing these plans were most evident for all stakeholder groups in regards to contact tracing and quarantine protocols, which were often perceived as inconsistent and at times contradictory. At the administration level, one administrator shared, "I serve on the secondary association of school principals

for the region and there's 10 of us on this board from all different schools and all different districts and the commonality that because this was all going on, you're building the airplane in the air 10,000 feet and you're writing the draft on a cocktail napkin. We would reach out to each other regularly and be like, what are you doing over here? What are you doing over there?" The connections made across districts administrators during the pandemic helped them to feel reassured and connected.

4. Discussion

The goal for this supporting aim of the SR2S study was to better understand the perceptions of COVID-19 testing and vaccination across the four stakeholder groups in these districts, the impact of virtual learning, and the thoughts and experiences of stakeholders during the return to in-person learning. As a broad investigation, our findings cut across many different potential avenues for implementation and dissemination. Here we focus on factors contributing to the stress and anxiety experienced by school staff, the structural supports and resources that either contributed to or hindered a positive work environment, and the creative and flexible approaches they have taken to help manage that same stress and anxiety in their classrooms, as viewed through the lens of all four stakeholder groups. Our data suggest that the school environment, regardless of district, is a highly demanding workplace for teachers and school staff. This environment is the result of both long-term challenges in the teaching profession and the sudden, dramatic paradigm shift imposed on education by the COVID-19 pandemic. These findings on the mental health and wellbeing of school teachers and staff complement recent findings in research conducted to assess changes in mental health and wellbeing of students of all ages, due in part to the altered school and social dynamics imposed by pandemic-era adaptations. Both stakeholder groups have demonstrated increases in reports of anxious and depressive symptoms and related diagnoses (39–46). The pandemic brought many of the issues facing school staff into the broader public discourse and pushed them past the "tipping point," so to speak, prompting both a mass exodus of teachers and a heightened emphasis on the socioemotional health and needs of both students and teachers, as provided within the school environment. Our findings offer insights into some of the factors fueling growing teacher resignation rates in the field, as prompted or worsened by the pandemic. In parallel, these findings also highlight some districts' practices and provide some considerations for efforts to address the socioemotional stressors and burdens resulting from the pandemic, particularly efforts to offer socioemotional health and wellbeing supports and resources to students and staff.

First, as has been widely covered in the public discourse, the pandemic has been a source of stress and anxiety for the majority of the population. School staff and students face a more demanding campus environment than they did prior to the pandemic, fueled in part by challenges students experience with re-integrating into the in-person learning environment, after spending many months in a virtual learning environment with far less human interaction. Aggression and negative behaviors increased for students, which was considered a significant contributing factor to increased teacher resignation rates in the participating districts. As the number of teachers in a district declines, the burden placed on the remaining teachers intensifies, further increasing the stress and anxiety many experience (47). Helping provide strategies and supports for students to cope with challenges in and out of school will allow them to have a strong foundation for re-adjusting to campus life. When on campus, incorporating socioemotional learning and coping strategies into existing lesson plans can also help students learn to better manage their emotions and contribute to a calmer school environment for all.

Second, sustained and increased communication within school communities would contribute to the feeling of a safe and supportive work environment for school staff (48). Communications should foster transparency as policies change, or the ability to provide feedback when policy changes occur, so that school staff feel included in an ongoing dialogue. Even when things do not change, several staff referenced frequent and transparent communication as a facilitator to feeling supported and heard by their school or administrators.

Third, building a supportive campus environment for both students and staff has the potential to significantly reduce the stress and anxiety teachers experience, thus supporting teacher retention and student success (49, 50). For essential workers, particularly those working in smaller spaces with large populations, understanding the physical resources that help employees feel safe and comfortable in their work environment (e.g., hand sanitizer, cleaning wipes, and masks) may be an important step.

Lastly, there are efforts underway to provide behavioral health resources and supports to students and staff, encourage stronger student-teacher relationships, bolster socioemotional learning in class lessons, and build a more trusting, compassionate, and empathetic school environment. Our research suggests that expanding these efforts would be supported by and valuable to students, staff, and parents in the school districts. Some participants discussed these efforts as one overall strategy to address the increase in students' negative behaviors within the schools and improve the work environment for school staff.

Moving forward, further research on this topic could explore a multitude of different questions and paths. Based on our findings, stakeholders in the school community, particularly teachers, would value research aimed at identifying effective means of addressing and reducing the heightened rate of aggressive behaviors in schools, approaches that increase clear and consistent communication and expand opportunities to garner input from a broader set of stakeholders, and approaches for building and leveraging trusting relationships within and outside the school community. Throughout all of the socioemotional burdens teachers have carried during this pandemic, as both educators and individuals, there remains the sense that, despite the difficulties wrought by the return to campus, some things are getting better. The knowledge gained and next steps for future research aim to build on that sentiment. In the words of one long-time teacher, "Even though this year was still difficult, I actually felt momentum, unlike last year, which felt like doggy paddling on the best days. Consistency, relationships, in-person expectations, and teamwork, those are so crucial to school success."

Data availability statement

The datasets presented in this article are not readily available because this is qualitative data, and as such, any potential data sharing must first be approved by our IRB. Requests to access the datasets should be directed to LR, rolfl@wustl.edu.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board, Washington University in St. Louis. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

JN was the primary contributor to conceptualization of the work. JN, NL, and NM contributed to the conceptualization and design of the study aim. LR, LV, AM, and NL contributed to data acquisition and initial analysis and conducted the qualitative thematic analysis and aggregation. LR, LV, AM, NL, NM, and JN contributed to manuscript content. LV and AM wrote the first draft of the Introduction section. LR wrote the first drafts of the Abstract, Methods, Results, and Discussion sections. LR, LV, and NL provided revisions to content, manuscript structure, and framing. JN and NM provided revisions to manuscript. LV developed the included tables and figure, with support from AM. AM managed and formatted the citations. LV formatted the manuscript. All authors contributed to manuscript revisions and read and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1096240/full#supplementary-material

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The effect of unstable job on employee's turnover intention: The importance of coaching leadership

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Swift social and economic environmental changes such as COVID-19 pandemic have led to increased job insecurity. The current study examines the intermediating mechanism (i.e., mediator) and its contingent factor (i.e., moderator) in the association between job insecurity and employee's turnover intention, especially from the perspective of positive psychology. By establishing a moderated mediation model, this research hypothesizes that the degree of employee meaningfulness in work may mediate the relationship between job insecurity and turnover intention. In addition, coaching leadership may play a buffering role to positively moderate the harmful impact of job insecurity on meaningfulness of work. With three-wave time-lagged data that was collected from 372 employees in South Korean organizations, the current study not only demonstrated that meaningfulness of work mediates the job insecurity–turnover intention relationship, but also that coaching leadership functions as a buffering factor in reducing the harmful influence of job insecurity on meaningfulness of work. The results of this research suggest that the level of meaningfulness of work (as a mediator) as well as coaching leadership (as a moderator) are the underlying processes and the contingent factor in the job insecurity–turnover intention link.

KEYWORDS

job insecurity, turnover intention, meaningfulness of work, coaching leadership, moderated mediation model

Introduction

The COVID-19 pandemic caused a significant global shock that has potentially resulted in recession and economic crisis, leading to many employees around the globe losing their jobs (1). To survive this unexpected crisis, many companies have implemented massive restructuring and downsizing. As a result, employees have suffered from an increased sense of job insecurity (2–4). Job insecurity can be defined as "the perceived threat of losing the current job in the near future" [(5), p. 65].

Previous studies have demonstrated that job insecurity is closely associated with organizational outcomes. By functioning as a severe job stressor, job insecurity has been known to significantly predict employee's poor mental/physical health, burnout, job stress, turnover intention, decreased organizational commitment/identification/trust, work engagement, creativity, and organizational citizenship behavior (3, 6–15).

Although a number of studies on job insecurity have revealed the influence of job insecurity on several important organizational outcomes, we believe that there may still be some research gaps to be examined (8, 12).

First, previous scholars have suggested there is an inconclusive link between job insecurity and organizational outcomes (8, 12, 16). Specifically, several review papers (8, 12, 16) reported that job insecurity significantly diminishes the quality of individual-level, team-level, and organizational-level outcomes. The detrimental influences are because job insecurity tends to significantly elevate the degree of employee stress and negative responses such as perceptions, attitudes, and behaviors (6, 11, 16). By contrast, other scholars have demonstrated that job insecurity is likely to promote the quality of various outcomes or performances (13, 17, 18). Based on the job-preservation motivation perspective (13, 18), These results are derived from the understanding that an unstable job would urge employees to do their best to survive in their role by achieving high levels of performance. In addition, other research has reported that job insecurity is not associated with their outcomes in an organization (19). These varied and inconclusive results are due to a lack of research on intermediating processes (i.e., mediators) and contingent/contextual factors (i.e., moderators) in the association (12, 16). Therefore, our attempt to investigate various mediators and moderators is meaningful.

