OCCUPATIONAL RISKS OF HEALTHCARE PERSONNEL

EDITED BY: Helena C. Maltezou, Caterina Ledda, Venerando Rapisarda and Begoña Martínez Jarreta

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OCCUPATIONAL RISKS OF HEALTHCARE PERSONNEL

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Table of Contents

Editorial: Occupational risks of healthcare personnel

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Editorial on the Research Topic
Occupational risks of healthcare personnel

Healthcare personnel (HCP), and especially those working in front-line roles, are at increased risk for occupational exposure to a variety of infections, including vaccine-preventable diseases (1). At the same time, HCP are exposed not only to environmental risks (e.g., biological, physical, and chemical risks) but also to psychological stress, which was exceptionally intensified during the coronavirus disease 2019 (COVID-19) pandemic. As such, ensuring safety within healthcare facilities and creating health-promoting workplaces is becoming increasingly relevant in a globalizing workplace (2).

It was an honor for us and a challenge at the same time to accept an invitation by *Frontiers in Public Health* and serve as Topic Editors for the Research Topic: "*Occupational risks of healthcare personnel.*" The aim of this Research Topic was to provide an overview of occupational risks of exposure and illness among HCP in the context of the COVID-19 pandemic, covering a wide range of occupational risks, from vaccine-preventable diseases to psychological issues and violence which has increased dramatically the past years.

Trevisan et al. studied a cohort of 11,022 students of a medical school in Italy and found excellent vaccination compliance, high seropositivity, and high antibody titers against rubella. This study highlights the importance of high vaccination coverage rates and immunity levels among healthcare students before joining the healthcare workforce. Yet, vaccine hesitancy has been recognized by the World Health Organization as a top threat to global health (3). Despite the deployment of mRNA COVID-19 vaccines <1 year after the declaration of the COVID-19 pandemic, vaccine hesitancy emerged as a major public health obstacle for the global efforts to control the pandemic and speed the return to normality. Particularly for HCP, COVID-19 vaccination significantly reduces their COVID-19-associated morbidity but also episodes and duration of absenteeism during periods of excess healthcare demand (4). A cross-sectional study conducted in May 2021 by Iguacel et al. showed high levels of negative attitudes toward vaccines

in up to 22.6% of participants, yet only 1.5% of them refused to get the COVID-19 vaccine. Notably, HCP did not show higher rates of positive attitudes toward vaccines compared with non-HCP while they showed higher rates of vaccination refusal, which is of concern. In addition, Gopalakrishnan et al. reported gaps in infection control training for HCP and fear to provide healthcare to COVID-19 patients in hospitals in India, despite the fact that most HCP had adequate knowledge about COVID-19 and practiced safety precautions adequately, which should be addressed.

The present Research Topic has also covered many topics related to the mental health of HCP during the COVID-19 pandemic. Resilience is a major topic: Afshari et al., Goff et al., and Gillie et al. identified psychosocial and demographic predictive factors that may contribute to greater resilience among HCP during the COVID-19 pandemic. The findings of the abovementioned studies can be used to implement psychosocial interventions, in particular for front-line HCP.

Another issue is violence in the healthcare workplace. Pina et al. and Ma et al. investigated on the identification of sources of conflict and causes of violence in hospital and indicate that frontline HCP urgently need relevant parties to take effective measures in terms of legislation, security, and dispute handling capacity, to prevent the occurrence of violence and protect medical personnel's safety.

Emphasis was also placed on the impact of burnout on HCP. Song et al., Xiao et al., and Ahmed et al. analyzed the role of burnout as a mediating factor between the three types of emotional labor strategies and presenteeism among HCP. The results suggested that interventions should be enhanced in vulnerable groups to reduce burnout and promote wellbeing.

Mental health disorders were studied by Salgado de Snyder et al., Wang et al., and Riedel et al. These research groups analyzed occupational and personal stressors, mental health indicators, perceived discrimination, and help-seeking behaviors among HCP.

In addition, Yuan et al. investigated the characteristics of neck-shoulder pain (NSP) among HCP and highlighted that concern from supervisors about workers' health, and the ability of workers to change their shift status to off duty when they were not feeling well was shown to induce significant effects to NSP. This shows that effective employee involvement can mitigate risks in the workplace. A similar approach carried out by Secosan et al. studied the frontline HCP's positive psychological state—PsyCap—impacts on anxiety/depression and burnout/mental health complaints. PsyCap is a crucial variable that may decrease the impact of anxiety and depression on psychological outcomes such as emotional exhaustion, inefficacy, and psychological problems among Romanian medical professionals working on the frontline during the COVID-19 pandemic. Thus, psychological interventions that help medical staff gain personal resources are appropriate in the context of the COVID-19 pandemic.

Stress among HCP during the COVID-19 pandemic was investigated by Ali et al. and Sun et al. These studies recommend that constructive planning and necessary provision of supportive measures by the legal authorities and policymakers protect nurses and minimize their psychological stress to fulfill high-quality nursing care. Sleep disorders were studied by Li et al. The latter investigation associated shift work-sleep disorder with scheduling strategies and personal behavior during the COVID-19 pandemic. Santoro et al. contributed to evidence the dermatological effects among HCP during the COVID-19 pandemic and indicated the development of prevention strategies in the workplace in order to improve the wellbeing of HCP and reduce the impact of dermatological adverse reactions to personal protective equipment. Wang and Yang investigated the influence of professional identity on E-Learning adaptability among Chinese nursing students during COVID-19. Lastly, Isonne et al. highlighted several challenging areas and critical issues relating to working conditions. Job satisfaction plays an important role in healthcare organization and management; it is critical for maintaining and improving staff efficiency and consequently the quality of care provided.

Conclusions

It is indisputable that appropriate health and safety management in the healthcare sector is essential to providing quality care to patients; likewise, HCP are exposed to a wide range of risks in their workplaces that require adequate preventive measures.

However, the COVID-19 pandemic has highlighted, as never before, the weaknesses and shortcomings of occupational risk prevention in the healthcare sector. Adding to that, it has made visible key issues such as the vaccination of HCP, the mandatory vaccination policies, the psychosocial risks derived from the health emergency (stress caused by work pressure, the risk of contagion, and the lack of means to protect their health and that of others, the fact of facing an unknown agent or suffering aggressive behavior from patients, etc.). All of them have become main concerns during the pandemic, as it is clearly reflected in this Research Topic, and are amenable to deep reflection.

The COVID-19 pandemic has shown that adequate protection of HCP from exposure to risks at work is still suboptimal and their improvement must be considered a priority also in the event of a sanitary crisis.

This Research Topic brings together works that contribute to increasing the scientific evidence on the occupational risks of HCP and promote cogitation for the present and future challenges in this field, including preparedness to face new emergencies and preventive measures to implement.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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

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Psychosocial Factors Associated With Resilience Among Iranian Nurses During COVID-19 Outbreak

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Background: In the face of COVID-19, healthcare workers need to cope with the ongoing stressors at play and keep psychological distress at a minimum level. This study examined the psychosocial and demographic factors associated with nurse's resilience in the hospitals of Ahvaz that is one of the top cities infected with COVID-19 in Iran.

Methods: The present cross-sectional study was conducted on 387 Iranian nurses in Ahvaz city. For data collection purposes, three online questionnaires (including Copenhagen Psychosocial, Demographic, and Connor–Davidson Resilience Scale) were distributed among the participants.

Results: The mean resilience score was equal to 61.8 ± 14.8 for 387 nurses. Resilience had a statistically significant negative correlation with quantitative demand ($r = -0.273$, $P < 0.008$), work pace ($r = -0.262$, $P < 0.011$), emotional demand ($r = -0.226$, $P < 0.030$), stress ($r = -0.458$, $P < 0.000$), and burnout ($r = -0.287$, $P < 0.005$). Multiple linear regression analysis indicated that stress, job satisfaction, burnout and age were the main predictors of nurses' resilience during the (COVID-19) pandemic ($R^2 = 0.45$).

Conclusions: We identified psychosocial and demographic predictive factors that may contribute to greater resilience among nurses during the COVID-19 outbreak. The findings of this study can be used to implement psychosocial interventions to amplify the resilience of medical staff during the COVID-19 outbreak.

Keywords: psychosocial, stress, nurses' resilience, COVID-19, healthcare workers

INTRODUCTION

Coronavirus disease (COVID-19) was first reported in Wuhan, China, in late December 2019 (1). The new coronavirus, the agent creating COVID-19 disease, is mostly transmitted via respiratory droplets by patients. Occupational exposure is one way through which the disease may be contracted and, thereby, many people are at risk of catching this disease due to their job nature. In this respect, nurses are at the frontline of controlling and treating this disease. Since this disease is highly contagious, nurses are more exposed to the risk of this disease. Hence, it can be argued that nursing is one of the high-risk occupations during the COVID-19 pandemic (2). According to recent studies, healthcare workers are more than 7-fold higher at risk of severe COVID-19 and be vectors of transmission.

In Iran, the first definitive disease infection case was reported on February 19, 2020. Within 10 days from the report of the first COVID-19 death case in Iran, this disease spread to 19 provinces

out of the 31 provinces of the country (3). The epidemiological studies conducted from January 30 to March 27, 2020, one of the hospitals in Tehran showed that 12,870 patients have been referred to the emergency ward of the hospital, out of whom 2,968 have been hospitalized with the diagnosis of COVID-19 (4). In a short time after being announced pandemic, many provinces in Iran reported healthcare services saturation because of severe care needs. In many provinces, the high rate of prevalence and mortality for the disease created a serious crisis (5).

The process of spreading this disease has been on the rise in Iran since its inception. Due to the lack of healthcare workers (especially nurses), personal protective equipment (PPE) and the prolonged use of PPE, high rates of physical and mental workload have been reported among the medical personnel during the COVID-19 pandemic (6). In addition to the high physical workload of healthcare workers, psychosocial risk factors, including a wide range of variables can influence their health, safety, and welfare. Such factors are widely in interaction with each other at the individual, collective, and organizational levels in a multidimensional manner. Therefore, considering the current situation resulting from this pandemic, healthcare workers are exposed to depression, anxiety, insomnia, and distress. In this regard, several cross-sectional studies have reported the prevalence of depression and anxiety symptoms among Chinese people during the COVID-19 pandemic (7–9).

In the face of COVID-19, one needs to cope with the ongoing stressors at play and keep psychological distress at a minimum level. When nurses work in such critical conditions and also experience high levels of stress and fatigue, resilience is the key factor that can help them cope with these conditions (10). Resilience assists people to return to the previous state or adapt successfully despite the existence of adverse conditions. This concept has been referred to as a multidimensional feature that helps a person successfully tackle the challenges ahead and enhances protection against stressful situations (11). Thus, the dominance of resilience among healthcare workers is important because measures of greater resilience have previously been connected to the lower levels of psychological and emotional distress and reduced adverse effects of stress on health-related life quality in different groups (12–15). Previous research findings strongly support the importance of resilience in the quality of working life in nurses (12); however, little is known about the factors associated with resilience in this population, especially during the COVID-19 pandemic. When different groups of employees and workers have information about the factors associated with resilience, they may know how to identify the possible methods of resilience promotion. This can be at play especially in the case of healthcare workers during the COVID-19 pandemic. According to psychologists, factors such as personality traits, family ties, and social systems amplify resilience (10).

This study attempts to provide nurses with a better perception of mental health by gathering data on resilience. To this end, a survey involving self–administered questionnaires was conducted to recognize a range of likely demographic and psychosocial factors associated with the higher or lower levels of resilience during the COVID-19 pandemic. The results of this study are expected to contribute to the identification of effective factors in enhancing resilience level among nurses and to the selection of appropriate strategies to manage the stress of dealing with the COVID-19 pandemic by hospital managers.

METHOD

Participants

In the present cross-sectional study, nurses who worked in hospitals affiliated to the University of Medical Sciences, Khuzestan province, Iran, were invited to participate in the research process. The qualified nurses were selected by census sampling from hospitals, from April to May 2020. There are 18 hospitals in the city of Ahvaz, of which, nine hospitals are affiliated to the university of Ahvaz medical science. Of these nine hospitals, four hospitals were designated as referral centers for patients with COVID-19.

The eligible nurses were selected by census sampling based on the inclusion criteria. The inclusion criteria were as follows: (a) having more than 1 year of clinical work experience (b) clinical work experience with patients with COVID-19 for more than 2 months. Since this study has been conducted during the COVID-19 pandemic, the questionnaires were made and sent to nurses online for data collection in order to reduce contact and face-to-face communication. All participating nurses signed a written informed consent form before participation, confirmed by the Ethics Review Committee of Ahvaz Jundishapur University of Medical Sciences (reference number IR.AJUMS.REC.1399.704).

Survey Measures
Demographic Questionnaire
The participants provided detailed information on a range of demographic items, including their age, gender, marital status, number of children, work experience, and education.

Connor–Davidson Resilience Scale (CD-RISC)
Resilience was assessed using the Connor–Davidson Resilience Scale (CD-RISC). CD-RISC Scale contains twenty-five items that are graded based on a Likert scale from not true at all (0) to true nearly all of the time (4). Thus, the questionnaire score ranges from 0 (lower degree of resilience) to 100 (greater degree of resilience). Resilience is determined by a CD-RISC score higher than 80. In this regard, Connor and Davidson have documented the Cronbach's alpha coefficient of the Resilience Scale to be 0.89. Moreover, for this scale, the reliability coefficient of 0.87 has been reported (16, 17). The reliability of this scale in Iran has also been assessed and the Cronbach's alpha coefficient of 0.89 has been reported for it (18).

Copenhagen Psychosocial Questionnaire (COPSOQ)
The second version of the Copenhagen Psychosocial Questionnaire was used to evaluate the psychosocial risk factors in this study. This questionnaire is one of the most comprehensive standard questionnaires that cover a wide range of psychological factors. Each scale is analyzed within the range of 0 to 100 where zero indicates the minimum degree of risk and 100 represents the maximum risk. The respondents to the COPSOQ are asked to respond to the questions using items on a

5-point scale, most of which are as A = Always, B = Often, C = Some, times, D = Seldom, and E = Never/Hardly or as A = To a very large extent, B = To a large extent, C = Somewhat, D = To a small extent, and E = To a very small extent. Based on the subjects' ratings, each item (scores A to E) scored 0, 25, 75, and 100, respectively, and the average score of the items on each of the factors determined the score of that factor. A lower rating for each of the factors indicates better and ergonomic psychosocial conditions of the work environment (19, 20). The reliability and validity of the Persian version of this questionnaire have been determined through Cronbach's alpha and the values of 0.75 and 0.89 have been reported for them (21).

Statistical Analyses

Kolmogorov–Smirnov statistical test was run to examine the normality of data distribution. The results showed that all data had a normal distribution; thus, differences in resilience scores between demographic characteristics with healthcare workers were assessed using the independent-samples t- test and one-way ANOVA. Pearson correlation test was also used to examine the associations of resilience with demographic and psychosocial variables. Then, the factors influencing resilience were carried out using multiple linear regression.

RESULTS

Demographic Information

Out of the 699 questionnaires sent online, 387 questionnaires were filled out, which is representative of the return rate of 55%. The demographic information of the participants is given in **Table 1**.

Psychosocial Factors

Psychosocial factors were investigated using COPSOQ. The results showed that quantitative demand, emotional demand,

quality of leadership, work-family conflict, burnout, stress, and job satisfaction were the psychosocial factors with high scores. It was also revealed that the lowest mean score belonged to the role clarity (**Table 2**).

Resilience

The mean score of 61 was determined for CD-RISC. It was also found that twelve percent of the study population had a high level of resilience (CD-RISC score > 80).

As shown in **Table 3**, participants with master's degree education had the highest resilience score in the study and there was a significant difference between participants with various levels of education in terms of resilience ($P = 0.03$). Based on the statistical analyses, a significant difference was observed between the female and male subjects with regards to the mean of resilience ($P = 0.03$). In this regard, the women had less resilience than men. Regarding work experience, people with more work experience had higher resilience and the difference in resilience was significant ($P = 0.01$) between various groups of work experience. Statistical analyses also showed that resilience is significantly different in various age groups ($P = 0.04$) and it increases with the increase of age.

Factors Associated With Resilience
Correlation Analysis

To investigate the correlation of resilience with psychological and demographic variables in the study participants, the Pearson correlation test was run. The results of this analysis are shown in **Table 4**.

The psychosocial factors were significantly correlated with resilience in three domains including, interpersonal relation and

TABLE 1 | Demographic information of the study participants ($N = 387$).

Variable	Mean (SD)
Age (years)	34.42 ± 8.35
Work experience (years)	8.31 ± 3.74
Gender	n (%)
Female	236 (61)
Male	151 (39)
Marital status	n (%)
Single	199 (51.4)
Married	188 (48.6)
Education level	n (%)
Associate degree	47 (12.1)
Bachelor degree	198 (51.2)
Master degree	142 (36.7)
Parent status	n (%)
Childless	168 (43.4)
With child	219 (56.6)

TABLE 2 | Mean and Standard deviations of COPSOQ dimensions ($N = 387$).

Dimension	Mean	± SD
Quantitative demand	62.3	20.7
Work pace	45.2	19.4
Emotional demand	65.9	23.5
Influence	39.8	19.8
Possibilities for development	44.7	21.5
Meaning of work	29.8	20.9
Commitment to the workplace	31.6	23.8
Predictability	48.2	21.6
Recognition (reward)	34.4	20.2
Role clarity	28.3	19.1
Quality of leadership	61.5	23.3
Social support from supervisor	44.1	19.9
Job satisfaction	67.6	20.8
Work family conflict	74.9	22.5
Trust regarding management	30.1	18.6
Justice	31.3	29.9
General health	50.2	25.2
Burnout	58.5	19.3
Stress	65.4	25.3

TABLE 3 | Comparison between demographic variables and the CD-RISC scores ($N = 387$).

Variable	Connor–davidson resilience scale (CD-RISC) score	P-value
Age groups (year)		
23–30	59.54 (15.15)	0.04**
30–37	60.44 (14.71)	
37–44	63.22 (13.24)	
44–51	67.35 (14.24)	
Work experience groups (year)		
1–5	53.29 (15.1)	0.01**
5–10	60.12 (15.26)	
10–15	61.27 (8.3)	
15–20	67.73 (13.4)	
Gender		
Female	59.53 (14.9)	0.03*
Male	62.36 (14.46)	
Marital status		
Single	62.01 (13.7)	0.34*
Married	60.5 (15.73)	
Education level		
Associate degree	60.02 (12.6)	0.03**
Bachelor degree	61.67 (15.3)	
Master degree	63.23 (13.42)	
Parent status		
Childless	62.339 (13.4)	0.66*
With child	60.36 (14.1)	

independent t-test.
**One-way ANOVA.*

TABLE 4 | Correlation between resilience and the psychosocial and demographic factors ($N = 387$).

Factors	r	P-value
Demand at work		
Quantitative demand	−0.273	0.008
Work pace	−0.262	0.011
Emotional demand	−0.226	0.030
Interpersonal relation and leadership		
Quality of leadership	0.219	0.036
Work individual interface		
Job satisfaction	0.417	0.000
Health and well-being		
General health	0.301	0.004
Burnout	−0.287	0.005
Stress	−0.458	0.000
Demographic		
Age	0.304	0.003
Education	0.210	0.044
Work experience	0.226	0.030

TABLE 5 | Multiple linear regression model for resilience.

	B	S.E	β	P-value
Coefficient	43.813	7.320		
Stress	−0.244	0.038	−0.528	0.000
Job satisfaction	0.191	0.065	0.234	0.004
Burnout	−0.049	0.028	−0.143	0.045
Age	1.544	0.859	0.144	0.076

R = 0.671; R^2 = 0.450; Adjusted R^2 = 0.425.

leadership, and work individual interface and health and well-being. As shown in **Table 4**, resilience had a positive correlation with the quality of leadership, job satisfaction, and general health. Therefore, resilience can be enhanced by improving the quality of leadership and job satisfaction and by reducing the quantitative and emotional demands of the job.

As shown in **Table 4**, those dimensions that had a statistically significant negative correlation with resilience included quantitative demand, work pace, emotional demand, stress, and burnout. This means that resilience is reduced with the increase of quantitative demand, work pace, emotional demand, stress, and burnout.

The results of correlation analysis demonstrated that age, an education level, and work experience were the demographic factors that had a statistically positive correlation with resilience.

Multiple Linear Regression Analysis
In order to investigate factors affecting resilience, a multiple linear regression analysis was run. The results of this test showed that stress ($β = −0.528$, $P < 0.000$), job satisfaction ($β = 0.234$, $P < 0.004$), burnout ($β = −0.143$, $P < 0.045$), and age ($β = 0.144$, $P < 0.042$) were the psychosocial and demographic factors predicting resilience. According to the coefficient of

determination (R^2), 45% of the resilience could be explained by these variables. The regression model has been presented in **Table 5**.

DISCUSSION

In this study, several demographic and psychosocial factors involved with resilience among nurses during the COVID-19 pandemic were assessed. The most significant finding of this study was that resilience was related to stress, age, job satisfaction, and burnout.

Demographic Factors and Resilience
The results of this study showed that the mean level of resilience in nurses was 61 during the COVID-19 pandemic, which was lower than that of medical staff who work in Radiology Departments (22). Also, the study carried out by Lin et al. on non-native nurses in Wuhan showed that the mean and standard deviation of nurses' resilience in COVID-19 pandemic conditions were equal to $64.86 ± 13.46$ (23).

The present study indicated that the nurses' resilience level during the outbreak of COVID-19 was relatively low. Considering the multidimensional nature of resilience, it seems

that various factors, including different work environment conditions and existing psychosocial risk factors due to the prevalence of COVID-19 disease have influenced the mean score of nurses' resilience. Therefore, such issues have resulted in a decline in resilience among the nurses.

In terms of resilience in groups with various work experiences, age groups, and education levels, the current findings showed that resilience has experienced an increase with the increase of work experience, age, and education level. Resilience had a significant positive correlation with age, the level of education, and work experience. In this regard, Gillespie et al. assessed the degree of resilience among operating room nurses and reported that nurses' resilience increases with the increase in their experience and education level (24). Similarly, Ang et al. also showed that age and education degree have a significant correlation with resilience. There was a strong association between the highest educational degree and resilience level, and nurses with a bachelor or master's degree had moderate/high resilience three times as much as nurses with only a general nursing certificate (25). Similarly, the results of the study done by Hsieh et al. also maintained that education level is significantly correlated with resilience (26).

The increase of nurses' age, education, and work experience may lead to the progress of their skills with exposure to stress and the development of their abilities to cope with stressful and critical conditions. The progress of such skills helps with the development of different coping strategies, which can simplify their adaptation and provide them with the facility to act usefully and more resiliently in such conditions. Therefore, for increasing resilience in the medical personnel with a lower level of work experience and education, it is strongly recommended to provide them with the relevant training that can enhance their science and experiences in COVID-19 management and coping.

A previous study showed that resilience in female personnel was significantly lower than that in male personnel. The study carried out by Dai et al. showed that a significant difference between male and female medical personnel in terms of the degree of concern about the development of infection among their family members during the COVID-19 pandemic (27). The reason may be attributable to the natural differences between the males and females in their perspectives and methods of looking at critical situations. Women are more sensitive and their anti-stress capability is also relatively weak and, thereby, they suffer from a sense of insufficiency for psychological compatibility. Therefore, more attention and psychosocial support should be assigned to female nurses.

The groups with different marital statuses were not significantly different in terms of resilience. However, the nurses without any children had a higher level of resilience. In fact, the sense of responsibility to the family members is believed to play a significant role in decreasing nurses' resilience during the COVID-19 pandemic. This finding is similar to the results of a study reported by Hsieh et al. (26). The results of a study by Guo et al. also showed that marital status was not associated with resilience (14).

Psychosocial Factors Associated With Resilience

The most important psychosocial risk factors identified in the current study included work-family conflict, stress, emotional needs, burnout, job satisfaction, and the quality of leadership. In the same vein, Fathi et al. also showed that emotional needs, stress, depression, and anxiety are among the challenges that the healthcare workers might face during the COVID-19 pandemic (28). The results of a similar study conducted by Freimann T & Merisalu demonstrated that work-related psychosocial factors, including quantitative demands, emotional needs, work speed, and role conflict are related to nurses' mental health and these psychosocial factors can produce stress and job burnout among nurses (29). In addition, the results of this study showed that quantitative demand, work pace, emotional demand, stress, and burnout were negatively correlated with resilience in such a way that the increase in the identified negative factors would cause a reduction in resilience among individuals.

Hernandez et al. assessed resilience among medical technicians and reported that resilience has a negative correlation with stress (30). In this regard, prior studies have found that stress, burnout, and fatigue are negatively associated with resilience (11, 31–33). Thus, to increase resilience among nurses, one needs to consider these psychological factors, especially when being involved in a stressful situation arising from unknown diseases.