Second, extant works have paid relatively less attention to employee's positive psychology–associated mediators or moderators (including meaningfulness of work, forgiveness, gratitude, and coaching leadership) when explaining the underlying processes and contextual factors between job insecurity and organizational outcomes (8, 12, 20). In other words, those studies have mainly focused on "negative" aspects of organizational life.

Positive psychology has tried to explain a variety of organizational phenomena from the perspective of positive processes, attributes, and outcomes instead of negative ones (20). For example, previous scholars have reported that various negative variables such as threat to manifest/latent benefits of work (5), frustration of psychological needs (15), psychological contract breach (5), and injustice (21) function as critical mediators in the job insecurity–organizational outcomes relationship (8, 12). We acknowledge that negative mediators and moderators can meaningfully explain the influence of job insecurity in an organization. However, given that "real" organizational life includes both positive and negative aspects, examining the underlying mechanisms and its contingent factors from the perspective of positive psychology is required (8, 12, 22). This is the reason why the positive psychological approach has been acknowledged to possess theoretical and practical value (20).

Third, existing studies on job insecurity have underexplored the important role of leadership in the context of unstable job (8, 12, 16). Although scholars have reported a variety of boundary conditions (or contextual factors) that buffer the negative influence of job insecurity, they have mainly focused on individual-level variables including self-esteem, self-efficacy, internal locus of control, proactive personality, psychological capital, resilience, job control, and emotional intelligence; or macro-level factors including labor market insecurity, social safety networks, and macro-economic conditions (23–32). Thus, few studies have examined the moderating role of leadership (8, 12, 16). Leaders significantly influence employees' perceptions, attitudes, and behaviors by assigning tasks, evaluating them, establishing (explicit and implicit) norms within an organization (33, 34). They are also regarded as a main actor symbolizing the organization itself from the perspective of employees (35). Thus, investigating the moderating role of leadership is meaningful.

To address the described research gaps, we explore the intermediating mechanism and its contextual factor in the relationship between job insecurity and turnover intention. This concept is defined as the degree to which a member wants to leave their current job or organization to seek another one (36, 37). More specifically, this research suggests that employee's meaningfulness of work mediates the association between job insecurity and turnover intention. Furthermore, coaching leadership may buffer the harmful impact of job insecurity on meaningfulness of work by positively moderating the relationship.

To empirically test our hypotheses, we present a moderated mediation model in this paper that uses structural equation modeling (SEM) with 3-wave time-lagged data from 372 Korean workers. We expect the findings of this study will contribute to both job insecurity and turnover intention literature as follows. First, in the current paper, we try to elucidate the inconclusive relationship between job insecurity and organizational outcomes by exploring the intermediating mechanism (i.e., a mediator) and its contextual factor (i.e., a moderator) of the relationship. Second, we explore the intermediating process and its contingent variable from the perspective of positive psychology (i.e., meaningfulness of work and coaching leadership). Third, the research emphasizes the important role of leadership by demonstrating that coaching leadership, as one of the emerging leadership styles, functions as a buffering factor that diminishes the harmful effect of job insecurity on meaningfulness of work. Lastly, from a methodological point of view, this study complements the limitations of cross-sectional data by applying a longitudinal approach (i.e., 3-wave time-lagged research design).

Theories and hypotheses

Job insecurity and turnover intention

In the current research, we propose that job insecurity would functions as a critical antecedent of employee turnover intention (8, 36, 38). According to the conservation of resources theory (38), when an individual copes with the threat of resource loss, they may seek to replace resources. Thus, when an employee feels a sense of threat of resource due to instability in their job, they are likely to redirect their energies and resources away from their current role to search for new and more stable employment (8, 38). Based on this argument, this research anticipates that job insecurity will be shown to increase employee turnover intention.

Hypothesis 1: An employee's job insecurity may increase their turnover intention.

Job insecurity and meaningfulness of work

We suggest that job insecurity will reduce the degree of employee's meaningfulness of the work. Meaningfulness of work is

defined as the general beliefs, values, and attitudes that employees have about their work (39) as well as the degree to which employees consider their work to be valuable and important (40). Existing studies have considered that the perception of meaningfulness of work is rooted in the subjective interpretation of each employee's experiences and interactions at work (40–42). Being based on self-efficacy perspective (43, 44), those studies reveal that employees' self-efficacy, self-esteem, and competence are the essential antecedents of their meaningfulness of work (41, 45, 46). An employee who not only successfully completes assigned tasks but also effectively makes positive changes in an organization would feel a sense of self-efficacy and self-esteem. Then, they are likely to experience a high level of meaningfulness of work (46, 47). However, in a state of job insecurity, employees feel great psychological stress, anxiety, and exhaustion, which significantly diminishes their self-esteem, self-confidence, and self-efficacy (48–51). Those negative psychological effects substantially reduce their sense of meaningfulness of work. Based on the arguments, we suggest this hypothesis.

Hypothesis 2: An employee's job insecurity may reduce their meaningfulness of work.

Meaningfulness of work and turnover intention

In the current study, we propose that diminished employee meaningfulness of work will increase their turnover intention. An employee tends to want their work to be more than just a means of making money; thus, they attempt to search for meaning in the workplace (41, 52). Extant studies have reported that employees' meaningfulness of work is likely to enhance their positive perceptions and attitudes, such as job satisfaction, organizational commitment, and intrinsic motivation (40, 46, 53–55), eventually enhancing positive emotions and their psychological states (56).

To be specific, the influence of meaningfulness of work on turnover intention can be explained by social exchange theory (57, 58). According to the social exchange approach, an individual or a group is likely to keep balance in relationships, that is called "the rule of reciprocity" (58, 59). When an individual or a group is provided something by someone or group, the beneficiary would perceive a sense of duty to repay it similarly (57, 59). For example, from the perspective of employees, the aforementioned positive or negative psychological states which are originated in meaningfulness of work may be perceived as "additional rewards" beyond an official contract (46, 54) since the employees receive a monetary reward for their labor. Then, the employees are likely to perceive a sense of obligation to repay the additional rewards to their organization. To repay it, the employees are likely to show positive attitudes toward their organization. Then, those positive inner states and experiences reduce the employee's degree of intention to leave their organization. However, if the employee feels a sense of job insecurity, they do not experience positive psychological states, even suffering from negative emotions such as anxiety, depression, and anger. Then, their turnover intention is increased. Taken together, we propose the following hypothesis.

Hypothesis 3: Decreased employees' meaningfulness of work may increase their turnover intention.

The mediating role of meaningfulness of work

Based on the above arguments, and to integrate the relationships between the research variables in the mediation structure (i.e., job insecurity, meaningfulness of work, and turnover intention), we suggest that meaningfulness of work will mediate the relationship between job insecurity and turnover intention. From the perspective of positive psychology, an employee's positivity (such as meaningfulness of work) may not only reduce due to negative perceptions such as job insecurity but may also directly reduce their negativity, such as turnover intention.

Hypothesis 4: Employees' meaningfulness of work may mediate the relationship between job insecurity and turnover intention.

The moderating role of coaching leadership

Furthermore, and more importantly, this research suggests that coaching leadership functions as a critical moderator to buffer the negative impact of job insecurity on meaningfulness of work. As already stated, our argument that job insecurity diminishes the level of employee meaningfulness of work may be reasonable and acceptable. However, the impact of job insecurity on meaningfulness of work may not always be valid in all situations or contexts in the same way because there are several contextual/contingent factors (such as personality, gender, age, leadership style, organizational climate, rule, and systems) that positively/negatively moderate the job insecurity–meaningfulness of work relationship in a real organization. Among several potential moderators, we focus on the role of leadership as a leader not only significantly influences employees' perceptions and attitudes by assigning tasks, evaluating the results, and establishing rules (34), but is also regarded as the main actor who symbolizes the organization itself from the employees' point of view (35).

Among various leadership styles, this paper focuses on coaching leadership. This concept can be defined as a leaders' behaviors that help followers effectively solve and cope with problems, difficulties, and conflicts in an organization, thereby enhancing their performance and helping them fully realize their potential and growth (60, 61). According to Heslin et al. (62), coaching leadership consists of three factors: (1) guidance, (2) facilitation, and (3) inspiration. First, guidance means providing constructive and positive feedback to followers on specific organizational expectations and goals and how to achieve them. Second, facilitation refers to helping followers analyze and explore how to solve job-related problems and improve their performance on their own. Third, inspiration means helping followers recognize their potential and value, motivating them to achieve better performance. Through these three factors, followers can develop their potential and capabilities to achieve greater self-efficacy and competence (60, 61). With increased coaching leadership, employees feel more respect and support from their leader (62, 63). This enables followers to develop a

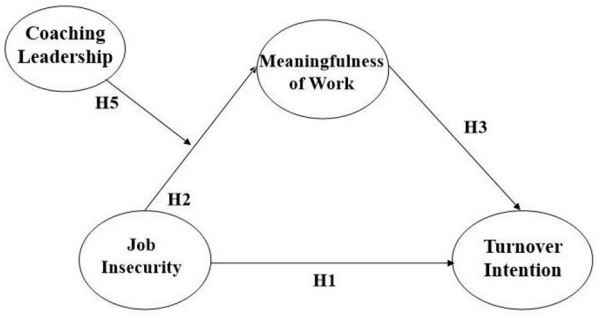

FIGURE 1
Theoretical model.

positive self-concept within the organization, feeling respected by the organization. Previous studies have reported that coaching leadership is closely and positively associated with employees' psychological wellbeing, job satisfaction, work performance, and organizational citizenship behavior (61–67).