Work-family conflict was recognized as one of the most important psychosocial risk factors in the present study. In this line, the results of a qualitative study on healthcare workers in Iran showed that conflict with family members is one of the important psychosocial factors for healthcare workers in the COVID-19 pandemic where the majority of families have opposed the presence of healthcare workers at their workplace (28). The results of other studies on psychological factors in the H1N1 pandemic have also suggested that the greatest concern of the healthcare workers was the possible infection of their family members and friends and the health consequences of the disease. This process has led to work-family conflict (34, 35). Thus, training the families and provision of social support in critical conditions can moderate work-family conflict as a psychosocial risk factor affecting resilience.

Another important result of this study was the significant and positive correlation between the quality of leadership and resilience in nurses. The managers of hospitals and wards can exert an important role in providing the necessary conditions for nurses to improve the level of resilience. For example, hospital administrators could implement a training intervention that provides medical personnel with information about the condition of the pandemic exposure and prevention of infectious diseases. These measures may decrease the harmful stress-related effects of exposure to covid-19, thereby, improving their resilience.

A large number of patients, long working hours, and the definition of new roles for nurses in the COVID-19 pandemic conditions lead to an increase in the quantitative and qualitative demands at work that require accurate management and social support. Wang et al. have also emphasized that social supports

are related to nurses' resilience (36). Thus, understanding the importance of this issue by managers and improving the quality of management and social support help with the improvement of nurses' resilience. The results of the current study showed that job satisfaction and general health were positively correlated with resilience. Similarly, other related studies have indicated the presence of a significant positive relationship between job satisfaction and resilience (37–39).

In the present study, the results of regression analysis on psychosocial and demographic factors showed that job satisfaction, stress, job burnout, and age have an important role in predicting nurses' resilience level in the COVID-19 pandemic. Indeed, nurses' resilience is negatively associated with job demand, including stress and burnout. These findings emphasize the importance of psychosocial factors in nurse resilience, especially in the COVID-19 pandemic. Therefore, identifying and modifying the factors affecting nurses' resilience in stressful conditions such as pandemics can lead to an increase in resilience. In general, the current findings represent that resilience in nurses can be strongly influenced and maintained by suitable organizational strategies and preventive planning during the prevalence of COVID-19.

Limitations

In this study, only healthcare workers were assessed. Due to the location and time limitations, this study surveyed only end-point resilience among nurses. Future studies are therefore suggested to employ a longitudinal design study to determine the changes in resilience during the covid-19 pandemic.

CONCLUSION

Our paper is the first study that examines the resilience levels of nurses during the outbreak of COVID-19 by exploring associations between resilience and psychosocial factors highlighting important associated risk factors to propose suggestions for amplifying resilience of medical staff during the COVID-19 outbreak. The results of the present study showed that the resilience level of nurses during the outbreak of COVID-19 was low. Thus, the identification of the factors affecting resilience in pandemic conditions and the adoption of related corrective measures are regarded as effective steps to support nurses at the frontline of the fight against this disease. Based

on the results of the study, the psychological and demographic predictive factors on resilience, including stress, job satisfaction, burnout, and age should be considered to boost nurses' resilience. In addition, more attention should be paid to other variables that may influence resilience, including education level, work experience, quantitative demand, work pace, emotional demand, quality of leadership, and general health. In general, the findings of this study indicate that the resilience of nurses can be heavily influenced and maintained by the establishment of proper organizational strategies and pre-emptive planning during the outbreak of COVID-19. The information of this study can be used to implement psychosocial interventions to amplify the resilience level of medical staff during the COVID-19 outbreak.

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 IR.AJUMS.REC.1399.704. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors made contributions to the study conception and design, made contributions to the interpretation of data. In addition, they also contributed to the drafting and revision of the article as well as approval and, submission of the final version.

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Corrigendum: Psychosocial Factors Associated With Resilience Among Iranian Nurses During COVID-19 Outbreak

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Author Maryam Nourollahi-darabad was accidently place as second author in the published article rather the first author. The updated author list appears below:

Maryam Nourollahi-darabad, Davood Afshari* and Niloofar Chinisaz

The authors apologize for this error and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

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Rubella Serosurvey Among Future Healthcare Workers

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Objective: Rubella is a very diffusive but relatively benign infectious disease unless contracted during pregnancy, when it causes congenital rubella syndrome. The aim of this research was to determine the prevalence and titer of antirubella antibodies in a population of future healthcare workers (students at the school of medicine).

Methods: The cohort consisted of 11,022 students who underwent antibody analysis after the presentation of a vaccine certificate.

Results: Vaccination compliance was very high, particularly in younger students (born after 1995), reaching almost 100% (at least one dose). Unvaccinated students born before 1990 had high seropositivity (>95%), but this percentage dropped to zero among the youngest students. Variables affecting antibody titer included year of birth and sex. Considering only vaccinated students, a greater antibody response was observed if the vaccine was administered between 8 and 10 years of age. Female sex was associated with more significant ($p < 0.0001$) positivity and higher antibody titer after one and two doses. However, this difference appeared less consistent in relation to year of birth.

Conclusions: The studied population exhibited excellent vaccination compliance, high seropositivity, and high antibody titer. Vaccine and immune coverage were higher than what is deemed necessary to achieve herd immunity.

Keywords: rubella, rubella vaccine, rubella antibodies, medical students, healthcare workers

INTRODUCTION

Rubella is an acute viral infection caused by an RNA togavirus (genus *Rubivirus*). A high percentage of rubella infections in both children and adults are subclinical, but rubella during pregnancy is associated with potentially serious complications for the fetus due to congenital rubella syndrome (CRS).

Since 1999, the Italian Board of Health has encouraged the measles, mumps, and rubella (MMR) vaccine, and a mass vaccination campaign was launched (1), even though the single rubella vaccine has been available since 1972. The rubella vaccine was actively offered to adolescent women during primary or secondary school from 1972 to the cohort 1988–1989. Notwithstanding the high percentage of immunity (acquired *via* disease or vaccination), relatively low compliance with vaccination is why rubella has continued to circulate in Italy and CRS still occurs (2). Fortunately, however, between 2005 and February 2018, only 88 cases of CRS were registered in Italy, and only 173 cases of rubella disease during pregnancy were reported (3).

In 2017, Italy approved the National Plan for Eradication of Measles and Congenital Rubella (4), according to the objectives of World Health Organization (WHO) 2012–2020 (5). Furthermore, according to the law established in 2017, the rubella vaccine (as MMR) is mandatory in Italy (6).

Moreover, the "National Vaccination Prevention Plan" 2017–2019 (4) recommends that healthcare workers (HCWs) be vaccinated against seven transmissible diseases, including rubella. Rubella immunity induced by vaccination appears to be persistent; therefore, routine booster immunizations do not seem to be necessary (7). However, a second immunization program should be considered to achieve high antibody-positivity rates and protect against primary vaccination failure. Several reports suggest that one dose can produce lifelong immunity (8) and that the vaccine induces a long-lasting antibody response of up to 21 years (9). The vaccination program carried out in Finland also eliminated CRS from that country (10).

The aim of this research was to evaluate the compliance with rubella vaccination, the percentage of seropositivity, and antibody titer according to the vaccination schedules (one or two doses) in a cohort of future HCWs recruited from a population of medical school students.

METHODS

Population

A cohort of 11,022 students enrolled at the School of Medicine of the University of Padua (Italy) were recruited (2004–2020) according to the following inclusion criteria: (1) born in Italy and therefore possessing uniform vaccination cards, (2) able to present a recent vaccination certificate issued by the Public Health Office, and (3) have a quantitative assay of antibodies against rubella.

The study involved 3,759 males (34.1%) and 7,263 females (65.9%) enrolled in medical and surgical degree courses (4,922, 44.7%), dentistry (334, 3.0%), and health professions (5,766, 52.3%). Geographically, most students originated from Northern Italy (93.6%), particularly the Veneto region (85.6%). Data were collected during health surveillance in compliance with legislative decree 81/08 and European Community Directive 90/679.

Antibody Measurement

Antirubella IgG antibody titer was measured using the EIA Enzygnost method (Dade Behring, Marburg, Germany), and the results are reported as positive (>10 IU/mL), negative (<4 IU/mL), or equivocal (4–10 IU/mL). Antibody levels were examined in relation to history of disease, vaccination, or both. Equivocal results were statistically processed as negative according to Centers for Disease Control and Prevention (CDC) recommendations (11).

Statistics

The 2×2 chi-square (χ^2) test (Yates correction) was used to compare the differences in the prevalence of positive antibodies. Comparisons between means were made using the unpaired t-test (assuming unequal variances). The linear regression coefficient r (Pearson's product–moment correlation coefficient) was calculated to correlate single independent variables with rubella antibody titer. Multiple linear regression analysis was employed to identify the variables affecting antibody level (dependent variable), such as (independent variables) sex, year of birth, and the number of vaccine doses received (none, one, or two). In all regression analyses (linear and multiple), the antibody titer data were $\log_{10}$-transformed due to the asymmetric distribution. Furthermore, 7 year-of-birth groups were established: before 1960, between 1961 and 1969, 1970 and 1979, 1980 and 1985, 1986 and 1990, 1991 and 1995, and after 1995. Other statistical analyses were descriptive. Significance is stated as $p < 0.05$. Statsdirect version 2.7.7 (Statsdirect Ltd., Birkenhead, Merseyside, UK) was used for statistical analyses.

RESULTS

Compliance with rubella vaccination began to increase in subjects born in the decade 1970–1979, almost exclusively for women, who reached ~50% vaccination coverage (one dose). In subsequent years, a progressive increase in vaccination
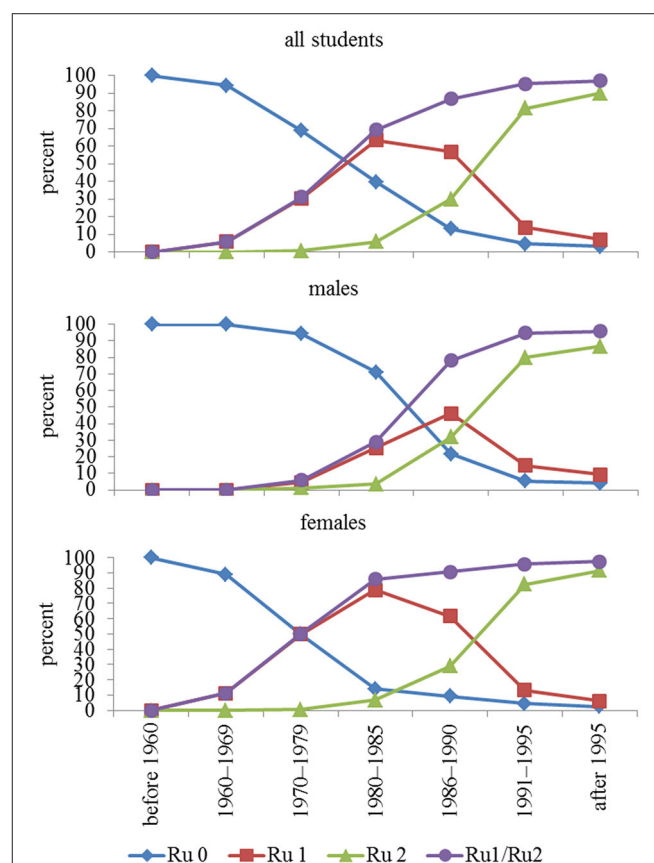
FIGURE 1 | Compliance with rubella vaccination in relation to year-of-birth group. In addition to no vaccination, one dose, and two doses, a fourth option is receiving the vaccine (regardless of whether one or two doses). Ru = rubella, Ru 0 = unvaccinated, Ru 1 = one dose, Ru 2 = two doses, Ru1/Ru2 = vaccinated once and twice considered together.

TABLE 1 | Seropositivity and antibody titer in unvaccinated students and students vaccinated with one or two doses.

| | | | | | Titer IU/mL | | Time* |
No vaccine	N	Positives	%	p	Mean ± SD	p	Years
All	1,404	1,218	86.8		129.8 ± 106.1		
Males	792	698	88.1		136.7 ± 109.8		
Females	612	520	85.0	n.s.	120.8 ± 100.5	0.0048	
One dose							
All	3,236	3,157	97.6		105.4 ± 83.9		13.8 ± 5.1
Males	776	735	94.7		82.1 ± 80.0		15.7 ± 5.3
Females	2,460	2,422	98.5	<0.0001	112.7 ± 83.8	<0.0001	13.2 ± 4.9
Two doses							
All	6,382	6,192	97.0		63.2 ± 58.0		10.1 ± 3.0
Males	2,191	2,101	95.9		58.2 ± 56.6		10.3 ± 2.9
Females	4,191	4,091	97.6	0.0002	65.8 ± 58.6	<0.0001	10.1 ± 3.0

*Statistical significance refers to the comparison between males and females. *Time was determined based on the date of vaccination if vaccinated once and on the second dose if vaccinated twice.*

compliance was observed in males, reaching a coverage (at least one dose) close to 100% (97%), as shown in **Figure 1**. Overall, 9,618 students were vaccinated (87.3%), of which 3,236 (29.4%) had one dose and 6,382 (57.9%) had two doses.

The vaccine, even after one dose, exhibited not only high coverage (97%), but also high seropositivity (>90%), even if the antibody titer, after both one and two doses, progressively declined in younger subjects.

Table 1 shows the differences in seropositivity and antibody titer between males and females; when considered collectively and subdivided according to the vaccination schedules, females were significantly more responsive than males with both one and two vaccine doses. It is also of interest that between those vaccinated, there was no statistically significant difference in the percentage of positives between those receiving one or two doses, but paradoxically, antibody titer was higher (1.67 times) in those vaccinated with one dose, even though the time between last vaccine dose and analysis was almost 4 years less in those vaccinated twice than in those vaccinated once.

However, by categorizing the students by year of birth and sex, even if a greater response from females was observed, it appeared less consistent and only in some year-of-birth groups (**Table 2**).

To better highlight this relationship, the two parameters (antibody titer and age at first dose) were plotted (**Figure 2**). A significant correlation was observed ($r = 0.389$, $p < 0.0001$) with two particular age groups: between 1 and 2 years and that of ∼11 years. The first probably consisted of subjects who afterward received a second dose of vaccine, whereas the second brings together both those who received only one dose during adolescence (particularly females) and those who received the second dose between the age of 8 and 11 years. The significant effect of the time between receiving the vaccine and the date of the analysis (data not shown) was significant ($p < 0.0001$) only from a statistical point of view due to the large number of samples, but it was not significant from an objective point of view ($r = -0.071$).

Among unvaccinated students, a high rate of positivity for antibodies against rubella was observed in those born

before 1990, although the number was dramatically reduced among females (due primarily to high compliance), and then seropositivity progressively declined to zero among younger students (**Figure 3**).

Multivariate analyses highlighted the effect of independent variables on antibody titer developed both after infection and after vaccination (**Table 3**). In panel A, all students were evaluated, including unvaccinated students: Year of birth, sex, and vaccination showed a significant effect on the antibody titer. In panel B, where the effect of independent variables was evaluated only in vaccinated students, the age at which the first dose of vaccine was administered is of particular interest. The number of vaccine doses administered did not affect the antibody titer.

Finally, a comparative analysis of seropositivity and antibody titer after the administration of the vaccine alone or in the MMR formulation was performed (**Table 4**). The effect of the vaccine alone (one dose) or the vaccine alone plus MMR (two doses) exhibited a more significant response in terms of seropositivity and antibody titer ($p < 0.0001$). It should be noted that the vaccine alone was used almost exclusively in females and before the year 2000. Only one student was vaccinated with two doses of rubella vaccine alone.

DISCUSSION

Rubella vaccination coverage appears to be optimal, especially for those born after 1985 (with at least one dose, >90%), reaching 97.5% in those born after 1995. Of interest is the fact that in those born before 1990, there is a significant discrepancy in vaccination compliance between males and females, with females much more compliant. This is likely related to two main factors: (1) the awareness that women of child-bearing age are at higher risk of CRS in the event of infection and (2) the active on-site supply of rubella vaccinations for teenage females during the last year of primary and first year of secondary school from 1972 to the 1988–1989 cohort.

TABLE 2 | Characteristics of antibodies against rubella in terms of positivity percentage and antibody titer.

Year of birth						Titer IU/mL	
No vaccine		N	Positives	%	p	Mean ± SD	p
Before 1960	All	14	14	100.0		101.5 ± 102.6	
	Males	7	7	100.0		104.7 ± 120.4	
	Females	7	7	100.0	n.s.	98.3 ± 91.1	n.s.
1960–1969	All	66	66	100.0		109.2 ± 69.8	
	Males	34	4	100.0		108.5 ± 69.1	
	Females	32	32	100.0	n.s.	109.9 ± 71.7	n.s.
1970–1979	All	276	274	99.3		130.2 ± 84.9	
	Males	162	160	98.8		141.6 ± 91.4	
	Females	114	114	100.0	n.s.	114.0 ± 71.9	n.s.
1980–1985	All	451	444	98.4		146.6 ± 96.2	
	Males	304	297	97.7		151.0 ± 99.8	
	Females	147	147	100.0	n.s.	137.4 ± 88.0	n.s.
1986–1990	All	336	317	94.3		162.9 ± 114.3	
	Males	173	162	93.6		162.8 ± 123.9	
	Females	163	155	95.1	n.s.	162.9 ± 103.5	n.s.
1991–1995	All	182	86	43.3		81.4 ± 119.6	
	Males	75	33	44.0		84.7 ± 128.3	
	Females	107	53	49.5	n.s.	79.1 ± 113.8	n.s.
after 1995	All	79	17	21.5		25.9 ± 73.9	
	Males	37	5	13.5		13.9 ± 52.4	
	Females	42	12	28.6	n.s.	36.4 ± 88.0	n.s.
One dose							
before 1960*	All	0					
1960–1969	All	4	4	100.0		90.4 ± 67.5	
	Males	0					
	Females	4	4	100.0		90.4 ± 67.5	
1970–1979	All	122	122	100.0		144.0 ± 85.3	
	Males	8	8	100.0		118.2 ± 83.9	
	Females	114	114	100.0	n.s.	145.9 ± 85.5	n.s.
1980–1985	All	929	925	99.6		121.6 ± 77.9	
	Males	108	107	99.1		105.0 ± 76.3	
	Females	821	818	99.6	n.s.	123.8 ± 77.9	n.s.
1986–1990	All	1453	1419	97.7		107.9 ± 88.1	
	Males	366	346	94.5		89.0 ± 84.1	
	Females	1087	1073	98.7	<0.0001	114.3 ± 88.6	<0.0001
1991–1995	All	542	516	95.2		80.5 ± 76.9	
	Males	210	196	93.3		72.3 ± 79.9	
	Females	332	320	96.4	n.s.	85.6 ± 74.5	0.0496
after 1995	All	186	171	91.9		52.1 ± 50.9	
	Males	84	78	92.9		44.0 ± 41.4	
	Females	102	93	91.2	n.s.	58.8 ± 56.8	0.0421
Two doses							
Before 1960*	All	0					
1960–1969**	All	0					
1970–1979	All	3	3	100.0		107.0 ± 78.5	
	Males	2	2	100.0		112.0 ± 110.3	
	Females	1	1	100.0		97	
1980–1985	All	86	86	100.0		86.3 ± 51.3	
	Males	15	15	100.0		86.5 ± 50.4	
	Females	71	71	100.0	n.s.	86.3 ± 51.9	n.s.

(Continued)

TABLE 2 | Continued

Year of birth		N	Positives	%	p	Titer IU/mL Mean ± SD	p
1986–1990	All	765	754	98.6		71.9 ± 61.3	
	Males	252	249	98.8		69.3 ± 59.3	
	Females	513	505	98.4	n.s.	73.2 ± 62.2	n.s.
1991–1995	All	3,182	3,136	98.6		69.4 ± 61.5	
	Males	1,130	1,101	97.4		63.3 ± 59.3	
	Females	2,052	2,035	99.2	0.0002	72.8 ± 62.5	<0.0001
After 1995	All	2,346	2,213	94.3		51.0 ± 49.5	
	Males	792	734	92.7		46.7 ± 49.5	
	females	1,554	1,479	95.2	0.0174	53.1 ± 49.4	0.0031

*The data are divided by groups of date of birth, sex, and number of doses of vaccine. *No student born before 1960 has had the rubella vaccine; **no student born before 1969 has had two doses of the vaccine. Statistical significance refers to the comparison between males and females.*

FIGURE 2 | Linear regression analysis of the relationship between age at which the first vaccine dose was administered (in years) and logarithm of antibody titer (IgG). Two particular age groups have been identified: between 1 and 2 years and that of ~11 years. The first age group consisted of subjects who afterwards received a second dose of vaccine, whereas the second brings together both those who received only one dose during adolescence (particularly females) and those who received the second dose between the age of 8 and 11 years.

FIGURE 3 | Percentage of seropositivity of antibodies against rubella in unvaccinated students in relation to the year of birth. The rate of positivity is high in students born before 1990 and progressively tends to zero in the population born after that year.

Of further interest is evidence that seropositivity was high (>95%) in those born before 1990, even if not vaccinated. For those born in subsequent years, seropositivity rapidly declined to <20% and then to zero. This means a significant decrease in circulation of the wild virus and therefore a lack of natural boosters, which is probably the cause of the progressive reduction in antibody titer after vaccination in the youngest. On the other hand, the immune response to a single dose of vaccine is optimal, such that it alone achieves and exceeds herd immunity, which for rubella has been calculated at between 85 and 87% (12). It is therefore evident that between natural immunity and immunity acquired with the vaccine, the population of future HCWs will have an immunization rate close to 100%. On the other hand, recent research in a cohort of female HCWs demonstrated that ~10% had non-protective antibodies, suggesting a third dose of the vaccine would be needed in these cases (13).
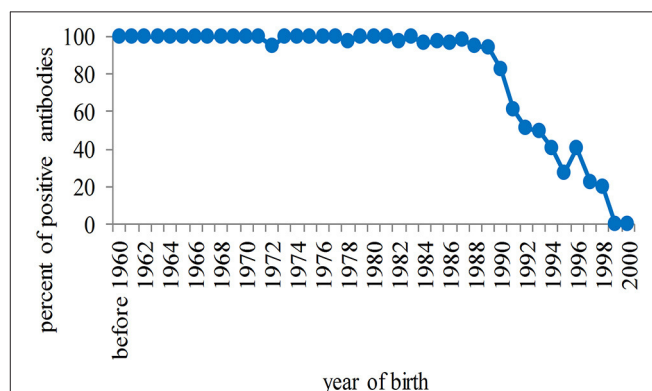
TABLE 3 | Panel A: Multiple linear regression analysis for all students, unvaccinated and vaccinated (once or twice); Panel B: The analysis was performed only for vaccinated subjects (once or twice).

Panel A	b	r	t	p
Intercept	54.471946		34.669043	<0.0001
Year of birth	**−0.026523**	**−0.303853**	**−33.477332**	**<0.0001**
Sex	**0.075356**	**0.09051**	**9.533432**	**<0.0001**
Vaccination	**−0.020842**	**0.028648**	**3.008307**	**0.0026**
Panel B				
Intercept	2.099115		50.369121	<0.0001
Year of birth	**−0.074095**	**−0.160494**	**−15.941666**	**<0.0001**
Sex	**0.0666**	**0.089416**	**8.801643**	**<0.0001**
Vaccination	−0.015588	−0.011065	−1.084844	0.278
Age 1st dose	**0.000057**	**0.15002**	**14.876456**	**<0.0001**
Time	**−0.000028**	**−0.091667**	**−9.025113**	**<0.0001**

Time is the interval between the last dose of vaccine and the measurement of antibodies (logarithmic transformation). Significant results are in bold.

TABLE 4 | Comparative analysis of seropositivity and antibody titer after administration of the vaccine alone or in the MMR formulation.

One dose	N	Positives	%	p	Titer IU/mL mean ± SD	p	Time* Years
Rubella alone	1,049	1,046	99.7		129.4 ± 81.3		12.7 ± 4.5
MMR	2,187	2,111	93.9	<0.0001	93.9 ± 82.7	<0.0001	14.3 ± 5.2
Two doses							
Rubella alone +MMR	110	110	100.0		101.8 ± 72.4		8.4 ± 3.8
MMR+MMR	6,272	6,082	97.0	n.s.	62.5 ± 57.5	<0.0001	10.2 ± 2.9

*Statistical significance refers to the comparison between rubella vaccine alone (or alone plus MMR) and MMR formulation. *Time was determined based on the vaccination date if vaccinated once and on the second dose if vaccinated twice.*

The high seropositivity in a very large cohort confirms that the rubella vaccine is particularly effective (14–18); the efficacy of one dose is >95%, and if high coverage is achieved, only one dose is required to achieve rubella elimination (19, 20). Indeed, two doses of the vaccine do not increase seropositivity and surprisingly result in a lower antibody titer. An adequate explanation is not at this moment available, except considering two factors: (1) One dose was administered at an older age (around 8 years) than the first dose, when the vaccine was administered twice (~2 years of age), and (2) the greater efficacy of the vaccine alone, widely used in the past, especially in females, in the single-dose vaccination schedule compared to the combined MMR vaccine, as already demonstrated for that vaccine against measles (21). Furthermore, our results clearly demonstrate that the antibody titer is significantly greater when the vaccine is administered in adolescence compared with that in childhood. Because infants lose maternally acquired immunity within 9 months of birth (22), vaccination is important to prevent rubella above all in women of child-bearing age (23).

Our results show that sex influences the antibody response, significantly higher in females, in terms of both seropositivity and antibody titer, with one or two doses. However, this difference is less consistent in relation to the years of birth, and males have a longer time interval between vaccine and serological analysis, especially if vaccinated with a single dose. The adaptive immunity in females is greater (24), and better vaccination response has been demonstrated for some vaccine types (25–27), but is not consistent for rubella (28) or for chickenpox (29).

The present research has the following weakness: Only the antibody titer was determined and not neutralizing antibodies. However, in such a large cohort, that analysis was economically impractical.

CONCLUSIONS

In conclusion, the results of this study show that both the vaccination and the immune coverage of future HCWs against rubella are optimal, well above that required for herd immunity. The coverage also includes the male sex, which in the past was not considered necessary, as rubella is a generally benign disease, with the understanding that the eradication of rubella, and therefore of congenital rubella, did not pass only from females and that males play a role, if not vaccinated, in keeping the wild virus in circulation. Based on data provided by the Istituto Superiore di Sanità, Italy is approaching the eradication of congenital rubella, and the complete immunization of HCWs is a good start. The modest difference in the sex-related immune response to the vaccine does not appear substantial from our point of view.

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. The patients/participants provided their written informed consent to participate in this study.

INSTITUTIONAL REVIEW BOARD STATEMENT

This was an observational study in which we analyzed data obtained from a mandatory health surveillance of workers exposed to biological risks regulated by Italian legislative decree 81/2008; consequently, evaluation by an ethics committee was not necessary.

AUTHOR CONTRIBUTIONS

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The Effect of Emotional Labor on Presenteeism of Chinese Nurses in Tertiary-Level Hospitals: The Mediating Role of Job Burnout

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Background: Employees who are physically present but work insufficiently because of illness are deemed as having presenteeism. In the health care setting, the issue has taken on greater importance because of the impairment of the physical and mental health of nurses and the nursing safety of the patients. According to the Job Demand-Resource Model, burnout may link emotional labor with presenteeism. Thus, this study analyzed the role of burnout as a mediating factor between the three types of emotional labor strategies and presenteeism among nurses in tertiary-level hospitals.

Methods: A cross-sectional study of 1,038 nurses from six Chinese hospitals was conducted. The questionnaires, including the 14-item emotional labor strategies scale, 22-item Maslach Burnout Inventory scale, 6-item Stanford Presenteeism Scale, and items about demographic characteristics and work-related factors, were used to collect data. A multivariable linear regression was used to predict work-related factors and investigate the correlation of emotional labor, burnout, and presenteeism. The structural equation model was implemented to test the mediating effects of job burnout.

Results: The results of the study showed that the average presenteeism score of the participants was 14.18 (4.33), which is higher than in Spanish, Portuguese, and Brazilian nurses. Presenteeism was explained by 22.8% of the variance in the final model in multivariable linear regression ($P < 0.01$). Presenteeism was found to be positively correlated with surface acting, emotionally expressed demands, deep acting, emotional exhaustion, depersonalization, and low personal accomplishment ($P < 0.01$). Notably, presenteeism was negatively correlated with deep acting ($P < 0.01$). In addition, burnout partially mediated the correlation between emotionally expressed demands, deep acting, and presenteeism with a mediatory effect of 24 and 63.31% of the total effect. Burnout completely mediated the association between surface acting and presenteeism, a mediating effect of 86.44% of the total effect.

Conclusions: The results of this study suggested that different emotional labor strategies affect presenteeism, either directly or indirectly. Nursing managers should intervene to reduce presenteeism by improving the ability of the nurses to manage emotions, thereby alleviating burnout.

INTRODUCTION

Presenteeism has become a common phenomenon in the workplace which is defined as impaired productivity or performance while ill but still working (1–4). The concept has been of great interest for over two decades. More than 80% of healthcare providers and physicians in England and Norway will attend work despite ill health (5, 6). Furthermore, more than 70% of Danish core workers had gone to the workplace while ill (7). Additionally, one cross-sectional study reported that 74% of Chinese employees must work despite being ill; the frequency of presenteeism is almost once a month (8). Previous studies in Turkey, Korea, and the United States had demonstrated the high prevalence and factors of presenteeism, including among doctors and nurses (9–11). Nurses may experience up to four times as much presenteeism as other health or welfare workers in Sweden (12) because of the apparent characteristics of nursing work, such as shift work, an increased workload, low replaceability, and extended working time (13–16). The presenteeism phenomenon may impair the physical and mental health of nurses (8, 17) and reduce health-related productivity and increased economic costs (18, 19). It has also been shown that presenteeism will compromise patient safety and reduce the work quality of nurses by increasing the risk of patient falls and medication errors and disease transmission (11, 20, 21). Therefore, combating presenteeism behavior may be a key to improve the health productivity of nurses. At present, there is little empirical research on the presenteeism of nurses. This study provided a new way of thinking for nursing managers to reduce the presenteeism of nurses.

Managers have taken notice of the link between emotional labor, burnout, and presenteeism. Nurses provide professional medical services as well as face-to-face communication and listening to the concerns of patients. Nursing is an emotionally labor-intensive profession. Emotional labor refers to individual efforts, plans, management of emotional expression, or bodily display in response to organizational demands in the workplace (22). Job burnout is a mental health injury state in which employees suffer from chronic work-related stress (23). The concept of burnout in three dimensions, including emotional exhaustion, depersonalization, and low personal accomplishment, as proposed by the study of Maslach and Jackson is generally accepted (24). The characteristics of burnout are emotional exhaustion, overextended alienation from the job, and a sense of perceived incompetence in positions (23, 24).

The study of Grandey et al. presented two main emotional labor strategies, namely, surface acting and deep acting; other studies have adopted this approach (25, 26). Surface acting is not just suppression but also the regulation of emotion with an expression that matches the expectations of the organization. Deep acting occurs when employees keep inner feelings consistent with their displayed expression (22). This is an antecedent-focused emotional regulation (reappraisal and situation modification), while surface acting is a response-focused emotion regulation (physiological change and expression suppression) (27). According to the meta-analytic structural model of Kammeyer, deep acting is a positive predictor of job performance, while surface acting predicted burnout negatively (28).

Investigators have recently examined the correlation between emotional labor and job burnout, emotional exhaustion, job-related stress, depression symptoms, customer orientation, and presenteeism (29–33). Previous research also has demonstrated that burnout, job-related anxiety, depression, and emotional labor can all be risk elements for presenteeism (16, 30, 32–34). Based on these discussions, job burnout may have a direct or indirect mediating effect on emotional labor and presenteeism.

Job Demand-Resource Model and Emotional Labor theory are applied to understand the correlation between emotional labor, job burnout, and presenteeism. The Job Demand-Resource Model proposes that job demand is the important antecedent of in-role performance through the mediating effect of the emotional exhaustion component of burnout, i.e., cognitive and emotional fatigue (35–37). Job demands are described as work-related aspects requiring sustained physical or mental effort with specific physical or psychological costs, including high work stress, emotional demands, and undesired working conditions (38). In-role performance is defined as meeting organizational targets and practical functions (35). The existing body of research on high job demands suggests that they are associated with occupational burnout (39) and presenteeism (40). At the same time, emotional display required by the organization is a significant job demand, especially for nurses (41). Based on previous studies and the foundation of the Job Demand-Resource Model, we proposed the hypothesis that emotional labor affects presenteeism through the mediating effect of job burnout.

According to the Emotional Labor theory, emotional labor affects individual and organization levels (42). Moreover, Grandey proposed that emotional labor, involving both surface acting and deep acting, is linked to individual well-being, involving both job satisfaction and job burnout, and organizational well-being, involving both performance and withdrawal behavior (22, 27). In addition, a past study demonstrated how Korean nurses associate emotional labor with presenteeism (30). However, few studies have explored
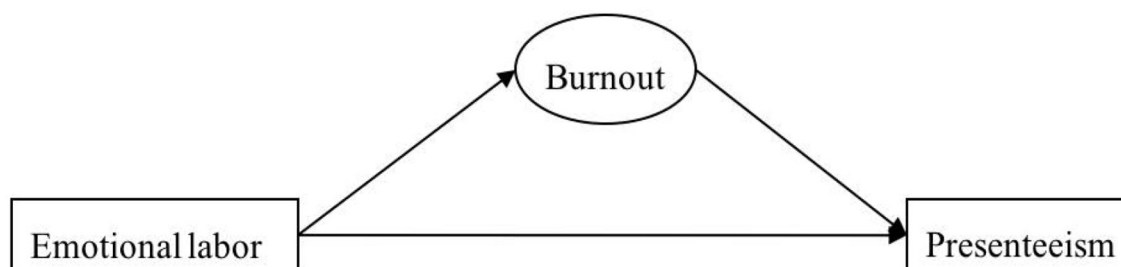
FIGURE 1 | The hypothesized model.

these different emotional regulation strategies, which have other effects.

Based on the Job Demand-Resource Model and Emotional Labor Theory, this study examined the correlations between emotional labor, burnout, and presenteeism and the mediating effect of burnout and the relationship between emotional labor and presenteeism in mitigating the low productivity of nurses. It is meaningful to understand how emotional labor affects presenteeism. **Figure 1** depicts the hypothesized model.

METHOD

Setting and Sample

Convenience sampling was used to recruit from the six tertiary hospitals in Shaanxi province, China. Six hospitals with similar hospital grades as designated by the Ministry of Health were selected. For a convenience sample, nurses with a professional certificate, informed consent, and voluntary involvement in this study were included. Excluded were nurses who had worked for less than a year and nurses who were on leave for various reasons during the investigation.

The study of Thompson recommended that 10–15 times of questionnaire items count the sample size for the structural equation model (43). The self-administered questionnaire consisted of 42-items, including 14 emotional labor items, 22 job burnout items, and 6 presenteeism items. The total sample size involved 630 participants. However, the sample size was expanded by 20% because of incomplete questionnaires, resulting in a final sample size of 756 participants. A total of 1,054 nurses were recruited.

Ethical Approval

The nurses voluntarily chose to participate in this study and were free to drop out. The electronic information submitted was anonymous, and only the researchers had access to data. The Ethics Committee of the Affiliated Hospital of Shaanxi University of Traditional Chinese Medicine, Shaanxi Province, China approved this study.

Data Collection

The study was carried out from October to December 2020. A structured questionnaire with four parts was distributed to all

participants, covering sociodemographic information, emotional labor, job burnout, and presenteeism. The participants were volunteers and we assured them that all their information would be kept confidential. Before the questionnaire was issued, we contacted the nursing departments of hospitals, introduced the purpose of this study to obtain permission, and discussed the survey time and the number of respondents. Two trained graduate students went to the six hospitals and conducted the field survey from October to December 2020. The nurses were informed of the purpose, significance, and independent completion of the survey. The questionnaires were completed on-site with the participation of the nursing managers of each hospital and the supervision of the two graduate students. WeChat (a popular social networking tool in China) was utilized to conduct the electronic questionnaire. Those who chose the same option in questionnaires and those who missed >10% of items were excluded. After filtering, 1,038 questionnaires were included in the subsequent analysis with a response rate of 98.48%.

Data Analysis

The analysis of the collected data was carried out using SPSS 26, Excel, and AMOS 23.0 software (both by IBM, Armonk, NY, USA). First, the demographic and work-related characteristics of the participants were determined using descriptive statistics. Pearson's correlation coefficients were used to calculate the correlation between all variables. Multivariable linear regression was used to predict work-related factors. Second, to test the validity and calculate the Cronbach alpha coefficient to estimate internal consistency, confirmatory factor analysis was conducted using AMOS. Third, to explore the link between the three emotional labor strategies, burnout, and presenteeism, the structural equation model was implemented and the mediating effects of job burnout were tested. The maximum likelihood method was used to confirm interrelationships and parameters between the variables in the structural equation modeling (SEM). We assessed the adequacy by the likelihood ratio (χ^2/df), adjusted goodness of fit index (AGFI), Tucker–Lewis fit index (TLI), comparative fit index (CFI), standardized root mean square residual (SRMR), and root means the square error of approximation (RMSEA). An RMSEA < 0.05, SRMR < 0.08, and

$\chi^2/df < 3$ indicated good model fit (44), while the other indices such as AGFI >0.90 can be construed as an acceptable fit (45).

Measurements

Sociodemographic Characteristics

The demographic questionnaire included gender, age in years, marital status, professional title, employment status, monthly income (RMB, yuan), and weekly overtime. The criterion age was categorized as 20–30, 30–40, 40–50, and >50 in years. Marital status was categorized as unmarried, married without children, married with children. Professional title was categorized as either nurse, senior nurse, nurse supervisor, or above. Employment Status was categorized as either contractual or permanent. The biggest difference between contractual and permanent status is that the employer may have the right to discontinue the contract after the contract period has expired, while permanent employees work until retirement. Monthly Income (RMB, yuan) was categorized as <3,000 RMB, 3,000–5,000 RMB, >5,000 RMB. The number of times working overtime per week was categorized as 0, 1–2, 3–4, and >5.

Emotional Labor Strategies

The emotional labor strategy scale was used to assess the emotional performance strategies of the nurses in clinical work. As discussed above, the emotional labor strategy scale has two factors which are surface acting and deep acting (46). Based on the Emotional labor strategy Scale, the study of Luo combined the Chinese clinical nursing reality, revised by psychology and nursing professionals, and formed a questionnaire including 3 dimensions with 16 items (47). The Chinese version of the nurse emotional labor strategy scale consists of surface acting (SA, 7 items), deep acting (DP, 3 items), and emotionally expressed demands (EED, 4 items). Emotionally expressed demands refers to when nurses are required to show specific behaviors or expressions to reflect the image of the nurse to be established in the hospital. Each dimension was scored on a Likert-6 scale. In our study, the values of Cronbach alpha for three subscales were 0.85, 0.70, and 0.812, respectively. Higher scores indicate nurses experience higher levels of emotional labor.

Maslach Burnout Inventory

The 22-item self-report Maslach Burnout Inventory (MBI) was used to measure burnout, which consisted of emotional exhaustion (EE, 9 items, depersonalization (D, 5 items), and low personal accomplishment (LPA, 8 items) (24). MBI responses range from 0 (never) to 6 (every day). The nine-item emotional exhaustion subscale mainly evaluates emotional reactions caused by excessive work stress. The five-item depersonalization subscale mainly evaluates stress-induced attitudes and feelings toward the service recipient. The eight-item personal accomplishment subscale mainly describes stress-induced perceptions of the work of oneself. The scale has been established as a reliable and valid measurement in other studies (48–50). In this Study, the Chinese version of the MBI revised by Hua is used (51). Cronbach's alpha for three subscales were 0.9, 0.74, and 0.84, respectively.

TABLE 1 | Demographic and working characteristics of nurses ($N = 1,038$) and scores of presenteeism.

Variable	Category	N (%)	Mean ± SD
Gender	Female	1,012 (97.5)	14.18 ± 4.31
	Male	26 (2.5)	13.92 ± 5.11
Age (years)	20–30	598 (57.6)	13.88 ± 4.29
	30–40	367 (35.4)	14.60 ± 4.41
	40–50	67 (6.5)	14.37 ± 4.01
	>50	6 (0.6)	15.83 ± 4.88
Marital status	Unmarried	272 (26.2)	13.96 ± 4.31
	Married without children	134 (12.9)	13.88 ± 4.32
	Married with children	632 (60.9)	14.33 ± 4.33
Professional title	Nurse	249 (24.0)	14.13 ± 4.64
	Senior nurse	543 (52.3)	14.00 ± 4.28
	Nurse supervisor and above	246 (23.7)	14.61 ± 4.09
	Permanent	88 (8.5)	14.19 ± 4.32
Weekly overtime	0	341 (32.9)	13.53 ± 4.07
	1–2	506 (48.7)	14.06 ± 4.22
	3–4	140 (13.5)	15.51 ± 4.65
	>5	51 (4.9)	15.94 ± 4.88
Employment status	Contract	950 (91.5)	4.08 ± 4.42
	Permanent	88 (8.5)	14.19 ± 4.32
Monthly income	<3,000	92 (8.9)	13.58 ± 4.77
	3,000–5,000	627 (60.4)	14.30 ± 4.34
	>5,000	319 (30.7)	14.10 ± 4.15

Stanford Presenteeism Scale

The Chinese version of the 6-item Stanford Presenteeism Scale (52), produced by the study of Koopman et al. (53), was used to estimate health-related productivity loss. It is a tool for evaluating the loss of productivity or performance due to presenteeism caused by specific health problems (53). Responses for presenteeism ranged from 1 (completely disagree) to 5 (totally agree). Six items make up the SPS-6, containing two dimensions of finishing work (four items) and avoiding distraction (two items scored in reverse). The Cronbach's coefficient of the scale was 0.71 in this investigation.

RESULTS

General Participants Characteristics

Demographic and work-related characteristics and scores of presenteeism among 1,038 nurses are shown in **Table 1**. Among the 1,038 participants, 97.5% were female. The average age was 31.2 ± 10.42 years. The number of married people with children (60.9%) was greater than unmarried ones (26.2%) and married ones without children (12.9%). Among the participants, senior nurses were the majority at 52.3%, and 48.7% of the participants worked overtime once or twice a week. In the case of employment status, contractual (91.5%) made up the majority. Nurses who earned 3,000–5,000 RMB were the majority at 60.4%.

TABLE 2 | Means, standard deviations, and correlations for all variables.

Variables	Mean ± SD	1	2	3	4	5	6	7	8	9
SA	23.37 ± 6.84	1								
EED	13.41 ± 4.11	0.395*	1							
DA	14.60 ± 2.40	−0.019	0.179*	1						
EE	20.21 ± 11.42	0.477*	0.224*	−0.105*	1					
D	5.12 ± 5.27	0.467*	0.228*	−0.150*	0.658*	1				
LPA	15.15 ± 10.73	0.155*	−0.022	−0.384*	0.155*	0.224*	1			
Emotional labor	51.38 ± 9.72	0.865*	0.745*	0.309*	0.404*	0.388*	0.005	1		
Burnout	40.47 ± 20.39	0.453*	0.153*	−0.326*	0.784*	0.711*	0.726*	0.329*	1	
Presenteeism	14.18 ± 4.33	0.301*	0.212*	−0.139*	0.482*	0.364*	0.160*	0.442*	0.267*	1

*SA, surface acting; EED, emotionally expressed demands; DA, deep acting; D, depersonalization; EE, emotional exhaustion; LPA, low personal accomplishment. *P < 0.01.*

TABLE 3 | Results of multivariable linear regression to predict presenteeism factors.

Variable	β	t	P	VIF
Gender (vs. male)				
Female	0.034	1.222	0.222	1.049
Age (vs. 20–30 years)				
30–40	0.071	1.857	0.064	1.974
40–50	0.060	1.664	0.096	1.741
>50	0.046	2.067	0.039	1.112
Marital status (vs. unmarried)				
Married without children	0.004	0.139	0.890	1.367
Married with children	0.016	0.393	0.694	2.147
Professional title (vs. nurse)				
Senior nurse	0.005	0.144	0.886	1.960
Nurse supervisor and above	0.025	0.506	0.613	3.172
Weekly overtime (vs.0)				
1–2	0.062	1.780	0.075	1.273
3–4	0.157	4.628	0.000	1.220
>5	0.120	3.760	0.000	1.093
Employment status (vs. permanent)				
Contract	0.018	0.560	0.576	1.396
Monthly income (vs. <3,000)				
3,000–5,000	0.064	1.281	0.201	1.396
>5,000	0.047	0.884	0.377	3.333
Emotional labor	0.214	7.063	0.000	1.154
Burnout	0.407	13.415	0.000	1.233

Correlations Analysis Among Emotional Labor, Burnout, and Presenteeism

Presenteeism was significantly positively correlated with surface acting, emotionally expressed demands, deep acting, emotion exhaustion, depersonalization, and low personal accomplishment ($P < 0.01$), according to correlation analysis. Notably, presenteeism had a significant negative association with deep acting ($P < 0.01$). Details can be found in **Table 2**.

Multi-Variable Linear Regression

The sociodemographic and job-related factors affecting presenteeism were predicted using multiple linear regression models. Presenteeism was explained by 22.8% of the variance in the final model as shown in **Table 3** ($P < 0.001$). At the same time, more frequent weekly overtime and >50 years of age had predicted higher presenteeism in the regression model. The results also revealed that the higher the score of emotional labor and burnout, the more frequent the presenteeism.

Measurement Model and Structural Equation Model

Pearson's correlation coefficient for presenteeism, burnout subscales, and emotional labor subscales was used to create a measurement model with four latent constructs and three observable variables. To assess the model fit using the maximum likelihood estimate, confirmatory factor analysis was performed. The initial fit indices of the measurement model had indicated that the factor loading of personal accomplishment (observed variables of burnout) was <0.5, thus this variable was eliminated. **Figure 2** depicts the measuring model. The measurement model was used to construct the structural model (**Figure 3**). The modification indices were used to correct the structural model, and the fit indices showed that the structural model with good fit was $CMIN/df = 1.371$, RMSEA = 0.019, SRMR = 0.009, AGFI = 0.991, CFI = 0.999.

Table 4 displays the standardized estimates, critical ratio, standardizing effects, and mediating effect ratio for the route analysis. The direct impact on presenteeism was not significant ($\beta = 0.033$, $P = 0.386$), but surface acting had a considerable effect on burnout ($\beta = 0.542$, $P < 0.001$). On the other hand, surface acting had a substantial indirect influence on burnout ($\beta = 0.204$, $P < 0.001$). Burnout and presenteeism were significantly affected by emotionally expressed demands ($\beta = 0.095$, $P = 0.004$) and ($\beta = 0.114$, $P = 0.001$). Burnout and presenteeism were negatively linked with deep acting ($\beta = -0.165$, $P = 0.001$) and ($\beta = -0.107$, $P = 0.001$). The indirect effects of emotionally expressed demands and deep acting on presenteeism were 0.036 and −0.064, respectively.

DISCUSSION

In this study, 1,038 in-care nurses from six tertiary-level hospitals in Shaanxi Province were studied *via* constructing a structural equation model to investigate the correlations
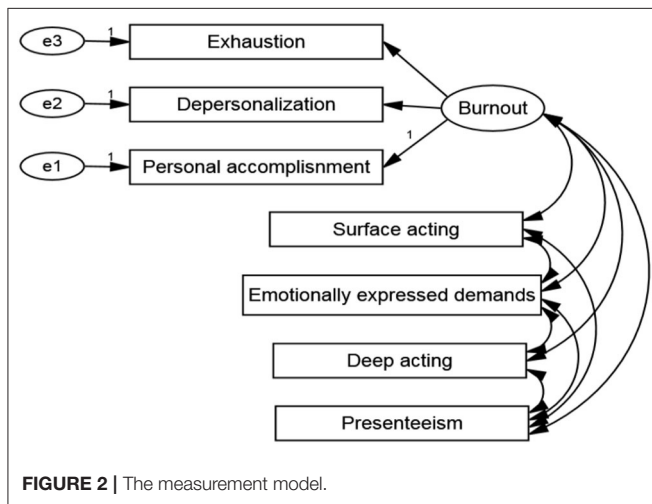
FIGURE 2 | The measurement model.
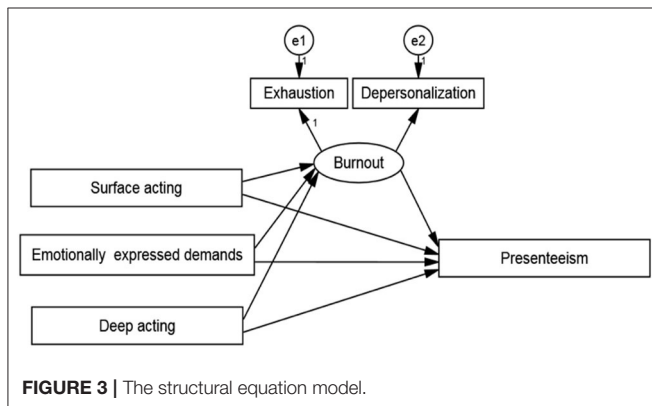
FIGURE 3 | The structural equation model.

between three factors of emotional labor, burnout, and presenteeism. Deep acting alleviated burnout and reduced presenteeism directly, whereas emotionally expressed demands raised job burnout and presenteeism. Burnout played a completely mediating effect between surface acting and presenteeism.