In this paper, we propose that coaching leadership mitigates the detrimental influence of job insecurity on meaningfulness of work. A leader's coaching behaviors provide effective guidance for their followers to adequately deal with negative emotional states, personal problems, and crises that originate from job instability (62). This leadership enables followers to feel a sense of respect, mutual trust, support, and self-worth within the organization, eventually reducing the negative effects of job insecurity on meaningfulness of work (60, 68). For example, when the level of coaching leadership is high, a leader's coaching behaviors guide employees to effectively cope with anxiety and fear from unstable employment, even if they feel a high degree of job insecurity. As a result, followers are less likely to feel diminished levels of meaningfulness of work.

By contrast, when the level of coaching leadership is low, followers may experience difficulty dealing with negative emotions, personal problems, and crises that are derived from unstable employment, making them feel less respected and supported by the organization (62, 64). Therefore, less coaching leadership will make employees who suffer from job insecurity perceive that they cannot adequately address the problem and are isolated from the organization. As a result, the negative impact of job insecurity may not be properly resolved and may even be amplified. Thus, we suggest the following hypothesis (please see Figure 1).

> **Hypothesis 5:** Coaching leadership may positively moderate the relationship between job insecurity and meaningfulness of work by reducing the negative effect of job insecurity on meaningfulness of work.

Methods

Participants and procedure

The sample consisted of currently working employees over 19 years old in various organizations in South Korea across three different time points. They were recruited through an online survey company which has an online survey system with the largest population of research panelists of ∼3,450,000. The participants reported their occupational status when they registered for online membership *via* a user authentication system (i.e., cellular phone number or email address). Such online survey systems are considered a reliable method for accessing various samples (69).

Data was collected from employees of South Korean firms at three different time points. This was done in an effort to complement the fundamental issue embedded in cross-sectional research design. The research company randomly provided an identification number for each respondent. And the identification number was managed through the online surveying system of the company. Based on this method, we could match the questionnaires at the 3 time points. The operating function of the online system allowed us to track who responded to our survey, confirming that participants from time point 1 to time point 3 were the same. The interval between each stage was 4–5 weeks. Our survey system was open for 2 or 3 days each at each time point to provide enough time for participants to respond. When the system was open, participants could access it at any time. The company monitored the integrity of data by using traps for geo-IP violators and timestamps to flag efficient response time, which restricted participants from logging into the survey site and filling out the surveys multiple times.

The research firm contacted the participants directly to establish consent to participate in the survey, ensuring not only that their participation would be voluntary but also that their responses would be confidential and only used for research purposes. The company also reported and obtained informed consent and compliance with ethical requirements from those who agreed with the participation and reporting. The company provided the participants with a reward for their participation in the form of cash (US $8). The study was approved by the Institutional Review Board of a representative university in South Korea.

The research company selected the participants with a random stratified selection process to reduce the possibility of sampling bias. In stratified sampling, a random sample is drawn from each of the requisite strata. Through this sampling method, the possibility of bias from various employee characteristics that may influence the results of this research (e.g., gender, age, position, education, and industry type) is reduced. Due to its various operating functions in the online systems, this paper was able to track down who responded to it, implying that respondents from time point one to time point three are the same.

During time point 1, 512 employees participated in our survey, with 421 taking part at time point 2, and 379 at time point 3. After collecting the data, we eliminated responses with missing data. Finally, the study utilized data from 372 employees who provided complete answers to all three waves of the survey (response rate: 72.66%). To determine the sample size, we utilized various suggestions from previous research. First, we checked whether our sample size was appropriate by calculating the minimum sample size with G*Power version 3.1.9.7. Power analysis demonstrated that a sample size of 372 provided sufficient power (≥0.80) to detect a medium effect with an alpha level of $p = 0.05$ (70). In addition, Barclay et al. (71) suggest that one observable variable needs at least 10 cases (i.e., the rule of 10) when conducting SEM. Because the research model in this study comprised 22 observable variables, our

final sample of 372 cases was considered an adequate sample. The characteristics of the respondents are described in Table 1.

Measures

At each time point, the survey measured distinct variables in our research model. At time point 1, the respondents were asked about the level of job insecurity and coaching leadership. At time point 2, participants' data were collected to measure their degree of meaningfulness of work. At time point 3, data were collected on participants' turnover intention. These variables were assessed through multi-item scales on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Moreover, through Cronbach alpha values, the internal consistency of each variable was computed.

Job insecurity (time point 1, collected from members in an organization)

We used four items for the job insecurity scale (72). Sample items were: "*If my current organization were facing economic problems, my job would be the first to go*," "*I will not be able to keep my present job as long as I wish*," and "*My job is not a secure one*." The Cronbach's alpha value was 0.90.

Coaching leadership (time point 1, collected from employees)

To measure the degree of coaching leadership, we utilized 12 items from previous studies on coaching leadership (60, 61). Sample items were: "*My leader believes in my potential for growth*," and "*My leader asks questions that make me reflect on my thoughts and perspectives*." The Cronbach's alpha value was 0.94.

Meaningfulness of work (time point 2, collected from employees)

To measure the level of employee meaningfulness of work, the current study used five items of the meaningfulness of work scale from extant works (73, 74). Sample items were: (a) "*The work that I do is meaningful*"; (b) "*The work that I do makes the world a better place*"; and (c) "*My work is one of the most important things in my life*." The Cronbach's alpha value was 0.88.

Turnover intention (time point 3, collected from employees)

The degree of turnover intention was measured through three items from existing studies (36, 37). The items were: (a) "*How likely is it that you will look for a job outside of this organization during the next year*?" (b) "*How often do you think about quitting your job at this organization*?" and (c) "*If it were possible, how much would you like to get a new job*?" The Cronbach's alpha value was 0.89.

TABLE 1 Descriptive characteristics of the sample.

Characteristic	Percent
Gender	
Male	50.8%
Female	49.2%
Age (years)	
20–29	14.0%
30–39	36.5%
40–49	33.1%
50–59	16.4%
Education	
Below high school	8.6%
Community college	19.4%
Bachelor's degree	60.5%
Master's degree or higher	11.6%
Occupation	
Office worker	71.3%
Profession (practitioner)	7.2%
Public official	6.0%
Manufacturing	5.7%
Sales and marketing	4.3%
Administrative positions	4.0%
Education	0.3%
Others	1.2%
Position	
Staff	23.1%
Assistant manager	22.6%
Manager or deputy general manager	32.8%
Department/general manager or director and above	21.5%
Tenure (years)	
Below 5	47.0%
5–10	27.2%
11–15	12.9%
16–20	7.0%
21–25	2.4%
Above 26	3.5%
Industry type	
Manufacturing	24.3%
Wholesale/retail business	12.5%
Construction	12.9%
Health and welfare	9.9%
Information services and telecommunications	8.6%
Education	8.1%
Services	6.5%
Financial/insurance	3.8%
Consulting and advertising	1.3%
Others	11.3%

TABLE 2 Correlation between research variables.

	Mean	S.D.	1	2	3	4	5	6	7
1. Gender_T2	1.49	0.50	–						
2. Education_T2	2.75	0.77	−0.15**	–					
3. Tenure_T2	7.45	7.29	−0.27**	0.01	–				
4. Position_T2	2.92	1.59	−0.42**	0.22**	0.29**	–			
5. Job insecurity_T1	2.82	0.85	−0.05	−0.05	0.01	0.11*	–		
6. CL_T1	3.16	0.73	−0.06	0.05	0.01	0.10*	−0.06	–	
7. MoW_T2	3.13	0.79	−0.19**	0.16**	0.14**	0.23**	−0.17**	0.29**	–
8. TI_T3	3.09	1.03	0.13*	0.04	−0.19**	−0.03	0.12*	−0.25**	−0.34**

*$p < 0.05$. **$p < 0.01$. S.D., standard deviation; CL, coaching leadership; MoW, meaningfulness of work; TI, turnover intention. As for gender, males are coded as 1 and females as 2. As for position, general manager or higher are coded as 5, deputy general manager and department manager 4, assistant manager 3, clerk 2, and others below clerk as 1. As for education, "below high school diploma" level is coded as 1, "community college" level as 2, "bachelor's" level as 3, and "master's degree or more" level is coded as 5.

Control variables

Based on extant studies (36, 37), the dependent variable of this research—turnover intention—was controlled by various factors such as tenure, gender, position, and education of an employee. The control variables were collected at time point 2.

Statistical analysis

First, frequency analysis was performed to check the participants' demographic features. We conducted Pearson correlation analysis using the SPSS 26 program to assess the relationships between our research variables. Then, following the suggestion of Anderson and Gerbing (75), we took a two-step approach that consists first of measurement and then the structural model. To test the validity of the measurement model, we performed confirmatory factor analysis (CFA). Next, based on SEM, a moderated mediation model analysis with the maximum likelihood (ML) estimator was performed using the AMOS 23 program to test the structural model.