First, the average presenteeism score was 14.18 (4.33). The SPS-6 score of China is greater than that of other countries (54). It may be related to the medical system of China. Nurses who work in public hospitals experienced more presenteeism (55). Health workers in China are extraordinarily overworked and have lower incomes than their counterparts in Europe and the United States (56). Multivariable linear regression carried out in this study has predicted demographic factors associated with presenteeism, and results revealed that higher presenteeism was predicted by more weekly overtime and >50 years of age. The results may be related to work stress, poor health, and organizational norms (55). It is noteworthy that presenteeism more likely occurred in older employees. Nurses with lengthy experience seemingly have a negative view of meeting workplace demands (8). Furthermore, nurses experience higher presenteeism with more frequent weekly over time, as previously reported (57). This suggested that managers should intervene to reduce presenteeism.

Second, this study examined the correlations between the research variables among the nurses. The Pearson's correlation coefficients for surface acting, emotionally expressed demands, emotion exhaustion, depersonalization, low personal accomplishment, and presenteeism were all significant. This study identified that deep acting and emotionally expressed demands directly and indirectly impacted the presenteeism of the nurses. Deep acting created an internal-external union that might result in favorable psychological states, which could expend limited resources on internalizing emotional expression and inner feeling (29, 58, 59). On the other hand, acting in good faith (deep acting) negatively affected presenteeism, congruent with a previous study (60). Therefore, nurse managers should be aware that deep acting emotion strategies could effectively reduce presenteeism. To improve

TABLE 4 | Standardized estimates, critical ratios, and standardized direct, indirect, and total effect and mediating effect ratio.

Endogenous variable	Path	Exogenous variable	CR	Direct effect SE (P)	Indirect effect SE (P)	Total effect SE (P)	Mediating effect ratio (%)
Burnout	←	Surface acting	15.121	0.542 (<0.001)		0.542 (<0.001)	
	←	Emotionally expressed demands	2.904	0.095 (0.004)		0.095 (0.004)	
	←	Deep acting	−5.474	−0.165 (<0.001)		−0.165 (<0.001)	
Presenteeism	←	Surface acting	2.269	0.033 (0.386)	0.204 (<0.001)	0.236 (<0.001)	86.44
	←	Emotionally expressed demands	3.59	0.114 (0.001)	0.036 (0.005)	0.150 (<0.001)	24.00
	←	Deep acting	−4.579	−0.107(<0.001)	−0.064 (<0.001)	−0.169 (<0.001)	63.31
Presenteeism	←	Burnout	10.367	0.438 (<0.001)		0.376 (<0.001)	

←, Model pathway.

the emotion management skills of the nurses, various research had indicated that self-training mindfulness, emotion therapy, empathy training, and educational training interventions can improve emotion regulation (61, 62). These interventions include self-emotional management, hospital management of caregivers, and organizational management. Emotion expression demands were also linked to greater burnout and presenteeism according to the study. It is difficult to compare our results to previous research because there are few studies in which emotionally expressed demands could predict presenteeism. The emotionally expressed demands are the particular behavior or emotion which mirrors the image of the nurse the hospital wishes to present. In turn, nurses remain courteous despite the patients make unreasonable demands (47). Undoubtedly, the requirements of the nursing profession had placed high-work demands on nurses. When nurses were constantly subjected to high expectations (for example, severe workload and emotional dissonance), they were positively linked to presenteeism (63). It should be noted that there is a lack of research indicating a link showing how emotionally expressed demands are related to presenteeism. Further study on this topic is necessary.

Surface acting did not directly influence presenteeism, which did not correspond with earlier research (30). The reason for this might be that, to our knowledge, this is the first study to construct a structural equation model to show the path association between the three emotional labor methods, burnout, and presenteeism in nurses. Furthermore, future studies should account for the confounding variables to explore the correlation between variables in this study.

In this study, we anticipated that burnout could mediate the effect of emotional labor techniques on presenteeism, and SEM has clarified this relationship. The structural equation model indicated that burnout has partially mediated the relationship between deep acting, emotionally expressed demands, and presenteeism, with a mediating effect of 24 and 63.31% of the total impact. Additional data also confirmed that job burnout played a complete mediating role in surface acting and presenteeism, with a mediating effect of 86.44%. The risk of nurse emotional dissonance and lost productivity can be mitigated by relieving nurse burnout. A previous study revealed that nurses are required to display a particular expression at work that matches the requirements of the organization by expending resources according to the conservation of resources theory (64). The workload was also positively associated with presenteeism through higher burnout levels (36). Emotional dissonance caused by long-term surface acting and matching emotion expression demands will undoubtedly increase the emotional resources of the nurses, which only disappears after a lengthy recovery period. However, nurses must continue to work to meet high job demands, which disrupts the restoration process, causes chronic exhaustion, and leads to productivity loss. Given the shortage of nurses and presenteeism, hospital administrators should not force nurses to express the emotional labor required by the hospital in the face of rude or demanding patients (65). Burnout has been linked to dissatisfaction, missed care, self-compassion, and occupational turnover intention, according to studies (48, 66–68). Furthermore, interventions to improve the ability of the nurses to regulate emotions in specific patient settings may prevent burnout and productivity loss.

Nevertheless, several limitations should be acknowledged. First, cross-sectional research resulted in insufficient data compared to a longitudinal design, which have drawn a causal association between emotional labor, burnout, and presenteeism. A subsequent longitudinal study will still have to evaluate the findings, and such linkages to inductive reasoning change the correlations between these variables. Secondly, our research participants comprised nurses from six hospitals but failed to consider the distinctions across the departments, such as in emergency, surgery, and critical care. In addition, the majority of research participants were women. Thus, further studies should analyze the disparities between nurse populations and gender. Third, only nurses from six hospitals in Xi'an city were chosen using convenience sampling. Although the representativeness of the sample was restricted, the structural equation model might be employed in future research to investigate the link between these variables using random sampling.

CONCLUSION

After investigating the demographic and job-related factors to predict presenteeism, we discovered that nurses who worked more overtime each week and were >50 years old were more likely to exhibit presenteeism. The nursing managers should reasonably arrange human resources, adjust shifts, reduce overtime work, and focus on nurses with rich experience. Different factors of emotional labor have different effects on presenteeism, according to the findings. Self-training mindfulness, emotion therapy, or other effective methods could improve the emotional management skills of the nurses and help them master the correct emotional labor strategies. The structural equation model verified our prediction that burnout acted as a mediator between diverse emotional labor techniques and presenteeism. Improving emotional management skills and alleviating burnout can reduce presenteeism. Nursing administrators should focus on alleviating the emotional exhaustion of nurses by reducing workload and increasing support among colleagues, among other methods.

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 Affiliated Hospital of Shaanxi University of Traditional Chinese Medicine, Shaanxi Province, China. The

patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JS implemented this study and was responsible for data collection and analysis and writing. XL supported the investigation and data analysis. ZQ and RZ provided assistance in reviewing the

manuscript. FL guided the study design and interpretations. All authors approved the final paper.

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Attitudes of Healthcare Professionals and General Population Toward Vaccines and the Intention to Be Vaccinated Against COVID-19 in Spain

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Background: To achieve herd immunity, the acceptance of the COVID-19 vaccine by the population, especially healthcare professionals, plays a key role. The objective of the present paper is to address the differences in attitudes among Spanish healthcare professionals compared with the general population regarding COVID-19 vaccination.

Methods: This cross-sectional study included data from 2,136 adults ($n = 664$ healthcare professionals) from an online survey conducted from May 6 to June 9, 2021. The Vaccination attitudes examination scale was used to measure the negative attitudes toward vaccines. Four subscales: mistrust of vaccine benefit, worries about the unforeseen future effect, concerns about commercial profiteering, and preference for natural immunity were calculated. Generalized linear mixed models were conducted to study these associations.

Results: Between 10.2 and 22.6% of the subjects showed high levels of negative attitudes toward vaccines. However, only 1.5% of our sample (2.1% among healthcare professionals) refused to get the COVID-19 vaccine when it was offered because they chose otherwise. Retired people showed the lowest concerns and the highest trust in vaccines. No statistically significant effects were found between working in a healthcare field and having higher positive attitudes toward vaccines.

Conclusion: Low levels of rejection against the COVID-19 vaccine were identified in the present sample. However, despite being at a higher risk, health care professionals did not show higher positive attitudes toward vaccines. Furthermore, refusal percentage to vaccination was higher among healthcare professionals compared with non-healthcare professionals. Developing a strategy to increase positive attitudes against the COVID-19 vaccine should be an objective for public health policy.

Keywords: vaccines, COVID-19, attitudes, healthcare professionals, intention to vaccinate

INTRODUCTION

In a global pandemic context, such as that generated by SARS-COV-2, immunization of the population through vaccination is a public health priority (1–3). The success of COVID-19 vaccination depends, to a large extent, on the confidence that the population has in vaccines. Different studies have shown the efficacy of the vaccines currently in the market, reporting levels above 90% for Pfizer, Moderna, and Sputnik V, or above 60% in the case of Vaxzevria (AstraZeneca) or Janssen (3). However, in recent months, confidence in vaccines (especially in the case of the Vaxzevria vaccine) has been dampened by doubts about their efficacy and reported side effects (4–7). Even though vaccines have undergone strict safety controls, it is also necessary that the information offered to the population and users be adequate and expressive of maximum transparency (8).

In a recent study carried out in England, 16% of respondents showed high levels of distrust about vaccines in one or more domains. Attitudes of distrust toward vaccination were higher among people from minority ethnic backgrounds, with lower levels of education, lower annual income, low awareness of COVID-19, and compliance with government COVID-19 guidelines. Overall, 14% of respondents reported being unwilling to receive a vaccine for COVID-19, while 23% were unsure (9).

Vaccine hesitancy can be considered a global health threat. But particularly is concerning the negative attitudes toward vaccination among healthcare professionals such as doctors, nurses, emergency medical personnel, dental professionals and students, medical and nursing students, laboratory technicians, pharmacists, hospital volunteers, and administrative staff. The acceptance of the COVID-19 vaccine among healthcare professionals plays a key role in combating the pandemic since they are not only among the first group to receive the vaccination but also, this group has an increased risk of contracting and transmitting disease and has a potentially powerful influence on patient vaccination decisions. Hence, it is important to consider their attitudes about COVID-19 vaccination to better address barriers to widespread vaccination acceptance. One of the possible solutions that Governments have proposed to increase COVID-19 vaccine rates is making this vaccine mandatory for several high-risk groups such as healthcare professionals, care home workers, or even all federal public servants and many other workers (10). A study conducted in Spain with data collected from September 10 to November 23, 2020, revealed that 22.43% of the respondents would not be vaccinated (of which 20–24% were non-health professionals or unemployed, 17.5% physicians, 31.5% other health professionals, and almost 35% nurses) (11).

At a time when cases of the Delta variant are rising sharply worldwide and countries are lifting restrictions, it is key to know the concerns and doubts that people have about vaccination. In a recent survey of 1,050 subjects conducted in Spain between March 17 and 18, most Spaniards (52%) responded that the Vaxzevria vaccine was unsafe, twice as many as a month ago (25%). However, the perception of the safety of the other three vaccines administered in Spain, Pfizer-BioNTech, Moderna, and Janssen, increased. The same attitude was recorded in Italy, France, and Germany (12). After the resumption of vaccination with Vaxzevria in Spain, official data showed that only 1% refused to receive it (12). However, there have been more consultations in primary care centers about the effects of the vaccines, although these seem to dissipate after the information provided by health professionals. Thus, it is important to provide as much transparency as possible, generating a climate of trust between government, healthcare professionals, and regular citizens to be vaccinated.

Although there are different ways to measure antivaccination attitudes (13), the current work includes a multidimensional conceptualization of antivaccination attitudes that encompasses four items derived from the vaccination attitudes examination (VAX) scale (14): (1) distrust about vaccine benefit, (2) concern about unpredictable vaccine effects in the future, (3) concerns about commercial profiteering, and (4) preference for natural immunity. The 12-item VAX scale is a short questionnaire with high internal consistency reliability (15).

Most of the investigations so far have focused on measuring attitudes toward vaccines rather than the explicit vaccination itself. Since intention does not always correlate with behavior o our purpose is to address differences in attitudes among Spanish healthcare professionals compared with the general population, including the actual acceptance level of the COVID-19 vaccine. Moreover, we aim to explore potential associations between sociodemographic factors (mainly gender, age, migrant status, education, and occupational status) and negative attitudes toward vaccines and intention to vaccinate in a sample of the Spanish population.

MATERIALS AND METHODS

Study Design and Participants

Data were collected from an online anonymous survey conducted from May 6, 2021, to June 9, 2021. This cross-sectional study included a convenience sample of the adult population of Spain.

We used Google Forms, an online survey platform, to publish the questionnaire, and the link generated was then shared via social networks such as Facebook, Twitter, and WhatsApp or email. The interviewees visited the URL on their electronic devices to answer the questionnaire. Additionally, healthcare professionals who work at university hospitals of three medium-sized cities (Zaragoza, Logroño, and Murcia) were contacted via email with the support of the Health Research Institute of each city to get the maximum sample of this professional group. The inclusion criteria were individuals who (1) were 18 years old or older; (2) voluntarily agreed to participate in the online survey and (3) were able to read and complete the self-administered questionnaire independently.

After excluding those participants who did not complete more than 50% of the required questions ($n = 45$) a total of 2,136 were finally included in the present study. Since during data collection in Spain around 40% of the participants had not received any vaccination yet only 1,189 were asked to complete all the questions.

Measures

Vaccine Attitudes and Intentions

The VAX scale was used to measure the negative attitudes toward vaccines (14). To answer this 12-item scale, participants were asked to focus on the specific COVID-19 vaccine they had received.

The VAX scale has been already adapted and translated into Spanish (16). In the present research, the VAX scale was translated from English to Spanish by author II (back-translation verified by another co-author JA) and finally revised by all co-authors who are experts in medicine and epidemiology. Internal consistency for the 12-item showed excellent internal consistency (Cronbach's $\alpha = 0.92$). In agreement with our results, the VAX scale has been recently used in several investigations, showing a good validation of this scale in the context of the COVID-19 pandemic (9, 17, 18).

Responses were rated on a 6-point scale from 1 "strongly agree" to 6 "strongly disagree."

Then, four sub-scales (1) mistrust of vaccine benefit (e.g., "I feel safe after being vaccinated."), (2) worries about the unforeseen future effect (e.g., "I worry about the unknown effects of vaccines in the future"); (3) concerns about commercial profiteering (e.g., "Vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people."); and (4) preference for natural immunity (e.g., "Natural immunity lasts longer than a vaccination.") (14), including three-items each respectively, were calculated. Therefore, a higher total score indicates more positive attitudes toward vaccinations, with three of the initial 12-items being reverse coded.

For descriptive purposes, the four subscales and the attitude toward vaccine question were grouped into high (a score of 5–6 on a scale of 1–6), intermediate (score of 3–4), and low (score of 1–2) levels of negative attitudes toward vaccines.

Similarly, the general attitude toward vaccines was assessed with the agreement on the currently recommended child and adolescent immunization schedule and recoded into the low agreement (score of 1–2 on a scale of 1–6), intermediate (score of 3–4), and high (score of 5–6).

All predictor variables were selected by reviewing the existing literature on the topic. Thus, we collected sociodemographic information such as gender (male vs. women), age group (18–25, 26–35, 35–45, 45–55, 56–65, and 65+), migrant status (born in Spain: yes vs. no), educational level (undergraduate; health-sciences-related graduate or postgraduate i.e., medicine, nursing, pharmacy; and non-health-sciences-related graduate or postgraduate), and occupation status (healthcare professional, non-healthcare professional, retired, and unemployed or student).

Moreover, we included some questions about receiving the flu vaccine in the previous year; the possibility of vaccination against COVID-19 ("no, for medical reasons," –i.e., the hematologist recommended not to have it, "No, because I was pregnant," "no, because they did not offer me the vaccine yet," "no, because I just had COVID-19," "no, because I refused to," "yes, but I only got one dose (and I need two doses)," "yes, and I got all doses," i.e., one for Janssen or two for Pfizer, Moderna or AstraZeneca/Vaxzevria;

and the possibility of being vaccinated after knowing previously possible side effects "yes, of course," "yes, but I would think about it more," "I will have doubts," "no, side effects that I had do not make up for it."

Statistical Analysis

For descriptive analyses, percentages and chi-square tests were used to evaluate the associations between sociodemographic characteristics such as gender, age, migrant status, education, and occupational status, and attitudes toward vaccination (agreement with current recommended Child and Adolescent Immunization Schedule, mistrust, worries about unforeseen effects, concerns about commercial profiteering and preference for natural immunity). Subsequently, we conducted generalized linear mixed models to study the associations between occupational status (healthcare professional, retired, unemployed or student, and non-healthcare professionals used as reference). For the above regression, betas and the respective 95% confidence intervals (CI) were estimated. Furthermore, since odds ratio (OR) can be more easily interpret for the reader, multinomial logistic regression models were also conducted after creating binary variables for each factor (four-subscales). As responses were rated on a six-point scale, the four subscales were grouped into a positive attitude (a score of 4–6 on a scale of 1–6) vs. a negative attitude (score of 1–3). All analyses were performed using SPSS version 26.0 (IBM Corporation, New York, NY, United States). The alpha level was set at 0.05, and $p < 0.05$ was considered statistically significant.

Raw models were unadjusted models and adjusted models included gender and sex. Since occupational status and education were highly correlated, educational status was not included as a confounding factor.

Finally, to compare the factor structure of each construct generated from the Spanish sample to the structures obtained in the original US samples, principal components analysis (PCA), was conducted for the VAX-scale used in the survey. PCA results with Varimax with Kaiser normalization to obtain a simple structure were reported in the results section (**Supplementary Table 1**).

RESULTS

Table 1 presents the characteristics of the sample of this study. About 33.1% of the sample were graduates or postgraduates in a Health Science field, and 31.1% had a healthcare occupation. Around 55.2% reported having been vaccinated against COVID-19 (27.6% with necessary doses, 44.8% were not vaccinated yet due to medical reasons (0.6%), pregnancy (0.8%), just had COVID-19 (0.5), or the vaccine had not been offered yet (38.6%). 1.5% of the sample affirmed that the vaccine had been offered but they had rejected the jab. This percentage (rejection of COVID-19 vaccine) was higher among healthcare professionals compared to non-healthcare professionals, students, or those unemployed. Almost half of the sample (47.3%) received a flu vaccine the previous year.

TABLE 1 | Sample characteristics (N = 2,136).

N = 2,136	N	%
Age (in years)		
18–25	307	14.4
26–35	223	10.4
36–45	526	24.6
46–55	480	22.5
56–65	369	17.3
>65	231	10.8
Gender		
Male	690	32.3
Female	1,446	67.7
Born in Spain		
Yes	1,977	92.6
No	136	6.4
Education		
Undergraduate	599	28.0
Graduate or Postgraduate (no Health Sciences related)	827	38.7
Graduate or Postgraduate (Health Sciences related)	710	33.2
Occupation		
Healthcare Professional	664	31.1
Non-healthcare Professional	986	46.2
Retired	157	7.4
Unemployed or Student	329	15.4
Vaccination against COVID-19		
No, for medical reasons	13	0.6
No, because I was pregnant	18	0.8
No, because they did not offer me the vaccine yet	825	38.6
No, because I just had COVID-19	59	2.8
No, because I refused to	32	1.5
Yes, but I only got one dose (and I need two doses)	590	27.6
Yes, and I got all doses	599	28.0
Agreement with current recommended Child and Adolescent		
Low	338	15.8
Moderate	172	13.9
High	1,607	75.2
Missing	19	0.9
Flu vaccine in prior year		
Received a flu vaccine	1,010	47.3
Did not receive a flu vaccine	1,113	52.1
Missing	13	0.6
N = 1.189 vaccinated with at least one dose	N	%
Possibility of being vaccinated after knowing side effects		
Yes, of course	1,057	88.9
Yes, but I would think about it more	34	2.9
I will have doubts	32	2.7
No, side effects that I had do not make up for it	11	0.9
Missing	55	4.6
Trust/Mistrust		
Trust	873	73.4
Uncertain	94	4.4
High mistrust	217	10.2

(Continued)

TABLE 1 | Continued

N = 2,136	N	%
Missing	5	0.4
Worries about future effects		
Low worries about unforeseen vaccine effects	513	24.0
Moderate worries about unforeseen vaccine effects	429	36.1
High worries about unforeseen vaccine effects	242	11.3
Missing	5	0.4
Concerns about commercial profiteering		
Low concerns	485	40.8
Moderate concerns	430	36.2
High concerns	269	22.6
Missing	5	0.4
Preference for natural immunity		
Low preference	426	19.9
Moderate preference	497	23.3
Strong preference	261	22.0
Missing	5	0.4

Around 10.2% of the sample manifested high mistrust about the safety of the vaccine, 11.3% expressed high worries about the unforeseen vaccine effects, 22.6% reported high concerns about commercial profiteering and 22.0% expressed strong preference.

Regarding the question of whether they would still be willing to receive the vaccine had they known the side effects they experienced, 88.9% of the sample had no doubts about being vaccinated. Nevertheless, 2.9% expressed that they would think about it more, 2.7% said to have some doubts and 0.9% had regrets due to the experienced side effects.

To investigate the validity of the VAX scale in Spanish and refute the existence of the four factors (the four abovementioned sub-scales), we conducted PCA. As shown in **Supplementary Table 1** the number of extracted factors was four and they accounted for 79.79% of the explained variance. The Varimax rotated solution for the VAX-scale was presented.

Table 2 shows attitudes toward vaccines (agreement with current recommended Child Immunization Schedule and the four domains of the VAX scale trust/mistrust, worries about unforeseen effects, concerns about commercial profiteering, preference for natural immunity) by gender, age, migrant origin, education status, and occupation (in percentage).

By gender, women showed a statistically significantly higher percentage of mistrust (19.6%) compared to men (14.8%). By age, younger adults (18–25 years old) presented a higher percentage of 1) lower agreement with recommended child and immunization schedule (23%) and 2) worries about unforeseen effects (26.7%) compared with elderly (12.5 and 18.1%, respectively). Those who were not born in Spain had a statistically significantly higher percentage of lower agreement with the recommended child immunization schedule (16.1 compared with 14.1% of those born in Spain.

By education, those who were graduates or postgraduates in a field related to health sciences showed a higher agreement

TABLE 2 | Attitudes toward vaccines (agreement with current recommended Child Immunization Schedule, trust/mistrust, worries about unforeseen effects, concerns about commercial profiteering, preference for natural immunity) by gender, age, migrant origin, education status and occupation (in percentage).

In percentage (%)	Agreement with recommended Child immunization schedule			Trust/Mistrust			Worries unforeseen effects			Concerns commercial profiteering			Preference for natural immunity		
	Low	Moderate	High	Trust	Uncertain	High mistrust	Low	Moderate	High	Low	Moderate	Strong	Low	Moderate	High
Gender															
Male	15.1	8.2	76.7	79.0	5.6	14.8	45.3	31.1	23.1	43.2	37.3	18.9	34.9	40.2	24.3
Female	16.4	8.1	75.6	71.2	8.8	19.6	42.3	38.1	19.3	39.8	35.7	24.1	36.2	42.4	21.0
p-value		0.267			**0.036**			0.120			0.261			0.601	
Age (in years)															
18–25	23.0	5.6	71.4	73.8	3.3	22.4	27.6	45.2	26.7	46.7	34.3	18.6	42.9	38.6	18.1
26–35	17.0	13.0	70.0	69.8	7.3	22.9	36.5	39.6	24.0	39.6	40.6	19.8	47.9	36.5	15.6
36–45	16.4	9.8	73.8	69.1	9.9	20.9	45.5	33.0	21.5	38.2	37.2	24.6	35.1	41.9	23.0
46–55	14.1	8.6	77.3	75.3	6.9	17.8	47.2	33.3	19.5	41.4	35.6	23.0	35.6	45.4	19.0
56–65	13.3	6.0	80.7	75.4	8.1	15.8	46.5	36.7	16.2	43.4	34.0	21.9	33.0	42.4	23.9
>65	12.5	5.4	82.1	74.2	11.3	13.6	51.1	29.9	18.1	33.9	38.5	26.7	28.5	43.4	27.1
p-value		**0.008**			0.104			**0.001**			0.508			0.073	
Born in Spain															
No	14.1	7.6	69.6	66.0	14.9	18.4	42.6	34.0	23.4	36.2	38.3	25.5	29.8	42.6	27.7
Yes	16.1	16.3	76.4	73.6	7.5	19.1	42.9	36.2	20.5	41.1	35.8	22.6	36.1	41.5	21.9
p-value		0.120			0.480			0.470			0.832			0.634	
Education															
Undergraduate	15.4	8.1	76.5	75.4	8.5	15.9	46.5	35.4	17.8	34.6	41.1	24.1	33.7	44.8	21.2
Graduate or Postgraduate (no Health Sciences related)	16.8	10.3	72.9	71.2	9.7	18.7	47.9	32.7	19.1	38.5	37.0	24.1	35.0	42.4	22.2
Graduate or Postgraduate (Health Sciences related)	15.5	5.6	78.8	73.2	6.7	19.5	39.0	38.0	22.5	45.6	32.8	21.1	37.5	39.7	22.3
p-value		0.942			0.606			0.186			**0.049**			0.846	
Occupation															
Healthcare professional	16.8	4.0	79.2	74.1	6.7	18.8	44.1	35.2	20.3	42.2	34.6	22.8	35.2	41.6	22.8
Retired	11.1	4.1	84.8	74.8	8.6	15.2	50.3	28.5	19.9	31.1	37.7	29.8	27.8	43.0	27.8
Unemployed or Student	19.3	3.9	76.8	74.2	6.6	19.2	30.6	44.1	25.3	46.3	35.4	18.3	43.7	38.9	17.5
Non-healthcare professional	16.1	5.7	78.2	70.7	11.0	18.0	47.7	28.5	19.9	38.9	38.9	21.9	35.0	43.8	20.8
p-value		0.426			0.326			**0.001**			0.066			0.061	

In bold significant results of Pearson Chi-Square.

	Unadjusted model		Adjusted model	
	β	95% CI	β	95% CI
Occupation				
Agreement with recommended Child Immunization Schedule				
Healthcare professional	−0.10	−0.27−0.07	−0.09	−0.27−0.08
Retired	**−0.49**	**−0.78−0.19**	**−0.50**	**−0.99−0.16**
Unemployed or Student	−0.01	−0.23−0.21	−0.26	−0.55−0.02
Non-healthcare professionals	Ref.		Ref.	

Statistically significant results are shown in bold font. Adjusted models were adjusted for age and sex.

with the current recommended child immunization schedule (78.8%) and lower concerns about commercial profiteering (21.1%) compared with those with studies in a different field (72.9, 24.1%, respectively).

By occupation, healthcare professionals had a higher percentage of agreement with the current recommended Child Immunization Schedule (78.2%), a lower percentage of worries about unforeseen effects (44.1), and lower concerns of commercial profiteering (42.2%) compared with non-healthcare professionals (73.1, 47.7, and 38.9%, respectively).

The lowest level of negative attitudes (or the highest level of positive attitudes toward vaccines) was shown by retired people compared with unemployed/students, healthcare professionals, or non-healthcare professionals.

Supplementary Table 2 indicates the intention to vaccinate by occupation status in percentage. The present crosstab shows that most of the healthcare professionals in Spain were already vaccinated with all necessary doses (64%). Besides, 2.1% of the healthcare professionals reported not to have been vaccinated because they refused to, compared to unemployed or students (0.3%), non-healthcare professionals (1.3%), or retired (2.5%).

Results from Generalized Linear Mixed Models to study the associations be between agreement with current Child Immunization Schedule and occupational status are presented in **Table 3**. Models (unadjusted and unadjusted) showed a statistically significant higher agreement with the current Child Immunization Schedule and occupational from retired people (beta =-0.5; 95% CI =-0.99–0.16) compared to non-healthcare professionals.

Finally, **Table 4** presents results from Generalized Linear Mixed Models to study the associations between occupational status and negative attitudes toward vaccines (mistrust, worries about unforeseen effects, concerns about commercial profiteering, and preference for natural immunity). Those who were unemployed, or students presented higher worries about unforeseen effects of vaccines compared to non-healthcare professionals (beta = 0.39; 95% CI = 0.17–0.62). After adjusting for age and sex this relationship was no longer significant (beta = 0.23; 95% CI = −0.08–0.53). No other statistically significant effects were detected. Similar results were found

when conducting multinomial logistic regression models (**Supplementary Table 3**).

DISCUSSION

The present study aimed to investigate the attitudes and intention to vaccinate in a sample of 2,136 adults in Spain. In this cross-sectional analysis, we collected information from May 6 to June 9, 2021, to identify characteristics associated with more negative attitudes and lower intention to vaccinate by occupational status.

In this study, despite a substantial percentage of negative attitudes (above 10% of high mistrust, high worries about unforeseen vaccine effects, and above 20% of high concerns about commercial profiteering and the strong preference for natural immunity), only 1.5% of the total sample claimed they had not been vaccinated because they had refused to do it. Additionally, another 1.4% refused to get the vaccination of which 0.6% was due to pregnancy and 0.8% for medical reasons (i.e., due to my conditions my medical doctor recommended not to get vaccinated).

Nevertheless, contrary to our expectations this percentage (rejection of COVID-19 vaccine) was higher among healthcare professionals (2.1%) and retired people (2.5%) compared with non-healthcare professionals (1.3%), students, or those unemployed (0.3%). These results suggest differences between attitudes and behaviors. Although these results should be more investigated in further studies, we can hypothesize that due to a higher perceived pressure to get vaccinated among healthcare professionals and elderly people these groups might be more likely to reject the COVID-19 vaccine [19].

Also, we have to take into account that there are fluctuations in attitude and also in behavior that have been observed in the Spanish population and other countries and therefore in health professionals [20].

Moreover, when asked whether they would still be willing to receive the vaccine had they known the side effects they experienced, around 90% of the sample had no doubts about being vaccinated. However, 3.6% had some doubts or regrets due to the experienced side effects that did not make up for it. On the one hand when studying the negative attitudes toward vaccines between healthcare professionals and non-healthcare professionals no statistically significant results were found in multinomial linear regressions. A systematic review collecting data until February 2021 found that vaccine acceptance among healthcare professionals varied widely and ranged from 27.7 to 77.3%. Although healthcare professionals had positive attitudes toward future COVID-19 vaccines, vaccine hesitancy was still common, particularly among nurses [21]. Concerns for safety, efficacy and effectiveness, and distrust of the government were the most important barriers cited. Compared to nurses, physicians have a higher level of confidence in vaccines. These results can be explained by the fact that nurses have a lower degree of medical training as well and higher contact with patients, which contributed to lower uptake of vaccines. In our study, we did not ask participants to specify the profession,

TABLE 4 | Associations between occupational status and negative attitudes toward vaccines (mistrust, worries about unforeseen effects, concerns about commercial profiteering, and preference for natural immunity). Results from Generalized Linear Mixed Models.

	Mistrust (unadjusted model)		Mistrust (adjusted model)		Worries unforeseen effects (unadjusted model)		Worries unforeseen effects (adjusted model)		Concerns commercial profiteering (unadjusted model)		Concerns commercial profiteering (adjusted model)		Preference for natural immunity (unadjusted model)		Preference for natural immunity (adjusted model)	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Occupation																
Healthcare professional	0.00	−0.22–0.23	−0.11	−0.35–0.13	0.09	−0.1–0.27	0.06	−0.14–0.25	0.06	−0.17–0.29	0.10	−0.14–0.34	−0.08	−0.30–0.14	−0.16	−0.40–0.07
Retired	−0.15	−0.47–0.16	−0.06	−0.52–0.39	−0.13	−0.39–0.12	−0.13	−0.51–0.23	0.41	−0.73––0.10	−0.41	−0.87–0.06	−0.26	−0.56–0.04	−0.11	−0.55–0.33
Unemployed or Student	0.76	−0.20–0.35	−0.06	−0.44–0.32	**0.39**	**0.17–0.62**	0.23	−0.08–0.53	0.27	−0.01–0.55	0.29	−0.10–0.68	0.24	−0.02–0.51	0.15	−0.22–0.51
Non-healthcare professionals	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	

Statistically significant results are shown in bold font. Models Adjusted models were adjusted for age and sex.

which can be explained why we did not find differences between healthcare and non-health care professionals.

In a survey conducted in Israel, significant differences regarding the intention to vaccinate between physicians, nurses, and the general population were found. A lower acceptance was obtained in nurses (61%) compared with the general population (75%) and doctors (78%) (22). These results are in line with a study conducted in the United States, where nurses and patient care associates were among those with the least intended to be vaccinated in comparison to medical students and physicians who were the highest (23).

Same results were also found in other countries of Europe, such as Belgium, as well as in Asia, such as Hong Kong, where again nurses were unsure about taking the vaccine while physicians had a more positive attitude (24–26).

A deeper knowledge of the vaccine may be the key to achieve higher positive attitudes and behaviors and it can be the cause of the differences found among doctors, nurses, and other health professionals.

Generally, the eligibility criterion used to prioritize vaccination was to start by vaccinating those most exposed, that is, healthcare professionals in contact with patients, and people working in nursing homes (27). Since these healthcare professionals (mainly doctors, nurses, and those professionals working at nursing home residences) have been among the first vaccinated in Spain and can exert an impact on getting people vaccinated, it is essential to increase the positive attitudes among healthcare professionals.

On the other hand, retired people (who are generally people above 65 years old in Spain) had the lowest concerns in vaccines and the highest trust.

Previous studies in Spain observed a low acceptance of the vaccine against COVID-19 in the phase prior to its availability (11, 28). In agreement with a previous study, our results demonstrated that in spite of initial suspicions, Spain has one of the highest acceptance rates worldwide (29).

Along with other studies, women, younger adults (<35 years old), those who were not born in Spain, those who study a degree in a field different to Health Sciences, and those who were unemployed or students presented a higher percentage of negative attitudes toward vaccines compared with men, elderly, native Spanish people, those who study a degree in a field related to Health Sciences and those retired (30, 31).

According to the latest data for Spain (June 22, 2021), there are 50.8% of people received at least one dose of the COVID-19 vaccine (32). Although our data has shown low levels of COVID-19 vaccine rejection in Spain (1.5%), vaccine hesitancy among healthcare professionals is specially concerning.

In view of these results, it seems that knowledge and perceived risk in different age groups or exposure/profession can be determinants in terms of attitude and behaviors. Nonetheless, we have not studied it in detail, and this could be a future line of research.

To our knowledge, this is the first study conducted in Spain to investigate the attitudes toward vaccines and intention to vaccinate against COVID-19 by occupational status and other socioeconomic characteristics with a sample size of 2,136

individuals (of which 31.1% were healthcare professionals) after the approval of the vaccine. In addition, although we used convenience sampling, we have a good representation of different age groups, and women represented 67.7% of the respondents, which is in agreement with the percentages of healthcare professionals in Spain and worldwide (33). Besides, our sample included information from three different cities of medium size in Spain (Zaragoza, Logroño, and Murcia). These cities (specially Zaragoza) are frequently chosen to carry out different studies because the sociodemographic profile and level of income of the sample were representatives of the Spanish population. Hence, the results of the present study could be extrapolated to the whole country (34, 35).

Nevertheless, our investigation has several limitations. This study is not random and therefore is not representative of the Spanish population. Moreover, there are some groups that could be underestimated, in part due to the collection method used, (i.e., men represented 32.3% of the sample or migrants were 6.4%). These differences among groups may affect the results of our study (men and natives appear to have higher positive attitudes compared with women and migrants, respectively). Therefore, the extrapolation of these results can be difficult. Although online questionnaires are simple tools that can offer advantages such as access to different populations and prompt answers, some questions that can arise when auto-filling the questionnaire and could be responded in a face-to-face interview are difficult to address online surveys. Finally, we did not differentiate between the various healthcare professionals, and consequently, future line investigations should discriminate between doctors, nurses, auxiliary nurses, pharmaceutical industry professionals, administrative staff, and also those who are on the front line against COVID-19 and those who are not. Consequently, results should be interpreted and considered based on all that.

CONCLUSIONS

A considerable percentage (between 10.2 and 22.6%) of the present sample showed high levels of negative attitudes toward vaccines (high mistrust, worries about unforeseen effects, concerns about commercial profiteering, and preferences for natural immunity). However, only 1.5% of the sample (2.1% among healthcare professionals) refused to get a COVID-19 vaccine when it was offered because they chose otherwise.

Notwithstanding, healthcare professionals can be at an increased risk of being infected with COVID-19, and no statistically significant effects were found between working in the healthcare field and higher positive attitudes toward vaccines. Developing a strategy to increase positive attitudes against the COVID-19 vaccine should be an objective for public health policy.

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 Comité de Ética de la Investigación de la Comunidad Autónoma de Aragón (CEICA). Affiliation: Instituto Aragonés de Ciencias de la Salud (IACS). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

II analyzed the data and drafted the manuscript. BM-J and ES critically revised the manuscript for important intellectual content. All authors contributed to the design of the study, approved the final version, and take responsibility for the content.

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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.2021.739003/full#supplementary-material

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Mental Health Disorders in Nurses During the COVID-19 Pandemic: Implications and Coping Strategies

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Nurses caring for patients who contract coronavirus disease 2019 (COVID-19) have experienced significant traumas in the form of increased workloads, negative patient outcomes, and less social support system access. Nurses should be provided with information regarding early detection, coping skills and treatment for anxiety, depression, post-traumatic stress syndrome (PTSS)/post-traumatic stress disorder (PTSD), and other mental health disorders. Early intervention is important as mental health disorders can cause dysfunction, internal suffering, and in the most extreme situations, lead to death if not properly cared for. Healthcare corporations should consider providing coverage for mental health treatment for employees who experience COVID-19 traumas. With the implementation of healthy coping skills and therapeutic intervention, nurses will be able to let go of the negative impacts that the COVID-19 pandemic has caused and reintegrate into their roles as caring and entrusted health care providers. The current paper evaluates the mental health disorders encountered by nurses in the COVID-19 era based on the current medical literature and aims to provide practical coping strategies.

Keywords: mental health disorders, COVID-19, pandemic, coping skills, health care workers, health care providers

INTRODUCTION

According to the Gallup's Most Honest and Ethical Professions Poll, for the last 19 years, Americans have rated nurses highly regarding honesty and ethical standards (1). Nurses are held to a high ethical standard and entrusted with a significant amount of patient care duties. During the Coronavirus 2019 (COVID-19) pandemic, expectations have risen, with greater emphasis has been placed on public health decision-making. Health care providers (HCP), including nurses, have been under a tremendous amount of pressure and have continued to be the society leaders in guiding the public during the pandemic. Nurses have been asked to pick up extra shifts, work late, and skip breaks all in a continuously high-stress environment. The patient-to-staff ratio is strained considering the number of medically unstable COVID-19 patients, and nurses have experienced negative patient outcomes and death at high rates. Under normal situations, nurses devote extra time to patients who are severely ill or those who are psychologically struggling with their illness. However, during the COVID-19 pandemic, this has not been possible. Nurses have not been able to provide their usual standard of care or emotional support which goes against their core nature; to help others to the best of their capabilities. Nurses have also been working at a faster pace due to the high burden of COVID-19 admissions. When there is a negative outcome, the COVID-19 unit

often does not have time to debrief, which does not allow time for individuals to fully process the trauma, experience grief, and subsequently recover (2, 3).

These conditions can impact the mental health of nurses and lead to the development of depression, anxiety, post-traumatic stress symptoms (PTSS), post-traumatic stress disorder (PTSD), and other mental health disorders. Prior to COVID-19, nurses may have been visited by family and friends, routinely exercised outdoors or in the gym or been involved in social group activities such as athletic teams or extracurricular clubs. However, social distancing has limited typical coping skills used for handling difficult, stressful, traumatic, and emotionally exhausting situations. These traumatic events often have a delayed impact on an individual's mental health. Those who have been traumatized by the COVID-19 pandemic may not currently be aware of the negative implications they will face in the future. Mental health awareness is critical as trauma will often impact work performance. Individuals may experience, irritability, sleep changes, and social or communicative withdrawal after traumatic events (4).

Working under poor conditions while not being able to provide excellent care to patients has been and will continue to impact the mental well-being of nurses as well as other HCP. The novel and overwhelming aspects of added ethical and patient care responsibility has contributed to an increased development of mental health disorders in nurses (5). The consequences of overlooking this problem could be devastating. Nurses must be supported to sustain a healthy mindset during these unprecedented times (5). This may be done through increased awareness of coping skills and professional services which can provide mental health relief related to the negative impacts of COVID-19. The current paper evaluates the mental health disorders encountered by the nurses during the COVID-19 era based on the current medical literature, assesses its implications, and aims to provide practical coping strategies.

MENTAL HEALTH DISORDERS DURING COVID-19 AND PAST PANDEMICS

To help nurses cope with COVID-19 related trauma, the relationship between COVID-19 and the development of PTSS and PTSD must be elucidated. Studies have shown that during the outbreaks of severe acute respiratory syndrome (SARS), Middle East respiratory syndrome Coronavirus (MERS-CoV), and COVID-19 the development of PTSD-like symptoms have ranged between 11 and 73.4% with 51.5% of HCPs scoring above the Event Scale-Revised (IES-R) threshold for PTSD diagnosis. It was also found that HCPs during the COVID-19 pandemic have had a higher rate of PTSD-like symptoms (71.5–73%) when compared to rates during the SARS outbreak (5%) (6).

One study predicted that between 10 and 40% of HCP will have a manifestation of PTSD between 1 and 3 years after a pandemic (6). This rate is particularly concerning when considering that coping skills and treatments for PTSD/PTSS are not easily assessable or well-known within the HCP community.

A recent study by Chen et al. investigated the development of PTSD-like symptoms in nurses working with COVID-19 patients. It was found that women nurses, working in ICUs and COVID-19 designated hospital and departments were at the highest risk of developing PTSD-like symptoms (7). In a meta-analysis looking at the prevalence of anxiety, depression, and insomnia during COVID-19, rates were found to be 23, 28, and 39%, respectively (8). A higher rate of affective symptoms was reported by nurses and female HCP. These findings suggest that hospitals should prioritize appropriate psychological support and treatment for these specific at-risk HCP groups.

PTSD and PTSS are not the only mental health disorders that HCP may experience related to COVID-19. A study by Zhang et al. in 2020 showed that a large percentage of HCP who developed PTSD during the COVID-19 pandemic also experienced higher rates of anxiety (30.71%) and depression (71.26%) (4). Anxiety and depression can have lasting and devastating consequences. Krishnamoorthy et al. (9) published a systematic review and meta-analysis looking at the mental health of HCP and found that stress, psychological distress, sleep quality, insomnia, anxiety, and depression were all increased secondary to COVID-19.

Aside from HCP, patients who had suffered from a COVID-19 infection were the only group to have a greater psychological burden reported. Furthermore, nurses and other HCP may be more likely to be exposed to COVID-19 due to their close proximity with sick patients. In a study looking at HCP who were exposed to SARS, MERS, or COVID-19, Salazar et al. (10) found that psychological distress (38%), fear (44%), anxiety (29%), depression (26%), PTSD (21%), somatization (16%), and burnout (34%) were all increased. Poor working conditions and the possibility of a COVID-19 exposure have a clear negative impact on the mental health of HCP.

RISK FACTORS FOR THE DEVELOPMENT OF MENTAL HEALTH DISORDERS IN HCP

The United States (US), when compared to 16 other countries, has one of the highest reported rates of exposure to traumatic events, defined as the "exposure to actual/threatened death, serious injury or sexual violation leading to flash backs, avoidance, negative cognitions, mood, and arousal symptoms" (11). While not all individuals who encounter trauma go on to develop PTSD, the populations most at risk for developing this disorder are younger females, those lacking social support, and economically marginalized individuals (11). Since a large proportion of the nursing population consists of young female workers who lack social support due to social distancing restrictions, this population is at a higher risk of developing PTSD in the current COVID-19 crisis (11).

In addition to national social distancing protocols implemented during the COVID-19 pandemic, nurses may be even further impacted due to self-imposed isolation practices. Some nurses have been living away from home in hotels so as to not put their family members at risk of contracting COVID-19. This extreme degree of isolation may contribute to an even

Risk factors for the Development of Mental Health Disorders During COVID-19 in Nurses
- Social isolation
- Female
- Younger age
- Economically marginalized
- Working directly with COVID-19 patients
- Lack of control at workplace
- Fixed work schedule
- Alcohol and substance abuse

FIGURE 1 | Risk factors for the development of mental health disorders during COVID-19 in nurses.

greater percentage of nurses being affected by mental health disorders (12).

In a study by Cui et al., the impact of socio-psychological and working condition variables on the development of anxiety in nurses during COVID-19 was evaluated. It was found that nurses who were female, had less rest time, and lacked confidence in fighting the pandemic were at risk for developing anxiety. In addition, while nurses with families at home may experience greater levels of social support, they were also more likely to develop anxiety as they feared infecting these family members after working on the COVID-19 front-line (13).

Saeed et al. investigated risk factors associated with depression in South Asian HCP during COVID-19 and found that female gender, younger age, and a fixed working schedule were independent predictors of depression. Female HCP were 1.6 times more likely to develop depression compared to their male colleagues, hypothesized to be due to the difficult balance of home and work responsibilities. In young HCPs, depression was more common potentially due to more difficult and demanding work duties as compared to senior colleagues. It was also found that nursing staff specifically was most at risk for the development of depression. Given that nurses are often, young, female, and have fixed work schedules, this study mirrors the previous findings (14) (**Figure 1**).

SUPPORT DURING THE COVID-19 PANDEMIC

A weak social support system is one of the greatest risk factors associated with the development of PTSS/PTSD (4). During the SARS outbreak, social and familial support was found to be protective against the development of PTSS/PTSD and nurses who had a strong support system were less likely to develop acute stress disorders which positively impacted their daily activities (4). Individuals who had someone to talk to regarding their work experiences were less at risk of developing PTSS, while individuals who tended not to vent about their experiences had higher levels of PTSS (15, 16). During the South Korea MERS outbreak, it was found that supervisor and colleague support was beneficial in the reduction of PTSS (15, 16).

In a systematic review by Sirois et al. (17) in which factors associated with psychological distress in HCP during an infectious disease outbreak were examined, 19 studies that specifically looked at the impact of social support found that this was a key protective factor. A meta-analysis revealed decreased social support was one of the most important risk factors among the 25 potential risk factors of PTSD. Having access to adequate economic assistance, psychological interventions, and sufficient social support may help alleviate PTSD symptoms in HCP (4). Similar findings were observed during the SARS outbreak as a greater level of family support was associated with the reduction of depression and anxiety levels (18). During the MERS outbreak poor family/friend support was associated with higher levels of burnout (19). During pandemics, having a strong social support system helped protect nurses against the development of acute stress symptoms (15, 16). Whether support was from family, friends, supervisors, and colleagues, it significantly decreased mental health disorders. In studies during the COVID-19 pandemic, social support significantly lowered levels of PTSD, anxiety, depression, and stress (20, 21).

In a study by Heath et al., social support before and during traumatic events was seen to decrease psychological injury experienced by HCP. It was also found that HCPs who had meaningful personal and professional relationships had a lower risk of burnout (22). As burnout is often related to increasing levels of stress, anxiety, and depression, social support may substantially decrease the burden of these mental health disorders leading to greater job satisfaction and job retention.

Organizational support in addition to personal, familial, or friend relationships has also been shown to buffer the development of mental health disorders. In nurses working during the SARS pandemic in Canada, the perception of a high level of organization support (i.e., positive feedback on job performance given by co-workers or doctors) was correlated with decreased levels of emotional exhaustion and overall positive attitudes toward the outcomes of the virus (23). During the SARS, MERS and COVID-19 pandemic, HCP who had positive perceptions toward colleagues and supervisors had lower levels of psychiatric symptoms such as PTSD and distress (17).

METHODS

A review of the medical literature was performed to find articles proposing strategies to cope with mental health related issues that may occur in the context of a pandemic. Due to the extensive

nature of this topic with a wide range of disorders and strategies, a systematic review was not performed. However, the medical literature was extensively analyzed so as to provide an overview of the following coping strategies: mindfulness and moral resilience, cognitive behavioral therapy, cognitive processing therapy, emotional freedom technique, prolonged exposure and eye movement desensitization and reprocessing therapy, and motor interference therapy and traumatic memories. The authors searched for these terms and selected articles that were applicable to the mental health disorders experienced in the context of the COVID-19 pandemic and were practical in implementation. In addition to an extensive literature search, the references of those publications that were reviewed were also reviewed so

as to capture all relevant articles. Overview of these common coping strategies aimed to allow for better resilience and fortitude for healthcare workers suffering from COVID-19 related mental health disorders.

COPING STRATEGIES FOR MENTAL HEALTH DISORDERS

Mindfulness and Moral Resilience

Nurses should focus on developing moral resilience when caring for patients with COVID-19. Moral resilience describes when one is able to confront distressful and uncertain situations with courage and confidence through reliance on a strong

Mindfullness and Moral Resilience

- Develop strong values and beliefs
- Breathing techniques
- Guided imagery
- "Calm", "Headspace" Apps

Cognitive Behavioral Therapy (CBT)

- Multiple formats, can use online courses
- Recognition and identification of thought patterns and replacement with positive coping skills

Cognitive Processing Therapy

- Education, information, developing skills, and changing beliefs
- Identification of poor coping skills

Emotional Freedom Techniques (EFT)

- Combination of somatic and cognitive therapy
- May use CBT, exposure therapy, and acupuncture

Prolonged Exposure (PE) and Eye Movement Desensitization and Reprocessing Therapy (EMDR)

- Confrontation and exposure leads to habituation or extinction
- Distraction from trauma through eye movements

Motor Interference Therapy and Traumatic Memories

- Combination of cognitive tasks and motor interference
- Cost effective

FIGURE 2 | Overview of coping strategies used to prevent the development of mental health disorders during COVID-19.

system of values and beliefs (**Figure 2**). Moral resilience helps keep individuals in check, allowing the mind to contextualize a situation and understand when events are out of one's control. The concept of moral resilience must be gradually built and developed by an individual and requires persistence and experience. Strategies that help build moral resilience include practicing mindfulness and focusing on strengthening the parasympathetic nervous system to positively react to stress (i.e., through deep breathing exercises) (5).