To test whether various model fit indexes are acceptable, this study utilized a variety of goodness-of-fit indices including the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean square error of approximation (RMSEA). Extant research has reported that the CFI and TLI values >0.90 and an RMSEA value of <0.06 are appropriate (76). Finally, bootstrapping analysis was implemented to test whether the indirect effect was significant (77). Lastly, to check whether our mediation hypothesis was supported, we conducted bootstrapping analysis with a 95% bias-corrected confidence interval (CI). This analysis can check the significance of the indirect mediation effect. If the CI does not include zero (0), this result indicates that the indirect effect is statistically significant with a 0.05 level (77).

Results

Descriptive statistics

Research variables (job insecurity, coaching leadership, meaningfulness of work, and turnover intention) were significantly related. The correlation analysis results are shown in Table 2.

Measurement model

To test the discriminant validity of the main research variables (job insecurity, coaching leadership, meaningfulness of work, and turnover intention), we performed CFA for all items by checking the measurement model's goodness-of-fit. To be specific, we compared our hypothesized model, a 4-factor model (job insecurity, coaching leadership, meaningfulness of work, and turnover intention), to other alternative models, such as 3-, 2-, and 1-factor models, by conducting a series of chi-square difference tests.

First, the hypothesized 4-factor model had a good and acceptable fit [$\chi^2_{(df=109)} = 212.224$; CFI = 0.974; TLI = 0.967; RMSEA = 0.051]. Then, we conducted a series of chi-square difference tests by comparing the 4-factor model with a 3-factor model [$\chi^2_{(df=112)} = 1239.387$; CFI = 0.715; TLI = 0.655; RMSEA = 0.165], a 2-factor model [$\chi^2_{(df=114)} = 1699.100$; CFI = 0.600; TLI = 0.523; RMSEA = 0.194], and a 1-factor model [$\chi^2_{(df=115)} = 1763.298$; CFI = 0.584; TLI = 0.508; RMSEA = 0.197]. The results of the chi-square difference tests showed that the 4-factor model was better than others. Thus, this result means that our four research variables have an appropriate degree of discriminant validity.

Structural model

In this study, we built a moderated mediation model including both mediation and moderation structures in the job insecurity–turnover intention relationship. In the mediation structure, the job insecurity–turnover intention relationship is mediated by the degree of employee meaningfulness of work. In the moderation structure, coaching leadership functions as a buffering factor that positively moderates the harmful impact of job insecurity on meaningfulness of work.

Next, in the moderation structure, we multiplied the two variables (i.e., job insecurity and coaching leadership) to make an interaction term between the variables. Before the multiplication, the two variables were centered on their means to decrease the harmful impact of multicollinearity. Such a centering method increases the validity of the moderation analysis by diminishing the degree of multi-collinearity between the variables and minimizing the loss of correlations (78).

TABLE 3 Results of structural model.

Hypothesis	Path (relationship)	Unstandardized estimate	S.E.	Standardized estimate	Supported
1	Job insecurity -> turnover intention	0.067	0.062	0.058	No
2	Job insecurity -> meaningfulness of work	−0.124	0.047	−0.150**	Yes
3	Meaningfulness of work -> turnover intention	−0.522	0.080	−0.379***	Yes
5	Job insecurity × coaching leadership	0.157	0.056	0.151**	Yes

**p < 0.01. ***p < 0.05. Estimate indicates standardized coefficients. S.E., standard error. The coefficient value of the path from job insecurity to turnover intention (H1) was in the partial mediation model which was not accepted as a final model.

To test the impact of the multicollinearity bias, we measured the value of variance inflation factors (VIF) and tolerances (78). The VIF values for job insecurity and coaching leadership were 1.003 and 1.003, respectively. Moreover, the values of tolerance were 0.997 and 0.997, respectively. The results with VIF values smaller than 10 with the tolerance values above 0.2 indicate that job insecurity and coaching leadership are relatively free from the multi-collinearity issue.

Results of mediation analysis

To find the best mediation model, we compared a full mediation model to a partial mediation model by performing a chi-square difference test. The full mediation model is identical to the partial mediation model except for the direct path from job insecurity to turnover intention. The fit indices of both the full mediation model [$\chi^2 = 254.539$ (df = 136), CFI = 0.962, TLI = 0.952, and RMSEA = 0.048] and the partial mediation model [$\chi^2 = 253.441$ (df = 135), CFI = 0.962, TLI = 0.952, and RMSEA = 0.049] were acceptable. However, the chi-square difference test between the models [$\Delta\chi^2_{(1)} = 1.098$, non-significant] demonstrated that the full mediation model was superior. This result indicates that job insecurity is likely to indirectly influence (e.g., *via* mediating effect of meaningfulness of work) turnover intention, rather than having a direct impact.

The control variables (tenure, gender, education, and position) were included in the research model to control for the dependent variable, turnover intention. The result showed that only position ($\beta = 0.11$, $p < 0.05$) and tenure ($\beta = -0.18$, $p < 0.05$) were statistically significant.

Including the control variables, our research model showed that job insecurity was non-significantly associated with employee's turnover intention ($\beta = 0.06$, $p > 0.05$), which does not support Hypothesis 1. For Hypothesis 1, the coefficient value of the path from job insecurity to turnover intention was in the "partial" mediation model (which was inferior to the full mediation model), not the full mediation model that was finally accepted. This result is consistent with the fact that the model fit indices of full mediation are better than partial mediation. Based on the results of the chi-square difference test between full and partial mediation models as well as the non-significant value of the path coefficient, we conclude that Hypothesis 1 was not supported. In other words, job insecurity is likely to influence turnover intention in an "indirect" way through the mediating effect of various mediators (e.g., meaningfulness of work) rather than in a direct way.

Job insecurity was significantly and negatively associated with employee's meaningfulness of work ($\beta = -0.15$, $p < 0.01$), supporting Hypothesis 2, and that meaningfulness of work is significantly and negatively associated with turnover intention ($\beta = -0.38$, $p < 0.001$), supporting Hypothesis 3 (please see Table 3 and Figure 2).

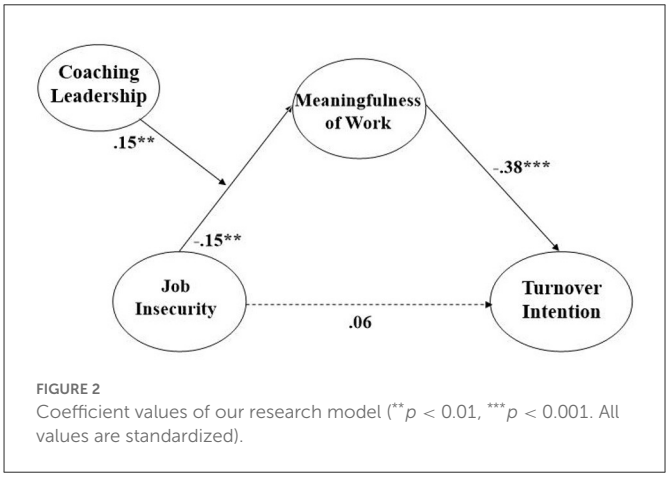

FIGURE 2
Coefficient values of our research model (**$p < 0.01$, ***$p < 0.001$. All values are standardized).

TABLE 4 Direct, indirect, and total effects of the final research model.

Model (hypothesis 4)	Direct effect	Indirect effect	Total effect
Job insecurity -> meaningfulness of work -> turnover intention	0.000	0.057	0.057

All values are standardized.

Bootstrapping

To test the mediation effect of meaningfulness of work in the job insecurity–turnover intention relationship (Hypothesis 4), we conducted bootstrapping analysis with a sample of 10,000 (77). The indirect mediation effect would be significant at a 5% level if the 95% bias-corrected CI for the effect of mean indirect mediation excluded 0 (77).

The results showed that the bias-corrected CI for the mean indirect effect did not include 0 [95% CI = (0.014, 0.109)]. This means that that the indirect mediation effect of meaningfulness of work was statistically significant, supporting Hypothesis 4. The direct, indirect, and total effects of the paths from job insecurity to turnover intention are shown in Table 4.

Result of moderation analysis

We tested the moderation effect of coaching leadership on the relationship between job insecurity and meaningfulness of work.

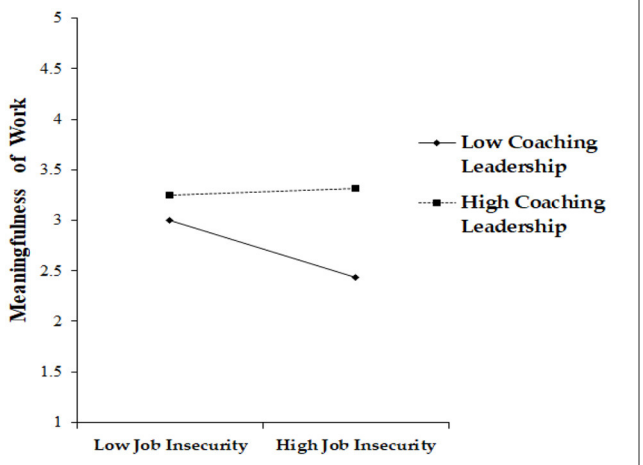

FIGURE 3
Moderating effect of coaching leadership in the job insecurity–meaningfulness of work link.