Mindfulness is a form of meditation where an individual focuses on current sensations and feelings in a specific moment without applying any thoughts to those feelings. While focusing on one's senses and feelings, the individual can apply relaxing practices such as breathing techniques and guided imagery to help the body and mind remain calm. This results in mental clarity and reduction of stress. In conjunction with moral resilience, practicing mindfulness has been shown to help calm the sympathetic nervous system by lowering stress hormones such as epinephrine, norepinephrine, and cortisol which are involved in the body's fight-or-flight response (24).

Focused breathing excises and keeping a clear and calm mindset prior to entering the room of a patient can help nurses tolerate inevitable stress and trauma that they will face. With nurses focused on work instead of anxiety, stress, and fear they can provide better patient care with greater efficiency. The development of mindfulness and parasympathetic nervous system strengthening strategies can be achieved through apps such as "Calm" or "Headspace." With the help of these tools, nurses can respond to ethical issues in a more positive way (5).

Cognitive Behavioral Therapy (CBT)

Cognitive Behavioral Therapy (CBT) has also been shown to be effective in the treatment of depression, anxiety, and PTSD. This therapy is a collaborative psychological treatment that may be given in various formats (group, individually) and with various levels of support systems present (i.e., parents, family, friends). CBT intervention involves the recognition of certain emotions or feelings, the identification of thoughts or triggers associated with the feeling, and the development of coping skills to use when the feelings are experienced. Coping skills may include modifying negative self-talk into positive-self talk, problem solving skills, and relaxation training, among others. In a systematic review and meta-analysis on the use of CBT in individuals with anxiety, it was found that CBT increases post-treatment remission in all anxiety diagnoses (25). It was also found that for patients with anxiety specifically, CBT was found to potentially be more effective than other attention control therapies (25).

In a study looking at the effects of CBT on sleep quality in HCP during the COVID-19 pandemic, it was found that an online CBT course improved sleep quality (26). As poor sleep quality often can contribute to mood disorders, and vice-versa, using CBT to improve this function may have benefits for HCP experiencing the early or more advanced symptoms of a mental health disorder. In a similar study by Weiner et al., the authors performed a randomized controlled trial to investigate the impact of online CBT on the stress levels, depression, and insomnia in HCP. It was found that a brief CBT program significantly decreased perceived stress levels and improved or prevented severe psychiatric disorders like PTSD and depression (27). The user friendly and easily accessible online CBT platforms that these studies mention may allow for nurses and other HCP to use CBT while still safely practicing social distancing. HCPs may also access CBT at convenient times that fit into their busy schedules.

Cognitive Processing Therapy

For individuals who have experienced trauma, cognitive processing therapy may be beneficial. Cognitive processing therapy is a form of CBT that follows a four-step process: education, information, developing skills, and changing beliefs. Using this approach in conjunction with a trauma therapist, nurses can start to identify mental health disorder symptoms and better understand how to recognize their thought and feeling patterns. Cognitive processing therapy can also help nurses understand how past traumas are directly linked to the stress, anxiety, and depression they are experiencing (5).

Individuals may greatly benefit from being self-aware of poor coping skills and addressing them appropriately. One study found that nurses and doctors started consuming alcoholic beverages at higher consumption rates and with greater frequency during the COVID-19 pandemic (28). Nurses should be extra vigilant regarding substance abuse as the profession is often ranked among the highest out of all professions for the prevalence of substance abuse (29). Developing poor coping skills during the COVID-19 pandemic could result in negative long-lasting and possibly fatal consequences for individuals. Nurses should be encouraged to spot poor coping skills and seek proper support and treatment accordingly. Cognitive processing therapy is among the many strategies that may be used to identify and alter negative habits. Through education and gathering information regarding the negative impacts of certain habits and developing skills to counteract them, nurses can change their beliefs, and develop more positive ways to deal with trauma.

Emotional Freedom Techniques (EFT)

Another common therapy found to be effective for the treatment of PTSD/PTSS is emotional freedom techniques (EFT). This therapy combines somatic and cognitive therapy in the form of CBT, exposure therapy, and in some cases a form of acupuncture. In a past study looking at the psychological impact of EFT on veterans with PTSD, outcomes were excellent with a significant reduction in psychological distress and PTSD symptoms reported (30). In the same study, when patients who received EFT were compared with those who did not, 90% of the EFT group vs. 4% of the non-intervention group did not meet PTSD clinical criteria. Educating nurses about the efficacy of EFT and providing access to these therapies and techniques ensures that mental health is being considered with a high priority (5).

Prolonged Exposure (PE) and Eye Movement Desensitization and Reprocessing Therapy (EMDR)

Two popular evidence-based trauma-focused treatments used for individuals suffering from PTSD are prolonged exposure therapy (PE) and eye movement desensitization and reprocessing therapy

(EMDR). PE therapy consists of a patient being instructed by a therapist to confront traumatic memories and expose themselves continuously to fearful stimuli with the goal of reaching habituation or extinction (31).

In EMDR therapy, patients are distracted from their disturbing or traumatic memories by using a dual attention task which typically involves eye movements. As these therapies target trauma in different way, individuals suffering from PTSD often benefit from implementing both PE and EMDR in a dual treatment setting. One study indicated individuals who participated in twice a day therapy sessions, with a PE session in the morning and a EMDR in the evening, were found to have higher satisfaction rates and reduced PTSD symptoms (31). The study concluded that PE tends to activate higher rates of fear in PTSD individuals whereas EMDR has been shown to reduce fear and leave a patient feeling relieved and satisfied. Providing PE sessions first and ending the day with EMDR helps an individual's overall levels of fear dissipate throughout the day so that their mind is relaxed at night and ready for sleep (31).

HCPs may benefit from combining PE and EMDR as a treatment option for the PTSS/PTSD symptoms related to the COVID-19 pandemic. One major benefit of both PE and EMDR is that treatment sessions are relatively short-term and shown to be highly effective. In previously mentioned study, patients underwent combined therapy for 2 weeks with a total of eight treatment days. Results showed that PE and EMDR were highly effective in reducing the severity of PTSD symptoms ($r = 0.59$, $p < 0.001$) (31). Having a relatively short-term treatment is convenient for nurses who are often extremely busy with their personal and professional lives. This is also unique as other standard cognitive therapies such as talk therapy may be conducted over the course of months or even years.

EMDR can be used to help reduce anxiety and depression associated the PTSD (11). A review on the topic found that EMDR was more successful at treating anxiety linked to PTSD than CBT. Individuals who are more comfortable with the traditional CBT approach should consider this option for coping with the negative effects of the COVID-19 pandemic, however, supplementing with EMDR therapy may further improve symptoms.

Motor Interference Therapy and Traumatic Memories

Motor inference therapy is effective in treating patients suffering from past traumas. This therapy is inexpensive and involves the combination of cognitive tasks and motor interference (such as finger-tapping). This therapy is similar to EMDR in that a certain task can be used to distract a patient and positively interfere with their traumatic memory processing. One experiment had patients with PTSD listen to audio stimuli which instructed them to finger-tap to certain sounds/cues while recalling their traumatic event. At 1-week post-treatment, 30% of individuals no longer met criteria to be diagnosed with PTSD (32). Like EMDR and PE, motor interference therapy only requires a short duration of treatment and is cost-effective. Therefore, this therapy may be an ideal treatment option for nurses who experience PTSD/PTSS from COVID-19.

DISCUSSION

Nurses caring for patients who contract COVID-19 have experienced significant traumas in the form of increased workloads, negative patient outcomes, and less social support system access. Mental health awareness should be discussed in both the workforce and personal social settings. Nurses should be provided with information regarding coping skills and treatment for anxiety, depression, PTSS/PTSD, and other mental health disorders. Nurses should be aware of the preliminary signs and symptoms of mental illnesses. Early intervention is important as mental health disorders can cause dysfunction, internal suffering, and in the most extreme situations, lead to death if not properly cared for. The COVID-19 pandemic has isolated healthcare workers in ways that are challenging for the general public to comprehend. Healthcare corporations should consider providing coverage for mental health treatment for employees who experience COVID-19 traumas. Institutions should reiterate to nurses and other HCP that they are not alone, there is hope, and that mental health will improve with the seeking of help and time. Due to isolation and social distancing, it is not uncommon to feel alone and hopeless during the COVID-19 pandemic. However, as a community we must support our HCP and make sure they have access and support for whatever care they may need. With the implementation of healthy coping skills and therapeutic intervention nurses will soon be able to let go of the negative impacts the COVID-19 pandemic has caused and reintegrate into their roles as caring and entrusted HCP.

AUTHOR CONTRIBUTIONS

BR and AH conceptualized the paper and wrote the first editions of the manuscript. All authors contributed to the manuscript with their expertise, also read and edited the submitted version, and approved the submitted version.

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Mediating Effect of Work Stress on the Associations Between Psychological Job Demands, Social Approval, and Workplace Violence Among Health Care Workers in Sichuan Province of China

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Objective: The aim of this study was to investigate the prevalence of workplace violence against health care workers, to explore the combined association of work stress, psychological job demands, and social approval with workplace violence and their respective mechanisms among health care workers.

Methods: Using data from the Chinese Sixth National Health Service Survey (NHSS) in 2018 conducted among 1,371 health care workers in Sichuan province of China. A self-administered structured questionnaire was used to collect data on health care workers' socio-demographic and work-related characteristics, work stress, psychological job demands, social approval, and workplace violence. We used structural equation modeling (SEM) to test the hypothesized relationship among the variables.

Results: The results showed that a total of 77.0% health care workers were exposed to workplace violence. Work stress was directly related to workplace violence ($\beta = 2.167$, 95%CI: 1.707, 2.627), while psychological job demands and social approval had indirect associations with workplace violence *via* work stress [$\beta = 0.427$, 95%CI: 0.297, 0.557; $\beta = -0.787$, 95%CI: (-0.941)–(-0.633)]. Both psychological job demands ($\beta = 0.197$, 95%CI: 0.139, 0.255) and social approval [$\beta = -0.346$, 95%CI: (-0.399)–(-0.294)] had direct associations with

work stress, while social approval had direct association with psychological job demands [β = −0.085, 95%CI: (−0.136)–(−0.034)]. Psychological job demands mediated the relationship between social approval and work stress.

Conclusion: Overall, decreasing workplace violence among health care workers requires to promote interventions to reduce work stress and psychological job demands by improving social approval.

INTRODUCTION

Workplace violence is defined as violent events that could invoke implicit or explicit challenge to staff safety, well-being, or health through abusive, threatening, or assaulting behaviors and emotions in their working workplace (1). Such violence ranges from physical violence to psychological violence (2). Physical violence is the use of physical force, such as beating, kicking, slapping, stabbing, shooting, pushing, biting and pinching against another person or group. Psychological violence, on the contrary, includes verbal abuse, bullying/mobbing, harassment and threatening against another person or group. Workplace violence has long been acknowledged as a global problem, particularly among health care workers, the professionals who are most vulnerable to workplace violence (3). Workplace violence from patient and visitor is a primary occupational hazard for health care workers (4).

Numerous studies conducted in different countries have reported high levels of workplace violence among health care workers [e.g., Australia (5), New Zealand (6), and the United Kingdom (7)], and there is a general belief that it is increasing, same in China (8, 9). Exposure to workplace violence may affect health of health care workers (10). Health care workers who were exposed to workplace violence had a lower quality of life than those who were not exposed to workplace violence (11). High anxiety, depressive symptoms and sleep disturbances were also associated with frequent workplace violence (12, 13). In addition, workplace violence significantly affects health care workers' job satisfaction and work engagement (14), declines work enthusiasm and work efficiency, thus leads to increased job burnout and turnover intention (15). Furthermore, workplace violence in the health sector, particularly in developing countries, seriously undermines health service environment (16), the quality of health services, the retention of health professionals and the effectiveness of health care systems (17).

As a result, an increasing amount of studies have been conducted on health care workers to explore risk factors for workplace violence. Traditionally, both patient characteristics (such as having a severe mental disorder), and socio-demographic characteristics of health care workers [i.e., age, gender, education level (18, 19)] predict workplace violence. In addition, work-related characteristics [i.e., profession, department, hospital type, professional title, work in shifts, years of work experience, and previous workplace violence training (20–22)] are considered as influencing factors of workplace violence. In addition, problems in psychosocial work environments may also contribute to the occurrence of patients' aggression (12, 23, 24), including work-related social support, work stress, psychological job demands, perception of the practice environment, etc.

Work stress usually refers to physical and mental health pressures, and body function disorders, due to the imbalance between staff's ability and their objective demands (25). Studies have shown that work stress significantly predicts negative outcomes, such as patient aggression (26, 27). Balducci et al. showed in their study that health care workers' experience of stress at work may make them more vulnerable to workplace violence (24). In a longitudinal study, Magnavita indicated that workers with work strain at baseline had a significant risk of being subject to aggression in the following year (12).

Psychological job demands refer to aspects of a job that require sustained psychological effort (28). It is a combination of stressors such as work load, unexpected tasks, and job-related interpersonal conflict and have mainly been operationalized in terms of work amount combined with time pressure (29). Job demands (including psychological and physical job demands) were identified as significant predictors of workplace violent threat. High levels of job demands were associated with more patient aggression among health care workers (12). In addition, as one of the sources of work stress, high levels of job demands also increase work stress (29, 30).

Social approval refers to workers' perception of the practice environment, from the perspective of health care workers, it mainly includes the perception of public trust, recognition and respect for their job, doctor-patient relationship, etc (31). Practice environment was demonstrated to be associated with workplace violence against health care workers. Previous study has showed that nurses who worked in poor practicing environment had greater odds of experiencing violence (32). The literature has shown that lack of trust and respect in the workplace are two antecedents of workplace conflict among nurses (33). Trenoweth found that the development of nurse-patient relationship is a protective factor against violence risk (34). Moreover, supportive practice environment, as a kind of job resource, can also increase work engagement and reduce the time required, thus decreasing psychological job demands through the motivation process (35). In addition, poor practice environment [like unsatisfactory doctor-patient relationship (36), lack of respect

by the community (37)] also increase work stress among health care workers.

Previous studies have examined the relationships between one of the above psychosocial work environments factors and workplace violence among health care workers, but comparatively little is known about the combined effects of these three factors or the underlying mechanisms of the relationships. Based on the above, we examined the relationships among work stress, psychological job demands, social approval, and workplace violence in health care workers in Sichuan province of China. The hypothesized model is shown in **Figure 1**. Specifically, work stress has a direct positive effect on workplace violence (hypothesis 1), social approval has direct negative effect on workplace violence (hypothesis 2), work stress (hypothesis 3), and psychological job demands (hypothesis 4). We also hypothesize that psychological job demands have direct positive effect on both workplace violence (hypothesis 5) and work stress (hypothesis 6). In addition, we suggest that the relationship between social approval and workplace violence is mediated by work stress (hypothesis 7), the relationship between psychological job demands and workplace violence is mediated by work stress (hypothesis 8) and the relationship between social approval and work stress is mediated by psychological job demands (hypothesis 9).

This study is the first to explore the combined association of work stress, psychological job demands, and social approval with workplace violence and their respective mechanisms among health care workers in China. Findings from this study may provide important references for strategies to decrease workplace violence and improve medical service environment, promote health care workers' job satisfaction and health, increase effectiveness and quality of medical care.

MATERIALS AND METHODS

Settings and Participants

This research used data from the Chinese sixth National Health Service Survey (NHSS) in 2018, conducted among health care workers in Sichuan province, China. All health care workers who had a practicing qualified certificate on file in the tertiary hospitals, secondary hospitals, community health centers, and township hospitals of Sichuan Province were eligible to be study subjects.

Multistage stratified random sampling was used to acquire the study sample. In the first stage, 14 cities were randomly selected from 21 prefecture-level cities. In the second stage, all the third-class comprehensive hospitals and some of the second-class hospitals were selected in the 14 cities, and a total of 70 towns and communities were randomly selected in these cities. All the community health service centers or township hospitals in the 70 towns or communities were enrolled in the investigated medical institutions. In the third stage, a total of 20 clinical physicians and 10 nurses were selected from each third-class comprehensive and second-class hospital by simple random sampling. Five physicians, three nurses, and two public health workers were randomly selected from each community health service center and township hospital.

The questionnaire was self-administered. Informed consent was obtained from each health care worker following a detailed explanation about the purpose of the study. A total of 1,685 health care workers were eligible to participate in 2018. We excluded 314 questionnaires from analysis because information was incomplete, with 1,371 questionnaires valid in this analysis (effective response rate: 81.4%).

Ethical Consideration

The study protocol was approved by the ethics committee of the National Health Commission of the People's Republic of China. Verbal consent was obtained from each participant following a detail explanation about the purpose of the study.

Measures

Respondents' socio-demographic and work-related characteristics, perceived work stress, psychological job demands, social approval, and exposure to workplace violence were collected using questionnaires.

Socio-Demographic and Work-Related Characteristics

Socio-demographic characteristics included age, gender, marital status, education level, individual annual income. Work-related characteristics included practice setting, profession, professional title, management responsibility, working in shifts, and hours worked per week.

Work Stress

The Chinese version of the Effort-Reward Imbalance (ERI) model was used to measure work stress (38). The ERI model is suitable for research on work stress in health professions (39) and consists of three dimensions: extrinsic efforts, rewards, and overcommitment. The items are scored from 1 to 4, with higher scores indicating higher demands of efforts, overcommitment, and rewards. Effort-reward ratio (ERR) was calculated using a predefined algorithm that quantifies the degree of mismatch between high cost and low gain. The ERI ratio (ERR) is given by [effort score/(reward score * k)], where k is a correction factor. The correction factor is the ratio of the number of items of effort and rewards used to adjust for unequal items on the subscales (3/7 = 0.4286 in this study). An ERR of >1 reflects a perception of an imbalance between efforts and rewards. In this study, we used ERR and overcommitment as observation variables to measure work stress. In this study, the Cronbach's Alpha coefficients of the scale was 0.736.

Psychological Job Demands

Psychological job demands were assessed with three items derived from the Chinese version of Job Content Questionnaire (C-JCQ) (40): (1) My work requires a high level of skill, (2) My work requires me to take on a lot of responsibilities, (3) My work requires long periods of intense concentration on the task. Four-point Likert scale ranging from 1 (highly disagree) to 4 (highly agree) was utilized to evaluate all these items, a higher score indicated higher identification of psychological job demands. The Cronbach's Alpha coefficients of this scale in this study was 0.774.
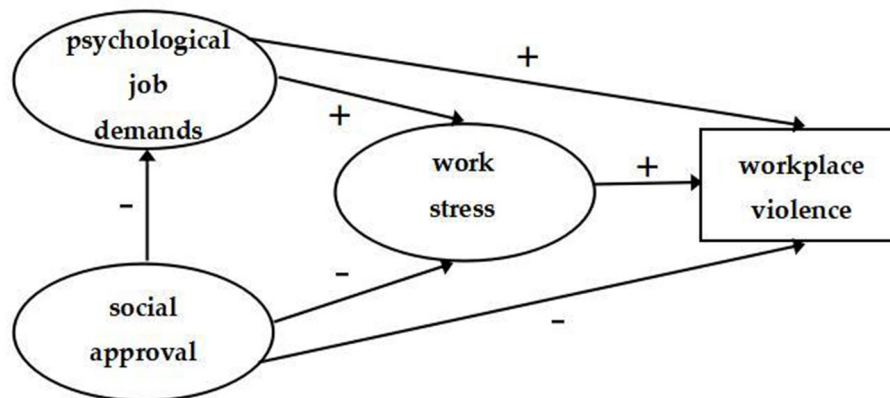
FIGURE 1 | The theoretical model and hypotheses.

Social Approval

Social approval was assessed by a five-item survey asking participants to answer five questions about the practice environment they perceived, including patients' trust, respect, and recognition to health care workers, the public respect for them and patient-doctor relationship. Items are rated on a five-point Likert scale from 1 (very low or poor) to 5 (very high or good). The total score was calculated by adding the response score for each item and ranged from 5 to 25 (5–11 = low; 12–18 = moderate; 19–25 = high) with higher scores indicating higher social approval. In the current study, Cronbach's alpha of the scale was 0.814.

Exposure to Workplace Violence

The exposure status of workplace violence was categorized into two basic types: 0 for no and 1 for yes. Workplace violence was defined in this study as any incident where health care workers experiences any of the following: (1) verbal abuse, (2) physical abuse, and (3) emotional abuse (such as hurtful attitudes or remarks). Health care workers were asked to indicate if they had experienced any of the three types of violence within the past 6 months.

Statistics Analysis

Data were entered using the Epidata 3.1 database and were analyzed using the IBM SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) and Mplus 7.11 (Muthén & Muthén, Los Angeles, CA, USA).

We first used descriptive statistics to examine socio-demographic and work-related characteristics of participants, and workplace violence status. Second, we undertook a descriptive analysis of respondents' work stress, psychological job demands and social approval, using means and standard deviations (SD). Third, a structural equation model (SEM) was employed to further test the hypothesized relationships among work stress, psychological job demands, social approval, and exposure status of workplace violence of respondents.

We performed SEM using the maximum likelihood estimation method to test the hypotheses (41). We used

the subscale score of work stress, psychological job demands and social approval, as measurement variables and the total scores of these measures as latent variables. The binary variable exposure status of workplace violence was also included as a measurement variable. To examine whether the estimated model fit the data, we employed 4-fit indices with their respective cutoffs (42, 43): root mean square error of approximation (RMSEA) < 0.08; Tucker–Lewis index (TLI) and comparative fit index (CFI) values > 0.90; and a χ^2/df of <5. If all indices demonstrate values close to or higher than these cutoff values, the model is considered to have a good fit to the data. Statistical significance was set at $p < 0.05$.

RESULTS

Socio-Demographic and Work-Related Characteristics of Respondents

Table 1 shows the socio-demographic and work-related characteristics of 1,371 respondents. Overall, 1,055 (77.0%) of the respondents experienced workplace violence. The average age of health care workers was 36.9 ± 10.0 years. Over half of the respondents were female (63.8%). Most of the respondents were married (78.8%). 49.9% of the respondents were with associate's degree and below. 47.6% of the respondents had an individual annual income of $7,500–14,999.

Over half of the participants practiced in secondary or tertiary hospitals (61.6%), were physicians (58.0%) and had a junior professional title (52.2%). Only 23.5% of the respondents had management responsibility. 16.3% of the respondents worked 41–48 h per week and 48.4% of the respondents worked more than 48 h per week. Differences are statistically significant in practice setting, profession, shift of work and hours worked per week between respondents with and without workplace violence.

Descriptive Analysis of Study Variable

Table 2 shows scores of the 1,371 respondents' work stress, psychological job demands, and social approval. The mean score

TABLE 1 | Socio-demographic and work-related characteristics of respondents (n = 1,371).

Characteristics	Total n	Without workplace violence	With workplace violence	χ^2	P-value
Socio-demographic Characteristics					
Gender				0.333	0.564
Female	875	206 (23.5)	669 (76.5)		
Male	496	110 (22.2)	386 (77.8)		
Age				1.237	0.539
18–29	366	81 (22.1)	285 (77.9)		
30–44	681	153 (22.5)	528 (77.5)		
$\geq$45	324	82 (25.3)	242 (74.7)		
Marital status				0.033	0.856
Currently single*	290	68 (23.4)	222 (76.6)		
Married	1081	248 (22.9)	833 (77.1)		
Education level				1.911	0.385
Associate's degree and below	684	167 (24.4)	517 (75.6)		
Bachelor's degree	593	126 (21.2)	467 (78.8)		
Master's degree and above	94	23 (24.5)	71 (75.5)		
Individual annual income, $				4.887	0.087
<7,500	578	150 (26.0)	428 (74.0)		
7,500–14,999	653	135 (20.7)	518 (79.3)		
$\geq$15,000	140	31 (22.1)	109 (77.9)		
Work-related Characteristics					
Practice setting				10.664	0.001
Community health centers and township hospitals	526	146 (27.8)	380 (72.2)		
Secondary or tertiary hospitals	845	170 (20.1)	675 (79.9)		
Profession				16.855	<0.001
Physician	795	179 (22.5)	616 (77.5)		
Nurse	425	83 (19.5)	342 (80.5)		
Public health workers	151	54 (35.8)	97 (64.2)		
Professional title				6.824	0.078
No	72	23 (31.9)	49 (68.1)		
Junior	716	172 (24.0)	544 (76.0)		
Intermediate	381	85 (22.3)	296 (77.7)		
Senior	202	36 (17.8)	166 (82.2)		
Has management responsibility				0.407	0.523
No	1049	246 (23.5)	803 (76.5)		
Yes	322	70 (21.7)	252 (78.3)		
Working in shifts				27.927	<0.001
No	413	133 (32.2)	280 (67.8)		
Yes	958	183 (19.1)	775 (80.9)		
Hours worked per week				16.717	<0.001
$\leq$40	484	142 (29.3)	342 (70.7)		
41–48	224	43 (19.2)	181 (80.8)		
>48	663	131 (19.8)	532 (80.2)		

currently single includes single, divorced, and widowed.

of ERR and over commitment were 1.2 ± 0.4 and 17.0 ± 2.7, respectively. 65.3% of the respondents experienced mismatch between high cost and low gain (ERR > 1). The mean score of psychological job demands was 10.8 ± 1.4, 0.6, 21.1 and 78.3% of the respondents had low, moderate and high psychological job demands, respectively. The mean score of social approval was 17.3 ± 3.2, 4.3% of the respondents experienced low social approval, 58.6 and 37.1% of the respondents experienced moderate and high social approval, respectively.

Test of Study Model

We used SEM to test the fitness of the hypothetical model in **Figure 1**. **Figure 2** shows the final model where all paths

were statistically significant and the model had an adequate fit: RMSEA = 0.047, TLI = 0.952, CFI = 0.972 and x^2/df = 4.1.

Table 3 shows the results of hypothesis testing. As expected, work stress had a significant positive correlation with workplace violence (β = 2.167, 95%CI: 1.707, 2.627). Psychological job demands (β = 0.427, 95%CI: 0.297, 0.557) and social approval [β = −0.787, 95%CI: (−0.941)–(−0.633)] had only indirect associations with workplace violence, rather than direct associations. Psychological job demands had a direct association with work stress (β = 0.197, 95%CI: 0.139, 0.255). Social approval had direct association with work stress [β = −0.346, 95%CI: (−0.399)–(−0.294)] and psychological job demands [β = −0.085, 95%CI: (−0.136)–(−0.034)].

Table 4 shows the significance testing of the mediating pathways. In these analyses, if the 95% CI does not include 0, the mediating effect is statistically significant. The results indicated that the relationships of psychological job demands and social approval with workplace violence were both mediated by work stress (95% CI: 0.297, 0.557; −0.900, −0.601). In addition, psychological job demands mediated the relationship between social approval and work stress (95% CI: −0.027, −0.006).

DISCUSSION

The study investigated the prevalence of workplace violence among health care workers in Sichuan province of China, and the purpose of this study was to explore the relationships among work stress, psychological job demands, social approval and workplace violence among health care workers, thereby providing theoretical support for future interventions for decreasing workplace violence among health care workers.

TABLE 3 | Direct, indirect and total effects of key study variables.

Pathways	Estimate	95%CI
Total effects		
Work stress → Workplace violence	2.167	1.707, 2.627
Psychological job demands → Work stress	0.197	0.139, 0.255
Psychological job demands → Workplace violence	0.427	0.297, 0.557
Social approval → Work stress	−0.363	−0.418, −0.308
Social approval → Workplace violence	−0.787	−0.941, −0.633
Social approval → Psychological job demands	−0.085	−0.136, −0.034
Direct effects		
Work stress → Workplace violence	2.167	1.707, 2.627
Psychological job demands → Work stress	0.197	0.139, 0.255
Social approval → Work stress	−0.346	−0.399, −0.294
Social approval → Psychological job demands	−0.085	−0.136, −0.034
Indirect effects		
Psychological job demands → Workplace violence	0.427	0.297, 0.557
Social approval → Workplace violence	−0.787	−0.941, −0.633
Social approval → Work stress	−0.017	−0.027, −0.006

CI, confidence interval.

TABLE 2 | Description of work stress, psychological job demands and social approval.

Contents	Range	mean (SD)
Work stress		
ERR	0.25–4	1.2 ± 0.4
Overcommitment	6–24	17.0 ± 2.7
Psychological job demands	3–12	10.8 ± 1.4
Social approval	5–25	17.3 ± 3.2

TABLE 4 | Significance test of mediating pathway.

Pathways	95%CI
Psychological job demands → Work Stress → Workplace violence	0.297, 0.557
Social approval → Work Stress → Workplace violence	−0.900, −0.601
Social approval → Psychological job demands → Work Stress	−0.027, −0.006

CI, confidence interval.
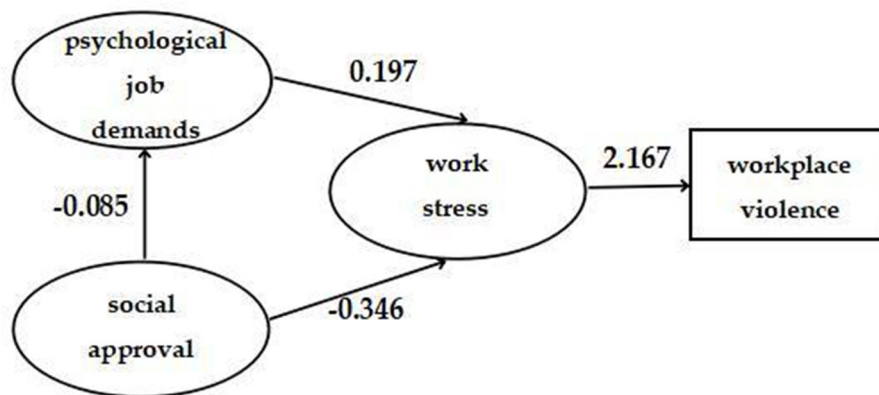
FIGURE 2 | The final model and standardized model paths.

Our findings indicated that overall 77.0% of the health care workers reported the exposure to workplace violence in Sichuan province of China. It is higher than the results from previous studies in China [62.2% in 2015 (44), 68.6% in 2016 (45)]. One possible explanation may be that we included emotional abuse in our definition of workplace violence. In addition, this also indicates that the exposure rate of workplace violence among health care workers in China is generally high. According to Abdellah et al., about 75% of health care workers believe that workplace violence could be prevented (46). Thus, efforts should be strengthened to prevent health care workers from being exposed to workplace violence. In some studies, female health care workers are significantly more likely to be exposed to workplace violence (47, 48). But in this study, no statistically significant differences were found for sex which was consistent with previous research by Hahn et al. (49).

The mean score of overcommitment and ERR among health care workers were 17.0 ± 2.7, 1.2 ± 0.4, respectively, with more than half (65.3%) of the health care workers experiencing effort-reward imbalance. This is consistent with previous study conducted on Chinese health care workers by Cheng et al. (50). This suggests that the effort-rewards imbalance level is not low among health care workers in China. It may due to the fact that health care workers are often exposed to heavy workloads and was offered meager rewards compared to expected rewards. Previous survey that was conducted on Chinese health care workers reported that 12.7% experienced feelings of low self-accomplishment, 41.4% were dissatisfied with their salary, and 41.7% complained of a heavy workload (51). According to the Survey on the satisfaction of health care workers, most health care workers' dissatisfaction with the pay, workload evaluation and promotion opportunities to work were high (52). Thus, many Chinese health care workers face inadequate compensation economically and psychologically and experience an imbalance between the effort they make for their job and the rewards they receive.

The model supported that health care workers' work stress had a direct positive effect on workplace violence which is consistent with previous studies. Pekurinen et al. showed that work stress indicator (ERI) was associated with higher odds of patient aggression (53). Magnavita verified that the relationship between work stress and subsequent workplace violence remained significant even after adjusting for other confounding factors (12). One possible explanation may be that the health care workers who had high work stress and low rewards, are likely to elicit recurrent negative emotions. These negative emotions may result in poor commitment to aggression prevention practices through lowered work motivation, thus leading to the increased patients' dissatisfaction and higher odds of patient aggression (38). Alternatively, the social interactionist perspective has also suggested that stressed health care workers are likely to make more errors than their peers and are therefore perceived as less competent and targeted as victims of aggression (54). Therefore, to decrease workplace violence, efforts should be strengthened to decrease health care workers' work stress.

The results revealed that the psychological job demands of health care workers were high with a mean score of 10.8 ± 1.4. The model results supported that health care workers with higher psychological job demands were more likely to experience workplace violence which is consistent with previous studies (53). In the current study, we found that the relationship between psychological job demands and workplace violence was indirect rather than direct, with work stress functioning as the mediator. These findings are a meaningful addition to the existing literature and suggest that high psychological job demands cause health care workers to experience more work stress. One possible explanation may be that high psychological job demands lead to work stress for the health care workers, leading to interpersonal conflicts between two parties, which, when unresolved, will evolves into a bullying behavior (20). Thus, to prevent workplace violence, hospital managers should take organizational measures such as increasing staff, making adequate job design, and conducting administrative intervention to ease the psychological job demands to decrease work stress.

In this study, 58.6% of the health care workers experienced a moderate social approval with a mean score of 17.3 ± 3.2, indicating that the current practicing environment from the perspective of health care workers was not very good. The results are consistent with a previous national research of Chinese health professionals, which showed that the medical practice environment of health care workers was poor and was getting worse (55). One reason for the poor practice environment in China may be that media's reporting of adverse news negatively affected impression of health care workers in the public (56). Another possible explanation may be that the current medical resources can't match the public increasing requirements on the services capacity of medical institutions and health care workers, which leads to the public dissatisfaction and disrespect to health care workers, resulting in the deterioration in practice environment (55). Therefore, efforts should be strengthened to construct a supportive practice environment.

In another study on health care workers' experiences of workplace violence, limited social approval or practice environment has been linked to more workplace violence. Previous study showed nurses who work in poor practicing environments have greater odds of experiencing violence (32). However, the study was unable to clarify the mediating factors in this relationship. The current study showed that there was an indirect effect of social approval on workplace violence, but no direct effect. Adequate social approval appears to be associated with decreased psychological job demands and work stress, both of which were related to higher odds of workplace violence. Prior study has shown that practice environment factors are sources of work stress among health care workers (36, 37). Thus, health care workers with poor social approval from their practice environment may perceive higher psychological job demands and work stress. Consequently, they may experience more workplace violence.

Study limitations should be taken into account. First, despite the SEM being used to determine the relationship among the variables, the cross-sectional design imposes a significant limitation to drawing any definitive conclusions. In addition, we collected the data through the participants' self-report and submitted questionnaires rather than face-to-face investigation.

CONCLUSIONS

The study shows that the exposure rate of workplace violence among health care workers in China is generally high. The results showed that work stress has a direct positive relationship with workplace violence, work stress also mediates the influence of psychological job demands and social approval on the workplace violence among health care workers. Therefore, priority should be given to interventions that target decreasing work stress. Paying more attention to increasing the public social approval to health care workers and decreasing the psychological job demands of the health care workers can decrease their work stress, thus decrease the exposure rate of workplace violence.

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 study protocol was approved by the Ethics Committee of the National Health Commission of the People's Republic of China. Verbal consent was obtained from each participant following a detail explanation about the purpose of the study. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

XS and DL: conceptualization and methodology. XS: formal analysis and writing—original draft. XS, MQ, JZ, JP, XZ, and DL: investigation. MQ, JD, and DL: writing—review and editing. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh. 2021.743626/full#supplementary-material

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Exploring the Psychological Stress, Anxiety Factors, and Coping Mechanisms of Critical Care Unit Nurses During the COVID-19 Outbreak in Saudi Arabia

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Background: The spread of coronavirus disease 2019 (COVID-19) throughout the world leads to a series of modifications of several National Health Service organizations, with a potential series of psychological consequences among nurses.

Methods: This study was undertaken to assess the psychological stress, anxiety factors, and coping mechanisms of critical care unit nurses during the COVID-19 outbreak. A cross-sectional research design was employed, and the convenience sample consisted of 469 nurses working at several hospitals in Saudi Arabia during the period from July to September 2020. This study used the Generalized Anxiety Disorder, Coping Mechanism, and Nursing Stress scale.

Results: Interestingly, more than one-third and one-quarter of the studied nurses had severe and moderate anxiety levels, respectively. In addition, the most anxiety-causing factors included providing care for their infected colleagues and worrying about infecting their families. More than one-quarter and slightly less than half of the studied nurses had high and moderate stress levels, respectively. Furthermore, more than half of the participants had low coping mechanisms and one-quarter had moderate coping mechanisms. In addition, there was a strong positive correlation between anxiety and stress levels, and there was a strong negative correlation between coping mechanisms and stress and anxiety levels.

Conclusions: Collectively, this study explored the psychological stress, anxiety factors, and coping mechanisms among critical care unit nurses during the COVID-19 outbreak in Saudi Arabia. Continuous educational programs for nurses on using coping mechanisms should be developed in combination with teaching preventive measures for defining

a psychological intervention plan within a mandatory occupational health surveillance program. This study recommends that constructive planning and necessary provision of supportive measures by the legal authorities and policymakers protect nurses and minimize their psychological stress to fulfill high-quality nursing care.

INTRODUCTION

In December 2019, multiple unexplained cases of pneumonia were reported in Wuhan, Hubei province, China. Epidemiological findings revealed severe human-to-human transmission, which was later confirmed to be caused by a novel coronavirus infection. The WHO named it as coronavirus disease 2019 (COVID-19) (1). The COVID-19 crisis has been characterized as the biggest challenge for the world since World War II due to the resulting health crisis. Importantly, the COVID-19 pandemic results in a wide range of disruptive respiratory and digestive symptoms. These symptoms range from mild self-limiting symptoms to acute pneumonia, acute respiratory distress syndrome, septic shock, and even multiple failure syndromes of the body systems (2). Droplets and direct contact, among others, are considered as the major sources of infection by COVID-19. Importantly, the world faced a slowdown or even a complete shutdown of daily activities during the first two waves of this pandemic. Moreover, individuals were encouraged to implement social distancing to reduce the transmission of the infection (3). Taking this into consideration, there are no specific available drugs and vaccines for combating the infection during the first wave of this pandemic, and treatment relied on antiviral therapy, isolation, and symptomatic support in combination with a close monitoring of the progression of the disease (4, 5), then the last year witnessed the development of vaccines for combating the pandemic (4–9).

It is noteworthy to state that health-care professionals faced many challenges resulting from an exponential increase in the demand for healthcare during COVID-19. These challenges included long work shifts, few resources, precarious infrastructure, and the lack of sufficient protective clothing also, many health-care workers felt unprepared to conduct the clinical intervention of patients infected with a new virus with no established clinical protocols or treatments (10). Taking this into account, frontline health-care staff members are one of the most vulnerable groups because they constantly deal with the threat of COVID-19 infection (11). It should be stressed that COVID-19 has been considered an emerging and easily clustering infectious disease (3). Because of the highly infectious nature of and limited knowledge about COVID-19, health-care workers are under extreme physical and psychological pressure while on duty (12). They are not only at an elevated risk of becoming infected but also having been reported to experience related depression, anxiety, insomnia, physical discomfort, difficulty breathing, stigma, and frustration (13). On reviewing the available literature, several studies have shown that the group of health-care workers who are in direct contact with

patients are exposed to the highest levels of risk for contracting COVID-19 (14, 15). Nurses are particularly vulnerable to many job-related hazards and undergo a considerable amount of emotional pressures in relation to their jobs because of their long, intense exposure to various stressors (16). Clearly, it is important to note the nature of the coping strategies used by these health-care and emergency workers in these situations and their effectiveness in terms of reduction and effectively coping up with stress. Indeed, the effective management of stress levels in the acute/emergency phase could reduce the risk of developing long-term stress or other pathologies, such as anxiety and depression (17). Importantly, providing social, moral, and psychological support services is urgently needed and should be based on coping strategies for managing stress mechanisms, which should go together with the provision of facilities and equipment by hospital managers and the government. The psychological intervention plan should include two pillars: (a) providing health-care workers with adequate information, training, and personal protective equipment to tackle the COVID-19 emergency and (b) enhancing the emotional skills of health-care workers to deal with anxiety by offering psychological support. Psychologists providing emotional support to patients and health-care personnel are also urgently needed (18). Given the aforementioned information, this study aimed to assess the psychological stress, anxiety factors, and coping mechanisms among critical care unit nurses during the COVID-19 outbreak by addressing the following research questions.

- Q1: What was the stress level among nurses during the COVID-19 outbreak in critical care units?
- Q2: What was the anxiety level among nurses during the COVID-19 outbreak in critical care units?
- Q3: What are the coping mechanisms of nurses during the COVID-19 outbreak in critical care units?
- Q4: What were the factors causing anxiety among nurses during the COVID-19 outbreak in critical care units?
- Q5: Is there a correlation between psychological stress and anxiety levels and coping mechanisms?

METHODS

Ethical Approval

This study was conducted with the approval of the research ethics committee of Jouf University (Approval No. 05-06-42). The submission of answers to the questionnaire was considered by giving consent to take part in this study. Confidentiality of the study subjects' data was maintained throughout this study by making the data nameless.

Research Design and Setting

A cross-sectional study was conducted from July to September 2020 at the Adult Intensive Care Units of several receiving hospitals ($n = 6$) in Saudi Arabia. The hospitals involved in this study were Arar Central Hospital, Arar; Qurayyat Public Hospital, Qurayyat; Prince Mohammed Ben Abdel-Aziz Hospital; Riyadh King Abdul Aziz Specialized Hospital; Prince Mutaib bin Hospital; and the Maternity and Children's Hospital pediatric care unit and neonatal intensive care units in Sakaka City, Jouf region, Saudi Arabia.

Subjects and Instruments

The convenience sample included 469 nurses working at the abovementioned settings and were enthusiastic to participate in this study; 58.2% of them were women, 67.2% were married, 50.7% had a bachelor's degree in nursing, 41.8% of them were bedside nurses, and the mean age was 31.73 ± 5.6 years, and the mean years of experience was 8.91 ± 2.35 years. The following tools were used.

Tool I: Psychological responses of nurses toward caring for critically ill patients with COVID-19, which consisted of two parts.

First part: The Generalized Anxiety Disorder-7 item test (GAD-7) (19) was used. It consisted of seven items that measured worry and anxiety symptoms. Each item was scored on a 4-point Likert scale (0–3) with total scores ranging from 0 to 21 with higher scores reflecting greater anxiety. Scores above 10 were considered to be in the clinical range (19). GAD-7 has been shown to have good reliability and construct validity (20). These scores were summed and converted into a percent score. The results were classified into three categories: severe anxiety if the score was >70%, moderate anxiety if the score was 50–70%, and low anxiety if the score was <50%.

Second part: The second section investigated 12 factors that could induce anxiety in the nursing staff that were adapted from Tam et al. (21). Responses included the four choices ranging from 0 to 3 (0 = not at all; 1 = slightly; 2 = moderately; 3 = very much).

Tool II: The coping mechanisms of nurses regarding COVID-19 were adapted from another previous study (22). The test consisted of 11 questions that looked at different personal coping strategies that the staff could have used. It initially comprised a yes or no response. Those who answered yes then rated the strategies from 0 to 4 (0 = never; 1 = sometimes; 2 = often; 3 = always). These scores were summed and converted into a percent score. The results were classified into three categories: a high coping mechanism if the score was >70%, a moderate coping mechanism if the score was 50–70%, and a low coping mechanism if the score was <50%.

Tool III: The Nursing Stress scale was adopted from a previous study (23). The scale consisted of 34 items that were distributed into 7 heterogeneous and potentially stressful situations, including death and dying patients (7 items), conflict with physicians (5 items), inadequate preparation (3 items), lack of staff support (3 items), conflict with other nurses (5 items), workload (6 items), and uncertainty concerning treatment (5 items). A 4-point Likert scale was used to indicate the frequency of work stressors experienced by nurses ranging from never (1), occasionally (2), and frequently (3) to very frequently (4). These scores were summed and converted into a percent score. The results were classified into three categories: a high coping mechanism if the score was >70%, a moderate coping mechanism if the score was 50–70%, and a low coping mechanism if the score was <50%. We used an online survey and email, Facebook, WhatsApp, and telegram services to collect the data from the subjects to maintain the rules of social distancing and limit the spread of COVID-19. The Google form (https://docs.google.com/forms/d/e/1FAIpQLSf7YLpKyVieUF_QewKwIIJRiaFQZ0XJxa3pmpzKG38F4pkjQQ/viewform?usp=sf_link) permits questionnaire design, the collection of data, a descriptive analysis of results, and the download of data through excel spreadsheets for extra analysis.

Pilot Study

The pilot study was conducted on 49 participants who represented 10.44% of the total sample at the abovementioned settings to test the applicability of the constructed tools and the clarity of the included tools. Additionally, this pilot study aimed to assess the reliability and validity of developing a tool before its use in this study. This pilot study also estimates the time needed for each subject to complete the questionnaire.

Validity and Reliability

A group of five experts in the critical nursing departments ascertained the content's validity to assess the layout, format, accuracy, consistency, and relevancy of the tools. Reliability pretesting was conducted using Cronbach's α for GAD-7, and the result was 0.894, the stress scale value was 0.914, and the coping mechanism score was 0.855.

Statistical Analysis

The data collected from the pilot sample were revised, coded, and entered into a personal computer. Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences version 24. Data were presented using descriptive statistics in the form of number and percent. Pearson's correlation coefficient analysis was used to measure the linear correlation between the two sets of data. Multiple linear regression (MLR), also known simply as multiple regression, was performed. This statistical technique used several explanatory variables to predict the outcome of a response variable.

RESULTS

The sociodemographic characteristics of the study participants are shown in **Table 1** and divided into subgroups. As depicted, 58.2% of the sample participants were women, 67.2% were married, and 65.7% had children and were from Saudi Arabia. Approximately half of the sample (50.7 %) had a bachelor's degree. Moreover, 41.8 and 44.8% of the participants were bedside nurses and had 6–10 years of experience in an intensive care unit, respectively. Participants from different genders had a moderate score level of GAD-7 scale for fear, anxiety, stress, and coping. However, the male participants had a high mean score when compared to women (**Table 2**). Furthermore, as presented

TABLE 1 | Characteristics of the study participants ($n = 469$).

Characteristics of the study participants		No.	%
Age (years), mean (SD)	31.73 (5.66)		
Gender	Male	196	41.8
	Female	273	58.2
Marital status	Married	315	67.2
	Not married	154	32.8
Have children	Yes	308	65.7
	No	161	34.3
Number of children	1–2 children	112	23.9
	3–4 children	126	26.9
	>4 children	70	14.9
	No children	161	34.3
Nationality	Saudi Arabian	308	65.7
	Not Saudi Arabian (Arabian)	98	20.9
	Not Saudi Arabian (Not Arabian)	63	13.4
Professional degree	Diploma	196	41.8
	Bachelor	238	50.7
	Postgraduate	35	7.5
Position	Matron	7	1.5
	Head nurse	119	25.4
	Supervisor	147	31.3
	Bedside nurse	196	41.8
Years of experience in the U	<1 year	42	9.0
	1–5 years	147	31.3
	6–10 years	210	44.8
	>10 years	70	14.9

in **Table 3**, 35.8% of the participants felt nervous, anxious, and restless, and were very worried about different things as a result of COVID-19. In addition, 31.3% of the participants were not able to stop or control worrying. Moreover, 38.8% of the participants felt afraid as if something awful might happen and 34.3% of them had a trouble to be in a relaxed atmosphere. Also, 35.8% of the participants became easily annoyed or irritable for several days (**Table 3**).

Table 4 shows that the distribution of the anxiety level scores and the factors "providing care for infected colleagues" and "worries about infecting their families" had the highest

TABLE 4 | Mean score of the studied nurses according to the factors that caused anxiety among the staff ($n = 469$).

Factors that caused anxiety among the staff	Mean (SD)
1. Seeing your colleagues were infected	2.39 (0.63)
2. You are worried about infecting your family	2.50 (0.58)
3. Small mistakes or inattentions can make you or others infected	2.46 (0.64)
4. Providing care for your infected colleagues	2.50 (0.58)
5. Seeing your infected patient die	2.43 (0.57)
6. New infections or suspected cases asking for your help	2.39 (0.63)
7. Lack of specific treatments for COVID-19	2.36 (0.68)
8. You were infected by an infected patient while working at the hospital	2.32 (0.67)
9. Seeing stress or fear from your colleagues	2.36 (0.68)
10. Constantly screening yourself for infection	1.32 (0.67)
11. Every day staying in protective clothing for a long time	2.29 (0.60)
12. You think the current protection measures are still lacking	1.04 (0.96)

TABLE 2 | Level score of Generalized Anxiety Disorder toward coronavirus disease 2019 (COVID-19) according to critical care nurses' gender.