To do so, we conducted a mean-centering process by making an interaction term. The coefficient value of the interaction term ($\beta = 0.18$, $p < 0.001$) was statistically significant. This result means that coaching leadership positively moderates the relationship between job insecurity and job stress by playing a buffering role. Moreover, it indicates that when the level of coaching leadership is high, the decreasing impact of job insecurity on meaningfulness of work is reduced, supporting Hypothesis 5 (please see Figure 3).

Discussion

Utilizing 3-wave time-lagged data from 372 employees in South Korea, the current study demonstrated that an employee's meaningfulness of work functions as an important intermediating process (i.e., mediator) in the job insecurity–turnover intention relationship. Moreover, this research empirically determined that coaching leadership plays a buffering role that reduces the harmful influence of job insecurity on meaningfulness of work (i.e., moderator). These results are consistent with the arguments of previous works on job insecurity, meaningfulness of work, turnover intention, and coaching leadership. To be specific, our result that job insecurity functions as a critical antecedent of employee turnover intention is consistent with the extant studies [please see Jiang and Lavaysse (8)]. And our result that job insecurity decreases the degree of meaningfulness of work corresponds with the existing works (45, 46). Also, the result that the diminished meaningfulness of work increases the degree if turnover intention is also consistent with the previous works (52, 59). Lastly, the moderating effect of coaching leadership is consistent with the recent works (63, 67). The reason why the results are consistent with the previous work is that our arguments are based on the proper and validated theoretical background.

This paper may contribute to the literature on job insecurity, meaningfulness of work, turnover intention, and coaching leadership by revealing why (i.e., mediator) and when (i.e., moderator) job insecurity influences turnover intention. In the following sections, we describe the theoretical/practical implications and limitations of the study, also providing suggestions for future research.

Theoretical implications

We believe that the current study may contribute to job insecurity literature from a theoretical perspective. First, the current paper may contribute to job insecurity literature by resolving the inconclusive relationship between job insecurity and organizational outcomes. To address the issue of inclusive results in the job insecurity-organizational outcomes link, we explored the intermediating process (i.e., mediators) and its contingent factor (i.e., moderator) of the relationship (12). As a result, we found and suggest that job insecurity negatively affects organizational outcomes *via* deteriorating employees' perceptions or attitudes at work (i.e., meaningfulness of work). To be specific, we unveiled the mediating role of employees' meaningfulness of work in the job insecurity–turnover intention link. Furthermore, by empirically validating that coaching leadership plays a buffering role in the relationship between job insecurity and meaningfulness of work, this research can shed light on a contextual or contingent factor which moderate the influence of job insecurity in an organization. We believe that this research can contribute to resolving the inconclusive results of job insecurity by bolstering existing studies that show a detrimental influence of job insecurity on organizational outcomes.

Second, this study attempts to interpret job insecurity from the perspective of positive psychology, by emphasizing the importance of a positive psychological intermediating mechanism (i.e., meaningfulness of work) and its contextual factor (i.e., coaching leadership). In other words, we believe that the current paper may contribute to expanding the scope of job insecurity literature by integrating job insecurity literature with positive psychology literature. In this paper, we demonstrated that an employee's meaningfulness of work, as a representative variable of positive psychology, plays a mediating role in explaining the impact of job insecurity on turnover intention. Thus, this paper reveals that job insecurity significantly diminishes employee positivity (i.e., meaningfulness of work), eventually leading to them leaving the organization. However, this paper also suggests that an employee's positivity in an organization can be recovered and protected through the positivity of the leader, for example, through coaching leadership. Positive leadership behavior can function as a buffering factor, which positively moderates the harmful effect of job insecurity on meaningfulness of work.

Third, the current study demonstrates that leadership plays a critical buffering role in explaining the negative impact of job insecurity. Considering that members in an organization tend to be influenced by their leaders' thoughts, feelings, words, and behaviors when they interpret the meaning of various events, systems, and situations around them (34, 35), leaders can substantially affect employees' perceptions and attitudes toward an important event or situation, such as job insecurity. In other words, leadership will significantly moderate the impact of job insecurity in an organization. Specifically, we show that the harmful influence of job insecurity on meaningfulness of work would be reduced by a high level of coaching leadership. When the level of coaching leadership is high, employees are likely to perceive that they are not alone and separated from their organization. Then, the negative impact of job insecurity can be alleviated. This result indicates that the coaching behaviors of a leader can be an important contingent variable in mitigating the harmful influences of job insecurity.

Practical implications

The current study can provide practical contributions for top management teams who want to understand the influence of job insecurity. First, the result of this paper suggests that top management teams should understand the seriously harmful impact of job insecurity on employees' turnover intention. We empirically demonstrate that job insecurity significantly boosts employees' turnover intention. Given that an employee's turnover is likely to be closely associated with several organizational outcomes, job insecurity substantially diminishes the level of an organization's competitive advantage and sustainability. Therefore, in this paper, we propose that top management teams are required to address and resolve this critical issue carefully by establishing effective and efficient human resource management systems.

Second, we provide useful indicators or criteria (i.e., meaningfulness of work as a mediator in the research model) for top management teams in monitoring and checking the harmful influences of job insecurity as well as the effectiveness of several buffering variables (e.g., coaching leadership, and several practices for decreasing the harmful impacts of job insecurity). Our results empirically demonstrate that the degree of an employee's meaningfulness of work plays the role of mediator in the job insecurity–turnover intention relationship. This indicates that the degree of an employee's meaningfulness of work can be utilized as an important measure or criteria to evaluate how severely job insecurity affects employee turnover intention.

The buffering effect of coaching leadership can also be measured or evaluated by the change of employees' meaningfulness of work. For example, when the level of meaningfulness of work does not change after implementing coaching leadership in an organization, the top management teams may interpret that the buffering influence of coaching leadership will not work adequately. In summary, we propose in this paper that top management teams should monitor the degree of employee meaningfulness of work to check the influences of both job insecurity and its moderating variable (i.e., coaching leadership).

Third, the current study also provides direction for top management teams who attempt to diminish the negative influence of job insecurity in an organization. We suggest that top management teams should understand and properly utilize the positive and buffering effects of coaching leadership. To alleviate the harmful influence of job insecurity, top management teams should apply coaching leadership in their organization. By providing training for coaching leadership behaviors, top management teams can cultivate effective coaching leaders and a coaching culture within an organization. This would significantly contribute to addressing the negative influence of job insecurity.

Limitations and suggestions for future research

Although we believe the current study may meaningfully contribute to job insecurity and turnover intention literature, there are still some limitations to be addressed. First, this research could not measure the level of job insecurity in an objective manner as the current study only utilized survey data relying on respondent's self-reporting, which would most likely be subjective. While we acknowledge that the objective phenomena (such as downsizing rate) may not directly influence employees' perceptions and attitudes because the objective characteristic (e.g., downsizing rate) tends to be interpreted through their sense-making processes, the objective measure would be unconsciously reflected in employees' responses. Thus, we suggest that future research needs to utilize both the subjective and objective measures and compare the differential effects of the different measures. Second, this research could not properly consider a number of external factors that substantially affect the degree of job insecurity. There are numerous objective factors that pervade an employee's perception of their subjective job insecurity, such as downsizing rates, the quality or characteristics of human resource management systems, and features of the social security system at the country level (9). Therefore, we suggest that future research should more fully consider the issue by elaborately controlling the objective variables.

Third, although the fundamental values and spirit of coaching leadership may be universal in Western and Eastern societies (79, 80), a number of cultural differences may exist with regard to understanding the role of leadership. These will eventually influence employees' responses toward leadership style. Given that South Korea has been affected by Confucian hierarchy for many centuries, Korean employees may be more familiar with the culture of command and discipline compared to the Western employees (79). As a result, Korean employees are likely to feel that a leader's coaching behaviors are not natural and effective in a real organization. Therefore, the results of the this study should be carefully interpreted.

Conclusion

This research investigated the impact of job insecurity on employees' turnover intention. The results showed that job insecurity promotes the extent of employee turnover intention *via* the mediating role of meaningfulness of work. Moreover, coaching leadership functions as a positive moderator in the job insecurity–meaningfulness of work relationship. The results indicate that the level of employees' meaningfulness of work is an underlying mechanism in translating job insecurity into turnover intention. In addition, the degree of coaching leadership provides a buffering factor that decreases the negative influence of job insecurity. Although this research has some limitations, we anticipate that the findings will offer a positive contribution to expanding the literature on job insecurity.

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 Macromill Embrain Group of Ethics Committee. Macromill Embrain Group is the company providing market research service and their approval is sufficient according to the

local requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JJ and B-JK contributed by writing the original draft of the manuscript and in the conceptualization, data collection, formal analysis, and methodology. M-JK contributed in the conceptualization, analysis, revision, and in editing the manuscript. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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

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Supplementary material

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Resilience of hospital staff facing COVID-19 pandemic: Lessons from Israel

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Introduction: The COVID-19 pandemic has placed additional burden on already strained healthcare systems worldwide, intensifying the responsibility and burden of healthcare workers. Although most hospital staff continued working during this stressful and challenging unprecedented pandemic, differences in the characteristics and attributes were noted between sectors and hospital departments. Israeli healthcare workers are trained and experienced in coping with national emergencies, but the pandemic has exposed variations in staff reactions. Understanding the intrinsic differences between sectors and departments is a key factor in staff and hospital preparedness for unexpected events, better resource utilization for timely interventions to mitigate risk and improve staff wellbeing.

Objective: To identify and compare the level of resilience, secondary traumatization and burnout among hospital workers, between different sectors and hospital departments, during the COVID-19 pandemic.

Methods: Cross-sectional research to assess the resiliency, secondary traumatization and burnout of healthcare workers at a large general public hospital in central Israel. The sample consisted of 655 participants across various hospital units exposed to COVID-19 patients.

Results: Emergency department physicians had higher rates of resilience and lower rates of burnout and secondary traumatization than staff in other hospital departments. In contrast, staff from internal medicine departments demonstrated the highest levels of burnout (4.29). Overall, physicians demonstrated higher levels of resilience (7.26) and lower levels of burnout compared to other workers.

Conclusion: Identifying resilience characteristics across hospital staff, sectors and departments can guide hospital management in education, preparation and training of healthcare workers for future large-scale health emergencies such as pandemics, natural disasters, and war.

KEYWORDS

resilience, burnout, COVID-19 pandemic, healthcare workers, intensive care unit, emergency department, risk perception

1. Introduction

In early 2020, as confirmed cases of COVID-19 began to rise dramatically in countries across the world, the World Health Organization (WHO) declared COVID-19 a global pandemic. That declaration, along with uncertainty as to the virus characteristics and its threat, caused widespread concern. Within 2 years, the number of confirmed cases has reached over 507 million, and the death toll has topped nearly 6.2 million lives (1). The COVID-19 pandemic has caused a jump in mortality and morbidity, as well as a more subtle, yet equally damaging impact on the psychological status of not only its victims, but on healthcare workers (HCW) caring for the ill. The pandemic struck Israel's already overloaded health care system. Within 2 years, Israel had approximately 4 million confirmed cases, with 10,670 deaths (1). Although Israel's healthcare system has prepared for and been repeatedly tested during national emergencies, from earthquakes and mass-casualty events to military conflict, the pandemic posed a significant and unique challenge, especially to frontline HCW's. Frontline HCW's, primarily in emergency departments (ED) and intensive care units (ICU), managed fast-paced high-intensity work with the uncertainty and added stress of the pandemic.

The pandemic may have significantly eroded the resilience of both medical staff and healthcare systems due to infectious disease's inherent unpredictability, ability to impact even young, previously healthy patients and through instilling the fear of contracting the disease by the caregivers themselves (2). *Resilience* is defined as a person or organization's adaptation to stressful external sources such as trauma or threat (3). Resilience has been shown to play a beneficial role in reducing perceived workload and burnout. HCWs in dynamic, high-stress environment such as Hospitals, and especially in emergency departments (ED) and intensive care units (ICU), are particularly exposed by burnout (4). Resilience may differ between sectors of HCWs, such as between physicians and nurses, and vary based on personal and psychological characteristics (5).

Studies of infectious disease outbreaks have found a noticeable rise in the psychological distress, secondary traumatization and post-traumatic stress among HCW's (6). These variables may differ considerably among sectors of the population at large as well as sectors of HCW's. Frontline HCW's may be particularly vulnerable (7). Socio-demographic and professional characteristics, such as age, experience, education levels, and risk perception may alter the understanding and perception of the risk inherent in infectious disease outbreaks in the eyes of HCW's. Higher perceived risk has been demonstrated to positively correlate with increased psychological distress (8). It is critical to identify those sectors of HCW's with higher perceived risks of exposure to take steps to mitigate these concerns (9).

In previous pandemics, medical staff reported experiencing high levels of stress, anxiety, and depressive symptoms (10). Studies have reported adverse psychological reactions to the 2003 SARS outbreak (11), demonstrating that HCWs feared contagion and infection of their family, friends, and colleagues (12). Stressors grouped HCWs concerns into four categories: "fear of transmission", "interference of workload with private life", "uncertainty/lack of knowledge", and "concerns about the team" (7). These acute concerns during the pandemic may be exacerbating already high rates of burnout amongst HCWs and leaving its mark on those that have cared for COVID-19 patients in the form of secondary traumatization.

Secondary traumatization is defined as "the stress deriving from helping others who are suffering or who have been traumatized" (13). As observed from previous viral outbreaks in recent times such as SARS, MERS, and Ebola, a large rise in secondary traumatization, psychological distress and post-traumatic stress in HCWs was reported during and following the pandemic. Secondary traumatization correlates with burnout (14).

In the UK, approximately 80% of physicians experienced burnout during the COVID-19 pandemic and reporting feelings of "psychological unease" (15). *Burnout* as determined by Freudenberger and Maslach (16) in the 1970's, can occur in any occupation, though higher levels of burnout have been reported among HCW's (17). Burnout is defined as failure or exhaustion because of excessive demands on energy, strength or resources in the workplace (18), thereby affecting patients' safety and health (19). Prior to the COVID pandemic, approximately half of physicians reported experiencing burnout (20). A 2018 Israeli Ministry of Health report identified the highest burnout among staff of ED and geriatric departments (21).

Burnout among HCW's could be negatively impacting the quality of patient care "in terms of adherence to guidelines, poor communication, medical errors, and patient outcomes and safety" (18). Burnout among staff may also contribute to patients' dissatisfaction with their treatment and an increase in complaints (22). In a large cross-sectional survey of HCWs in Taiwan in the first year of the COVID-19 pandemic, burnout was reported in 40.3% of respondents (22). The respondents who worked in the acute care division, compared with those who did not, had a 33.3% higher risk of burnout, especially, female, and therapists (physicians or nurses). A meta-analysis found that burnout was more prevalent in medical specialties with direct exposure to life-threatening situations, such as intensive care (18). Studies indicated that frontline HCWs may be at higher risk of negative emotional effects (23). In a study of ED physicians in Belgium, 1 in 3 met sub-clinical levels of anxiety and 14.5% met clinical levels for PTSD (24). Several studies in Spain have demonstrated that both female gender and less work experience among healthcare professionals correlated with increased susceptibility to the psychological effects of the pandemic (25, 26).

Remarkably, other studies have demonstrated the opposite; namely that frontline HCWs had lower levels of distress (27). A 2019 systemic review which analyzed findings from 31 research studies, found lower levels of secondary traumatization among first responders, possibly due to an immunization effect (14). Frontline HCWs may have been "immunized" or pre-conditioned for work during a pandemic by their previous experiences. A recent study demonstrated that oncologists who had been repositioned during the pandemic to work in frontline wards experienced lower levels of burnout than their colleagues, perhaps due to "immunization" from previous work experience (27).

There have been a limited number of studies that measured burnout among Israeli hospital workers. One study, conducted at a medical center in southern Israel demonstrated variability in

burnout among different medical sectors during the first wave of the COVID-19 pandemic (28). A second study in Israel found that frontline HCW's including those in the ED and ICU were at higher risk of suffering from both stress and burnout (29).

Interestingly, both Israeli studies noted that HCW's were generally more concerned with the health of family members and friends than themselves. They also expressed concern and doubt for how the crisis was managed at the organizational and national levels.

The aim of our study was to determine levels of resilience, burnout and secondary traumatization in hospital departments and across sectors of HCWs during the second wave of the pandemic in Israel.

2. Materials and methods

2.1. Measurement tools to construct profile of HCW

2.1.1. The Connor-Davidson resilience scale (CD-RISC-10)

We utilized the CD-RISC 10-itemScores in Non-treatment Seeking Trauma Survivors to measure four components of resilience: optimism, meaningfulness/purpose, resourcefulness/self-efficacy, and hardiness. Each question had five answer choices: not true at all (0), rarely true (1), sometimes true (2), usually true (3), mostly true (4), and true nearly all of the time (e.g., "always true") (5). In addition, the total scoring scale was modified to be scored 1–10, with higher scores indicating higher resilience (30).

2.1.2. Maslach burnout inventory (MBI)

An adoptive version containing 13 of the 16 components was utilized with a 10-point scale The higher the total score, the more severe the burnout (31).

2.1.3. Professional quality of life scale (ProQOL)

Professional Quality of Life Scale (ProQOL) was utilized to measure secondary trauma, was with a 1 to 10 answer scale: 1 indicated that the participant never felt this emotion and 10 if the emotion was felt very often. Thus, the lower the ProQOL score, the lower the secondary trauma experienced. To assess secondary trauma, we used the validated official Hebrew ProQOL questionnaire 4th edition adapted modified version of 10 out of the 30 questions was used; those 10 questions focused on secondary traumatization (32).

2.2. Procedure

The research was presented to and approved by the hospital "Helsinki Committee" acting as the Independent Review Board (IRB) and Independent Ethics Committee (IEC). Consent was obtained in writing by participants, all of whom were adults. The study was conducted during the third wave of the pandemic in Israel, between February and March 2021, in a 900-bed hospital, Shamir Medical Center (SMC) (Assaf Harofeh). This hospital provides care for over one million residents of Israel's central region. SMC's ED is the 4th largest in Israel, treating about 160,000 patients each year. The questionnaire was electronically disseminated to all hospital workers following three reminders *via* SMS (phone text message) and to employees' organizational email. Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at SMC (33). REDCap is a secure, web-based software platform designed to support data capture for research studies (34).

2.3. Data analysis

Categorical variables are reported as frequency and percentage. Continuous variables are reported as mean and standard deviation. Continuous variables were evaluated for normal distribution using histograms and Q-Q plots. The Mann Whitney test and Kruskal Wallis tests were used to compare continuous variables, and Chi-square test was used to compare categorical variables. FDR (False Discovery Rate) was used to control for multiple comparisons. All statistical tests were two tailed, and a *P*-value of $P < 0.05$ was considered statistically significant. SPSS software was used for all statistical analysis (IBM SPSS statistic for windows, version 25, IBM corporation, Armond, New York, USA 2017). Regression models were used and presented separately in accompanying tables. Cronbach Alpha was utilized to gauge the internal consistency of our survey.

3. Results

The questionnaire was electronically disseminated to all 4,200 hospital workers (see Table 1). Participation rate among staff from the ICU was 55.7% (34 of 61 workers), among staff from internal medicine departments 22.7% (88 of 387 workers) and among ED staff 89.7% (166 of 185 workers). The overall participation rate among all hospital staff who completed the questionnaire was 15.6%.

We utilized Cronbach Alpha to gauge the internal consistency of our survey. To measure resilience, the survey consisted of 10 items and the value for Cronbach's Alpha was $\alpha = 0.910$. For traumatization, the survey consisted of 10 items and the value for Cronbach's Alpha was $\alpha = 0.901$. Finally, for burnout, the survey consisted of 13 items and the value for Cronbach's Alpha was $\alpha = 0.905$ (Table 2).

The average score for staff resilience was 7.17, men 7.46, females 7.03 ($P = 0.020$). Physicians' resilience score was 7.26, nurses 6.85 ($P = 0.004$), hospital administration workers 7.47 ($P < 0.001$), physician assistants and paramedics 8.16 ($P < 0.001$). The average resilience among ED staff was 7.41; among internal medicine staff 6.93 ($P = 0.012$), and ICU staff 6.58 ($P = 0.041$).

The average score for burnout was 3.59, with no significant difference between men and women (3.75 and 3.51, respectively). Physicians reported a burnout score of 3.61, nurses 4.12 ($P = 0.009$), hospital administration workers 2.99 ($P < 0.001$), and physician assistants and paramedics of 3.27 ($P = 0.611$).

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TABLE 1 Distribution of resilience traumatization and burnout scores by population subgroups and characteristics (average, *P*-value).

Category	Characteristics	Number of participants	Resilience (measured by CD)	Traumatization (measured by ProQOL)	Burnout (measured by MBI)
	Total population	655	7.17	3.13	3.59
Gender	Men (31.3%)	205	7.46**	3.06	3.75
	Women (68.7%)	445	7.03**	3.16	3.51
Age	Below 40	273	7.20	3.10	3.85*
	Over 40	324	7.25	3.10	3.35*
Religion	Jewish	549	7.22	3.01**	3.45##
	Muslim	54	7.20	3.83##	4.09
	Christian	15	6.14*	3.79	4.94*
Profession	Physician	169	7.26*	3.22	3.61*
	Nurse	210	6.85*	3.36	4.12**
	Paramedic/PA	30	8.16*	2.94	3.27
	Hospital administration	139	7.47*	2.83*	2.99*
Department	Emergency department	166	7.41**	2.93	3.56
	Internal medicine department	88	6.93	3.85*	4.29*
	ICU	34	6.58##	3.44	3.94
Infected with COVID-19	Sick	79	6.81##	3.70*	3.72
	Not sick	568	7.21	3.04*	3.57
Vaccination status	Vaccinated twice	501	7.12	3.05	3.45

*$P < 0.010$; **$P < 0.020$; ##$P < 0.050$.

TABLE 2 Cronbach alpha for resilience, traumatization, and burnout.

	Cronbach's alpha	Number of items
Resilience	0.910	10
Traumatization	0.901	10
Burnout	0.905	13

Distribution by departments revealed staff from internal medicine departments had burnout score of 4.29, ED and ICU staff scored 3.56 and 3.94, respectively ($P < 0.001$). Staff from internal medicine departments reported an average secondary traumatization score of 3.85 ($P < 0.010$), and ED staff reported an average score of 2.93. Physicians reported an average score of 3.22; nurses reported an average score of 3.36 ($P = 0.608$); and hospital administration staff reported an average traumatization score of 2.83 ($P = 0.005$). Regression models were used and presented in accompanying tables (see Table 3).

4. Discussion

The levels of stress and burnout among hospital staff grew significantly during the COVID-19 pandemic worldwide (20). We noticed differences in resilience, burnout and secondary traumatization among hospital staff, and were intrigued to reveal the influential parameters that play a role in these differences. This study was aimed to highlight how and where hospital management can intervene in similar threats and crisis in the future.

Our findings reveal that ED staff showed higher resilience compared to colleagues in internal medicine wards, while staff from the ICU had the lowest resilience. This may be explained by a relative personal and professional scope, as ED staff members choose to work and are trained in front-line positions and pre-hospital care. Our primary assumption was that ICU staff members would have a similar level of resilience to ED staff, given the similar high-intensity work environment. However, a lower level of resilience in the ICU was observed. A possible explanation can be the unique circumstances in our hospital: first, during the pandemic ICU staff was assigned both to general ICU patients but at the same time to COVID-19 patients in special "COVID-19 ICU units" at two different sites on campus, bearing a larger burden. Second, ICU workers are exposed to much higher rates of patients' death in their routine practice compared to the ED, this was amplified during the pandemic, especially given the unexpected mortality rate in young, previously healthy patients. Third, senior workers from internal medicine departments were recruited to assist the ICU team, generating a subset of workers that were "new to the job" and unfamiliar with their colleagues, resulting in a low cohesive team that expressed lower support in peers.

Indeed, following our policy to recruit internal medicine staff to assist specially designated COVID-19 wards, we observed that while these staff members were separated from their original department colleagues, it dramatically impaired their social supportive network, beyond placing additional strains

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TABLE 3 Regression model—burnout.

Dependent variable: Burnout	Unstandardized coefficients		Significance	95.0% confidence interval for B	
	B	Std. error		Lower bound	Upper bound
Constant	3.904	0.367	0.000	3.183	4.624
Emergency department	0.005	0.190	0.980	−0.370	0.379
Internal medicine	0.721	0.249	0.004	0.230	1.211
Age	−0.017	0.007	0.011	−0.031	−0.004
Gender	0.394	0.176	0.025	0.049	0.739
Religion (Muslim, as compared to Jewish)	0.391	0.309	0.206	−0.216	0.999
Religion (Christian, as compared to Jewish)	1.252	0.492	0.011	0.285	2.218
Profession (Physician, Nurse, as compared to physician)	0.590	0.205	0.004	0.187	0.994
Profession (Paramedic/PA, as compared to physician)	−0.274	0.361	0.448	−0.983	0.435
Profession (Para-medical, as compared to physician)	−0.039	0.237	0.870	−0.504	0.427
Profession (Administration, as compared to physician)	−0.251	0.242	0.300	−0.728	0.225
Infected with COVID-19	0.341	0.487	0.484	−0.616	1.297
Dependent variable: Resilience	**Unstandardized coefficients**		**Significance**	**95.0% confidence interval for B**	
	B	Std. error		Lower bound	Upper bound
Regression model—Resilience					
Constant	7.079	0.336	0.000	6.417	7.740
Emergency department	0.228	0.176	0.197	−0.119	0.575
Internal medicine	−0.130	0.233	0.578	−0.589	0.329
Age	0.003	0.006	0.685	−0.010	0.015
Gender	0.214	0.162	0.187	−0.104	0.532
Religion (Muslim, as compared to Jewish)	−0.299	0.283	0.291	−0.854	0.257
Religion (Christian, as compared to Jewish)	−0.822	0.462	0.076	−1.729	0.086
Profession (Physician, Nurse, as compared to physician)	−0.128	0.191	0.505	−0.504	0.248
Profession (Paramedic/PA, as compared to physician)	0.647	0.338	0.056	−0.018	1.312
Profession (Para-medical, as compared to physician)	−0.410	0.220	0.063	−0.843	0.023
Profession (Administration, as compared to physician)	0.444	0.220	0.044	0.012	0.877
Infected with COVID-19	−0.491	0.457	0.283	−1.388	0.407
Dependent variable: Traumatization	**Unstandardized coefficients**		**Significance**	**95.0% confidence interval for B**	
	B	Std. error		Lower bound	Upper bound
Regression model—Traumatization					
Constant	2.476	0.360	0.000	1.769	3.183
Emergency department	−0.208	0.188	0.268	−0.577	0.161
Internal medicine	0.674	0.245	0.006	0.193	1.156
Age	0.011	0.007	0.109	−0.002	0.024
Gender	−0.090	0.173	0.601	−0.430	0.249
Religion (Muslim, as compared to Jewish)	1.167	0.297	0.000	0.583	1.750
Religion (Christian, as compared to Jewish)	0.801	0.484	0.099	−0.151	1.752
Profession (Physician, Nurse, as compared to physician)	0.176	0.201	0.382	−0.220	0.573
Profession (Paramedic/PA, as compared to physician)	0.226	0.355	0.524	−0.472	0.925
Profession (Para-medical, as compared to physician)	0.034	0.233	0.884	−0.424	0.491
Profession (Administration, as compared to physician)	−0.243	0.239	0.310	−0.713	0.227
Infected with COVID-19	−0.036	0.479	0.939	−0.978	0.905

on the remained staff in internal medicine wards. Previous studies have highlighted the importance of workplace and social support systems as a leading factor in combating workplace stressors (7). During the first and second waves of the pandemic, the combination of reduced organic sustenance from familiar colleagues, and the added trauma of being involved in the care of numerous critically ill patients, was remarkable; we witnessed burnout and secondary traumatization rates significantly increased specifically in internal medicine departments. In contrast, hospital administration workers had the lowest rate of secondary traumatization, probably due to minimal patient contact.

Other indirect effects of the pandemic were that internal medicine departments had a much greater patients load during the pandemic, in addition to the fact that internal medicine departments in Israel are constantly understaffed and overloaded with complex patients. The guidelines and instructions regarding COVID-19 patients also changed as awareness and knowledge of the virus grew, and protocols evolved, augmenting complexity and stress to staff workload. The flood of studies, reports and medical advice in medical journals and public resources complicated efforts to establish precise effective protocols for staff on the wards. This lack of clarity in protocols for dealing with COVID-19 patients, increasing uncertainty and stress (11).

The rates of COVID-19 infection were significantly lower among ICU staff, not only due to exposure to a smaller load of patients, but also due to increased personal protective equipment availability and use, as well as awareness to the most sever situation of the disease, similar to the literature (35). Resilience after being personally infected by the virus was lower however those being vaccinated showed higher resilience. We may carefully assume fear of death played a role in workers that personally experienced the disease.

Though the rate of illness in the ED workers was the highest, they still maintained the uppermost resilient population. We believe this is due to the nature of work in the ED that may pre-condition staff to stressful, and the high cohesiveness of ED teams within the demanding environment, both during routine and extraordinary circumstances.

Resilience significant differed between sectors: physicians had a higher resilience compared to nurses and hospital administration workers. We believe that is due to the physicians' general medical knowledge, education, training for swift respond to emergencies and a better understanding of the emerging threat of a global pandemic. Others suggest physicians also maintain a more pronounced internal locus of control increasing confidence (18).

Burnout was reported lower by physicians compared to nurses. This can be explained as nurses spend significantly more time in direct contact and care of COVID-19 patients. Moreover, in our study nurses were more affected by COVID-19 themselves. A former study confirms that "being a nurse and female conferred great risk of acquiring trauma or stress-related disorders, depression and anxiety" (36). We found men were more resilient than women, yet we assume this may be correlated to the fact that the majority of nurses in our hospital are women. Others have pointed to "background stressors" to account for gender differences in burnout and mental stress, which includes caring for children and other dependents during the pandemic (37).

Other sectors of HCWs including physician assistants, paramedics, and administrators reported lower levels of burnout. Studies have reported that junior hospital staff generally exhibited milder stress symptoms including anxiety, depression, and insomnia compared to more experienced workers (11). This can be explained by a lower risk perception in younger staff members either to the virus, or transmitting it to friends and family, meaning a lower accountability sense. In contrast, older workers may see themselves more vulnerable due to high age, chronic medical conditions, fear from complications, or a personal elevated risk perception based on their own experience.

Finally, while analyzing socio-demographic subpopulation, we observed that males of the majority subgroup had significantly lower burnout and higher resilience compared to the minority subgroup. This can be explained by the unique feature of Israeli lifestyle: exposure to terror, the mandatory military service of Jewish men and women, as well as cultural behavioral characteristics. We assume military training and past combat experience, and high alert to terror events, may prepare our medical workers for physical, psychological and emotional challenges, their resilience and lowering traumatization.

5. Conclusion

Though Israel is accustomed to the dynamic and stressful nature inherent in national emergency situations, significant differences in responses and attitudes were detected to the COVID-19 pandemic between departments and sectors in our hospital. This was unexpected, as many Israeli HCWs have previously served in military positions themselves under Israel's mandatory military service law, thereby providing additional training and mental hardiness; essential tools in national health crises to both reduce burnout and secondary traumatization as well as improve performance.

The focused findings can be used as a platform for hospital leadership and department directors in improving staff training, preparation and acceptance in future events, and contribute to building capable effective health force, improving staff emotional health, motivation and commitment. This can also provide an opportunity to maximize staff utilization for improved overall hospital performance. The parameters who fit the profile of "resilient HCW in hazards events" may be anchors for other workers, especially young and unexperienced, during future global health crises to improve clinical patient outcomes and HCW wellbeing. Healthcare leadership can design and initiate support programs for those sectors of HCWs who have been highlighted to be most "at risk" during such challenging times. Additional longitudinal research is needed to assess resilience over time.

6. Limitations

This study has several limitations. Firstly, a small sample of medical staff from a single hospital answered the survey. It is important to note however, that the hospital where this study took place is, for the purpose of this study, a microcosm of the diverse country at large. The heterogeneous workforce includes representatives of Israel's large religious groups, including Jews, Muslims, Christians and Druze, as well as multiple nationalities in similar percentages as those groups are represented in the country. As such, this study has a higher external validity than what would otherwise be expected.

As was mentioned in the study, Israel has a mandatory military service, unlike most other large Western democracies. This variable may have impacted the outcome of this study, specifically traumatization and resilience. Many studies have highlighted the effects of living in Israel with trauma and resilience (38).

Finally, the study also had a lower-than-expected participation rate in spite of our efforts to recruit higher numbers.

Data availability statement

The datasets presented in this article are not readily available because data can be made available upon request to the corresponding author and in accordance with Israeli public health and privacy laws. Requests to access the datasets should be directed to AC, ayaco@shamir.gov.il.

Ethics statement

The studies involving human participants were reviewed and approved by Shamir Medical Center's Helsinki Committee. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

DT was involved with conceptualization, data curation, formal analysis, investigation, methodology, supervision, visualization, drafting the manuscript, and reviewing and editing the manuscript. UA was involved with conceptualization, data curation, formal analysis, investigation, methodology, project administration, visualization, drafting the manuscript, and reviewing and editing the manuscript. JM was involved with drafting the manuscript and reviewing and editing the manuscript. NC was involved with data curation and reviewing and editing the manuscript. GT was involved with conceptualization, methodology, and reviewing and editing the manuscript. AC was involved with project administration. GP was involved with visualization and reviewing and editing the manuscript. MA and OL-K was involved with supervision, visualization, and reviewing and editing the manuscript. OT was involved with supervision, visualization, drafting the manuscript, and reviewing and editing the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

Publisher's note

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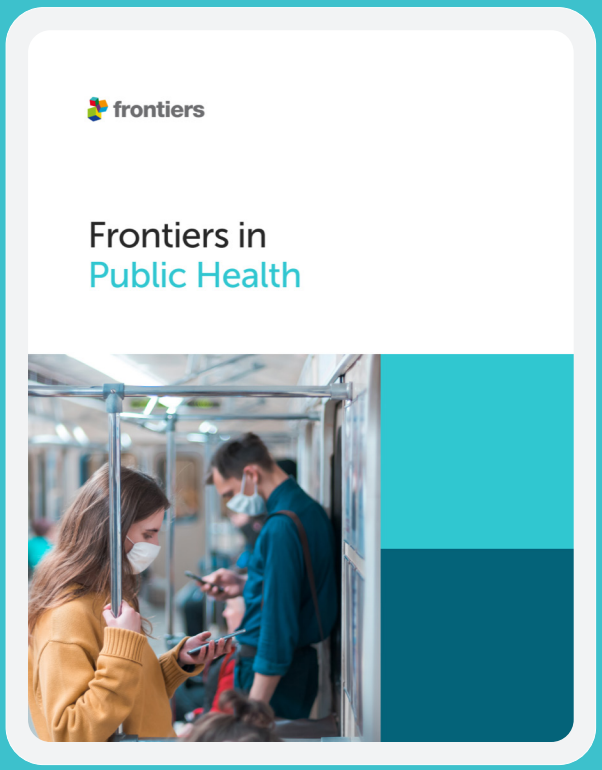

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