Level of generalized anxiety disorder 7-item scale score	Male N (%)	Female N (%)	Total N (%)	Male Mean (SD)	Female Mean (SD)	Significance
Minimal score (0–4)	0 (0)	49 (10.4)	49 (10.44)	0 (0)	2.71 (1.11)	0.00
Mild score (5–9)	56 (11.9)	56 (11.9)	112 (23.88)	7.63 (0.92)	7.75 (1.38)	0.85
Moderate score (10–14)	49 (10.4)	70 (14.9)	119 (25.37)	12.43 (1.81)	13 (1.15)	0.43
Severe score (15–21)	91 (19.4)	98 (20.9)	189 (40.29)	19.69 (1.97)	18.43(2.62)	0.72
Total	196 (41.79)	273(58.20)	469 (100)	13.96 (5.09)	12.0 (6.19)	0.17

TABLE 3 | Distribution of the anxiety psychological responses of nurses toward caring for critically ill patients with COVID-19.

Generalized anxiety disorder 7-item (GAD-7)	Not at all	Several days	More than half the days	Nearly every day	Mean (SD)
	N (%)	N (%)	N (%)	N (%)	
1. Feeling nervous, anxious or on edge	35 (7.5)	147 (31.3)	119 (25.4)	168 (35.8)	1.90 (098)
2. Not being able to stop or control worrying	56 (11.9)	105 (22.4)	161 (34.3)	147 (31.3)	1.85 (1.0)
3. Worrying too much about different things	28 (6.0)	133 (28.4)	140 (29.3)	168 (35.8)	1.96 (0.94)
4. Trouble relaxing	21 (4.5)	154 (32.8)	161 (34.3)	133 (28.4)	1.87 (0.88)
5. Being so restless that it is hard to sit still	56 (11.9)	119 (25.4)	126 (26.9)	168 (35.8)	1.87 (1.00)
6. Becoming easily annoyed or irritable	42 (9.0)	168 (35.8)	147 (31.1)	112 (23.9)	1.70 (0.94)
7. Feeling afraid as if something awful might happen	63 (13.4)	119 (25.4)	182 (38.8)	105 (22.4)	1.70 (0.97)

mean score [2.50 (0.58)], whereas thoughts that the current protection measures were still lacking, and constantly screening for infection had the lowest mean scores [1.04 (0.96) and 1.32 (0.67), respectively]. Conversely, 40.3 and 25.4% of the participants had severe and moderate anxiety levels, respectively (**Figure 1**). Additionally, 23.9 and 10.4% of the participants had mild and minimal anxiety, respectively (**Figure 1**). Importantly, **Table 5** shows that "talking to yourself," "motivating to face the COVID-19 outbreak with a positive attitude," and "choosing solo transport modes," such as self-driving and avoiding public transportation such as "subways" had the highest mean score [2.36 (0.67) and 2.34 (0.69), respectively]. "Venting emotions by crying" or "screaming and avoiding media news about COVID-19 and related fatalities" had the lowest mean score [1.04 (0.96) and 1.32 (0.67), respectively].

In accordance with the total coping mechanism, as shown in **Figure 2**, 53.7% of the participants had low coping mechanisms, 25.4% of them had moderate coping mechanisms, and 20.9% had high coping mechanisms. Conversely, 41.8, 47.8, and 38.8% of the participants had high, moderate, and low levels of stress related to workloads, inadequate preparation, and conflicts with other nurses, respectively (**Table 6**). Furthermore, 29.8, 47.8, and 22.4% of the participants had high, moderate, and low levels of stress, respectively (**Table 6**). As shown in **Table 7**, there was a strong positive correlation between anxiety and stress levels ($p < 0.01$). Meanwhile, there was a strong negative correlation between coping mechanisms and stress and anxiety levels ($p < 0.01$). As shown in **Table 8**, a highly significant model was detected through the F-test value of 13.808 ($p < 0.01$). This model explained a 52% variation in the anxiety scale detected through the R^2 value of 0.52. Also, the model explained that

age and experience had a high-frequency negative effect on the level of anxiety ($p < 0.01$), while high education level had a slight negative effect on the level of anxiety ($p < 0.05$). In addition, bedside nurses had a high positive effect on anxiety level ($p < 0.01$), while married nurses had a slight positive effect on anxiety level ($p < 0.05$). The dependent variable in **Table 8** represented the anxiety scale while the predictors included age, education level "high education," marital status "married," experience, and job title "bedside nurses." Furthermore, as stated in **Table 9**, a highly significant model was detected through the F-test value of 15.409 ($p < 0.01$). This model explained 54% of the willingness to report near misses detected through the R^2 value of 0.54. In **Table 9**, the dependent variable referred to the stress level while the predictors include age, education level "high education," marital status "married," experience, and job title "bedside nurses." Also, the latter model explained that an experience had a high-frequency negative effect on the level of stress ($p < 0.01$). Meanwhile, high education level and age had a slight negative effect on the level of stress ($p < 0.05$). In addition, bedside nurses had a high positive effect on stress level with $p < 0.01$, and the same finding was reported for married nurses.

DISCUSSION

Health-care workers are exposed to various infectious diseases, including those transmitted through blood or other body fluids and/or airborne infectious agents (12, 24). This study provided interesting baseline information in relation to the psychological stress, anxiety factors, and coping mechanisms of critical care unit nurses during the COVID-19 outbreak in Saudi Arabia. To the best of our knowledge, this is the first study to be conducted

FIGURE 1 | Distribution of the studied critical care nurses according to their total anxiety level ($n = 469$).
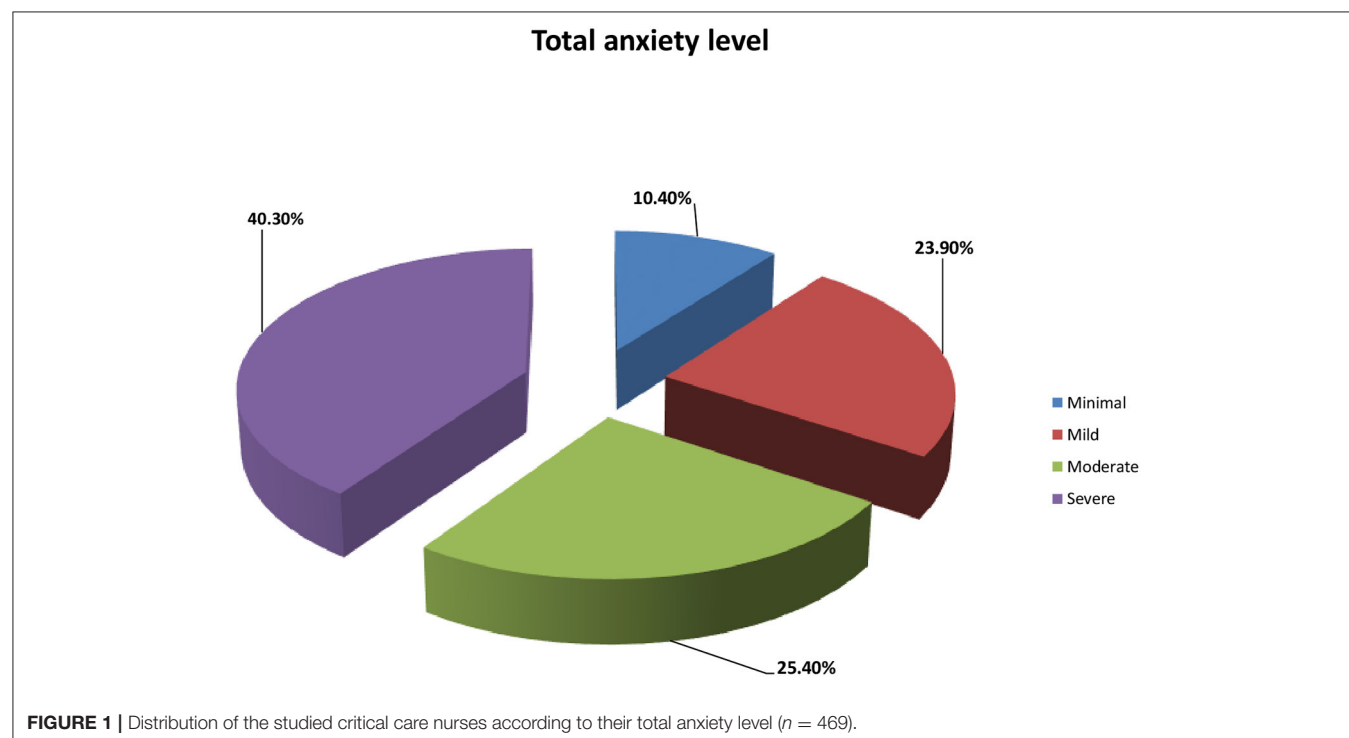
TABLE 5 | Distribution of the studied critical care nurses according to their coping mechanism (n = 469).

Items	Never	Sometimes	Often	Always	Mean (SD)
	N (%)	N (%)	N (%)	N (%)	
Following strict protective measures, such as hand washing and use of masks and protective clothing.	7 (1.5)	56 (11.9)	231 (49.3)	175 (37.3)	2.22 (0.71)
Every febrile patient may be infected with COVID-19, even if the nucleic acid test is negative.	14 (3.0)	35 (7.5)	280 (59.7)	140 (29.9)	2.16 (0.69)
Learning about COVID-19, its prevention, and mechanism of transmission.	0 (0)	56 (11.9)	224 (47.8)	189 (40.3)	2.28 (0.67)
Choosing solo transport modes, such as self-driving, and avoiding public transportation, such as subways.	0 (0)	56 (11.9)	196 (41.8)	217 (46.3)	2.34 (0.69)
Doing some leisure activities in your free time, such as watching movies and reading.	14 (3.0)	35 (7.5)	210 (44.8)	210 (44.8)	2.31 (0.74)
Chatting with family and friends to relieve stress and obtain support.	14 (30)	35 (7.5)	203 (43.3)	217 (46.3)	2.33 (0.75)
Talking to yourself and motivating yourself to face the COVID-19 outbreak with a positive attitude.	7 (1.5)	28 (6.0)	224 (47.8)	210 (44.8)	2.36 (0.67)
Seeking help from a psychologist.	42 (9.0)	28 (6.0)	231 (49.3)	168 (35.8)	2.12 (0.88)
Avoiding doing overtime to reduce exposure to patients with COVID-19 in the hospital.	21 (4.5)	35 (7.5)	259 (55.2)	154 (32.8)	2.16 (0.75)
Avoiding media news about COVID-19 and related fatalities.	63 (13.4)	112 (23.9)	189 (40.3)	105 (22.4)	1.72 (0.97)
Venting emotions by crying, screaming, etc.	245 (52.2)	98 (20.9)	77 (16.4)	49 (10.4)	0.85 (1.05)

FIGURE 2 | Distribution of the studied critical care nurses according to their total coping mechanism (n = 469).
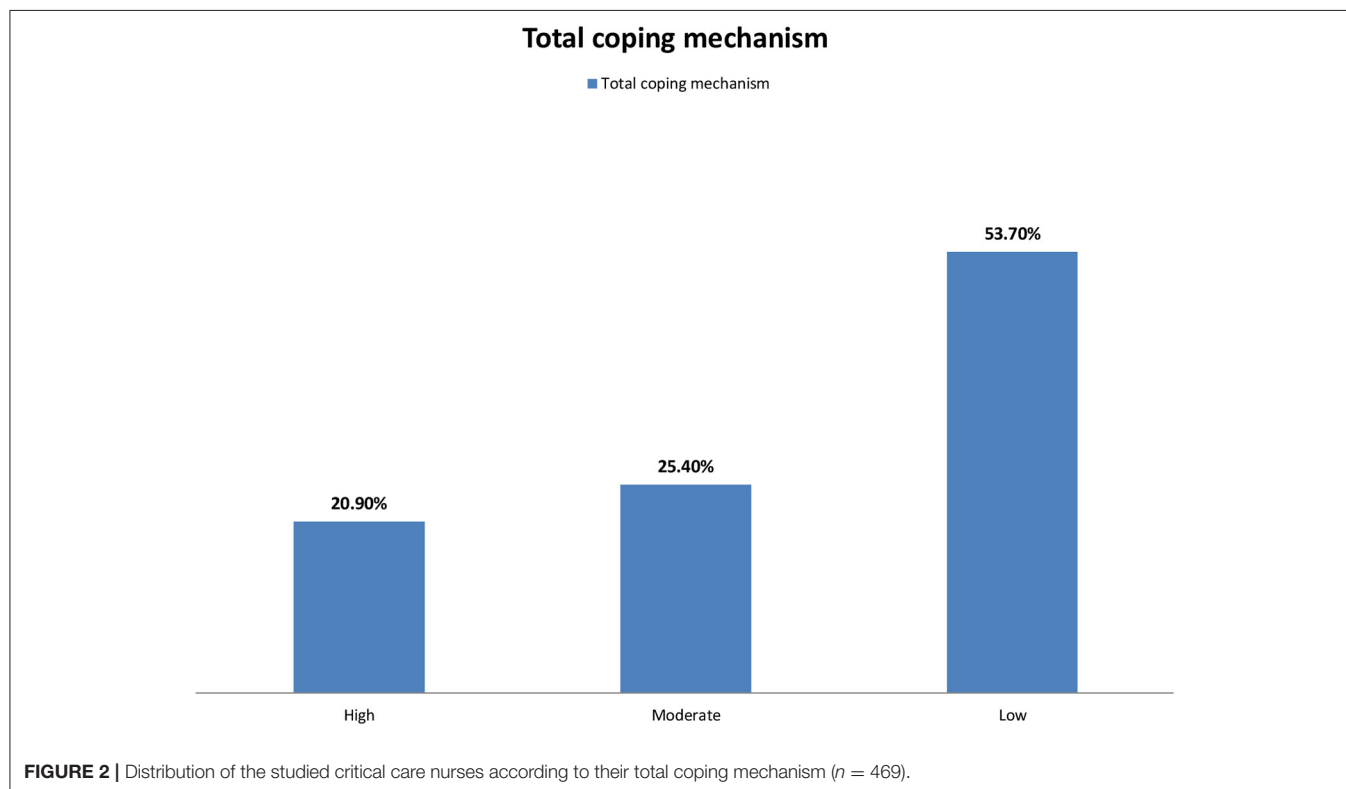
on nurses at a national level to explore the psychological stress, anxiety factors, and coping mechanisms of critical care unit nurses.

In accordance with the sociodemographic data and characteristics of the participants, this study showed that more than half of the sample was female, the majority of participants were married, and most of them had children. In addition, nationality was Saudi Arabian for the majority of participants and bachelor's degree constitutes about half of the sample. Nearly, half of the samples were bedside nurses with 6–10 years of working experience in critical care units. This study also reported a median age of 31.73 years. These demographic findings and characteristics of the participants are in agreement with those reported elsewhere (25). The results also emphasized that gender might influence the feeling anxiety and the ability to cope up with stress. In this respect, our results depicted that

TABLE 6 | Distribution of the studied critical care nurses according to their stress level (n = 469).

Stress domains	High		Moderate		Low	
	n	%	n	%	n	%
Death and dying patients	161	34.3	210	44.8	98	20.9
Conflict with physicians	133	28.3	189	40.4	147	31.3
Inadequate preparation	168	35.8	224	47.8	77	16.4
Lack of staff support	147	31.3	210	44.8	112	23.9
Conflict with other nurses	98	20.9	189	40.3	182	38.8
Workload	196	41.8	210	44.8	63	13.4
Uncertainty concerning treatment	154	32.8	245	52.3	70	14.9
Total	140	29.8	224	47.8	105	22.4

TABLE 7 | Correlations between studied variables.

		Anxiety level	Stress level	Coping mechanism
Anxiety	r.		0.688	−0.619
	p		<0.01**	<0.01**
Stress	r.	0.688		−0.549
	p	<0.01**		<0.01**
Coping mechanism	r.	−0.619	−0.549	
	p	<0.01**	<0.01**	

**Highly significant.*

TABLE 8 | Multiple linear regression (MLR) models for anxiety scale.

	Unstandardized Coefficients	Standardized Coefficients		
	B	Beta	T	P value
Age	−0.354	0.287	8.011	<0.01*
Education level "High education"	−0.299	0.201	4.123	<0.05
Marital status "Married"	0.190	0.135	2.809	<0.05
Experience	−0.344	0.256	6.770	<0.001
Job title "bedside nurses"	0.411	0.367	9.076	<0.01
Model	**R²**	**F**		**P value**
ANOVA				
Regression	0.52	13.808		P < 0.01**

**Significant, **Highly significant.*

TABLE 9 | MLR models for stress level.

	Unstandardized coefficients	Standardized coefficients		
	B	Beta	T	P value
Age	−0.211	0.134	3.242	<0.05*
Education level "High education"	−0.199	0.103	2.998	<0.05*
Marital status "Married"	0.305	0.211	7.644	<0.01**
Experience	−0.410	0.346	8.066	<0.01**
Job title "bedside nurses"	0.398	0.302	7.667	<0.01**
Model	**R²**	**F**		**P value**
ANOVA				
Regression	0.52	13.808		P < 0.01**

**Significant, **Highly significant.*

showed that more than half of the participants were very afraid from the contraction of the infection or making other staff or families infected and they were also very stressed about taking care of their infected colleagues and wearing protective clothing for a long time. A possible explanation that COVID-19 outbreaks were severe at the time of this study, and the measures adopted toward disease prevention were not clearly instigated. Similarly, a previous study (10) stated that nurses are among the most vulnerable groups at the core of infection and their worrying about being infected is attributed from close contacts of infected patients, physical discomfort, and facing the death of critically ill patients. Other previous studies (22, 29) revealed that the feeling of stress for critical care unit nurses might result from the awareness of the mortality rate.

Interestingly, this study demonstrated that participants felt nervous, anxious, and afraid from the occurrence of something awful, these findings are in agreement with some previous studies (30, 31). Furthermore, our results revealed that more than one-third and one-quarter of the participants had severe and moderate anxiety levels, respectively. In addition, approximately one-quarter of the participants had mild anxiety. This might indicate the good knowledge and information of some of the participants about the pandemic and reflects the efficacy of different media, including social media, in raising the public health awareness in relation to the distribution of the information about COVID-19 (32). In addition, the factors causing the highest anxiety levels include providing care for infected colleagues and worrying about infecting their family, whereas thinking that the current protection measures are still lacking and constantly screening yourself for infection were the factors causing the lowest anxiety levels. These results are in harmony with the data of Nemati et al. (33) who conducted a study on 85 nurses in Iran and stated that the mean anxiety score was 6.02 ± 2.6 and the score for anxiety about infecting their family was 6.87 ± 2.8. In addition, our present results are consistent with those of Simonetti et al. (34) in which 1,005 nurses employed in different Italian hospital wards had moderate

the total mean score of men was higher than that of women although both have a moderate score. In contrast, a previous study stated that women showed more severe anxiety and fear than men regarding COVID-19 (10). It was documented that women in the nursing society develop various personal and social mechanisms to cope up with stress in comparison with men (26). This discrepancy in the results might be attributed to the possible influence of regional and cultural variations, working environment, and conditions (27, 28). This study also

anxiety levels. Similarly, Yanez et al. (35) reported that more than half of the nurses in their study had moderate anxiety levels. Taking into account, several factors such as years of experience, workloads, inadequate preparations, the lack of safe and effective treatment for the disease, the statistics of pandemic and daily reported new cases, and shortages of supplies and equipment, availability of adequate protective measures, and the number of hospitalized cases in critical care units might contribute to the degree of anxiety, fear, and stress during similar pandemics (36, 37).

It is noteworthy to mention that nurses mostly have the highest level of occupational stress among health-care workers as they are often the first frontline health workers who respond to patients (38). More importantly, health-care workers might adjust to a stressful working environment but stressors might have a cumulative effect, resulting in psychological distress. Regarding stress levels, this study revealed that more than one-third and slightly less than half of the participants had high and moderate levels of stress related to their workloads and inadequate preparation, respectively. In accordance with total stress, more than one-quarter and slightly less than half of the participants had high and moderate stress levels, respectively. These findings were in agreement with those of Kar et al. (39) who conducted a study on 733 respondents within 10 days of the survey from 20 countries and stated that only less than one-quarter had stress symptoms. Furthermore, Said and El-Shafei (37) conducted a study on 420 nurses at Zagazig General Hospital and reported that three-quarters of the nurses had high stress levels and most nurses had stress related to workloads. Similarly, Maraqa et al. (40) conducted a study on 430 frontline health-care workers in Palestine and detected that approximately three-quarters reported high stress levels during the outbreak. Fear of transmitting the virus to their family was the most stressful factor, which is consistent with our present findings. It should be stressed that other previous studies reported discrepancies in the results in relation to the level of stress, whereas a wide range of prevalence levels for anxiety and stress (18.1–80.1%) were reported (41). Taking this into consideration, this variation in the level of stress might be attributed to multiple factors that include the possible influences of regional and cultural variations, the level of providing social and moral support, knowledge and preparedness, workloads and inadequate preparations, the lack of proper training and guidelines, and a variation in the methodology in the expression of anxiety and stress (42).

It should be stressed that having proper coping strategies during outbreaks of pandemic remains a critical line in the protection of health-care workers from the contraction of the infection besides their role in the prevention of several stress-related psychiatric disorders (43–45). Clearly, adequate coping strategies together with the social and emotional support are considered as major contributors to the motivation of health-care workers during these pandemic outbreaks. As shown in our present work, critical care nurses use many coping strategies for combating the stress and anxiety caused by the outbreak of COVID-19. The most common coping strategies are displayed in **Table 4**, which include talking to yourself and motivating yourself for combating the COVID-19 outbreak with a positive attitude,

chatting with family and friends to relieve stress, choosing solo transport modes such as self-driving, and avoiding public transportation, doing some leisure activities in your free time, and learning about COVID-19, its prevention, and mechanism of transmission. This study also revealed that more than half, one-quarter, and one-fifth of the participants had low, moderate, and high coping mechanisms, respectively. These results are in agreement with a study conducted by Huang et al. (10) on 804 subjects in China that showed approximately half of the participants had low coping mechanisms. Additionally, our results were consistent with those of Alsolais et al. (46) who detected that most of the participants had moderate coping strategies in Saudi Arabia. However, it should be borne in mind a strong link between individual vulnerability to stress and the used coping strategies during specific situations. Importantly, adequate protective equipment, managemental recognition, and teamwork might reduce the psychological distress of health-care workers during similar pandemics (45). Clearly, public health education of health-care workers about the importance of coping strategies and their effective methods would be very helpful.

Regarding the correlations among the studied variables, which are illustrated in **Tables 7–9**, this study revealed that age, education level, and years of experience had a high-frequency negative effect on the level of anxiety and stress, reflecting the possible influence of age and years of experience of participants on the reduction of the level of anxiety and stress. However, previous reports revealed that all age groups of health-care workers expressed psychological stress when they saw their colleagues under stress (45, 47). In stark contrast a previous study (48) in Jordan documented that older health-care workers had a higher level of psychological distress that might be related to a higher risk of severe multiple organ and respiratory failure among elderly during COVID-19 outbreaks. In the same study (48), a weak correlation was reported between years of experience and fear and anxiety, which could be attributed to the uncertainty of health-care professional safety, the regular reuse of personal protective equipment potentiated, and attending severe complicated and death cases (49). Furthermore, there was a strong positive correlation between anxiety and stress levels ($p < 0.01$). Meanwhile, there was a strong negative correlation between coping mechanisms and stress and anxiety levels ($p < 0.01$). These results are similar to those reported by Lorente et al. (50) on 421 nurses from 39 Spanish provinces. This study showed that emotion-focused strategies were negatively related to nurses' psychological distress directly and indirectly through resilience. Similarly, Lou et al. (51) studied 115 subjects in Montreal, Canada, and reported that adaptive coping strategies moderated a negative impact of stress on work performance and also a negative effect of stress on burnout. Additionally, our findings are in harmony with those of Vagni et al. (52) who conducted on 121 nurses in Italy and revealed that coping mechanisms caused to decrease anxiety levels in nurses. In addition, this study reported that bedside nurses had a positive effect on anxiety and the stress level that reflects the more anxiety and the stress level could be found among bedside nurses. A possible explanation for this finding is the close proximity of bedside nurses with critically ill patients, and they usually

spend more time and energy to be in close contact with the patients in critical care units. Furthermore, bedside nurses are always struggling to manage and coordinate their professional duties with their own life and family members, making them feel uncertain and unprotected and as a consequence increasing the level of anxiety and depression among these nurses (45). Moreover, the majority of bedside nurses are young health-care professionals, which make them afraid of being infected and died besides their fear from infecting other members in their families. Taking this into account, bedside nurses experienced a sharply deteriorating stage of the disease, which further increase fear and anxiety from being infected (53). In addition, the present findings revealed that the marital status of the study participants could be positive predictors for exploring the level of stress and anxiety that means the level of stress and anxiety is higher among married nurses. Similarly, a recent study documented that 44.4% of married nurses who have children and 29.4% of the nurses working in critical units experienced a high stress (54). Another study revealed that having children and stigmatization are among the relevant factors related to health-care workers' stress (55). A possible explanation of this finding that nurses are always worried about the health of their family as a result of the infection by COVID-19 (56). Collectively, the studied variables reveal that nurses exhibiting high levels of stress, anxiety, and fear from the contraction of the infection do not enact proper coping approaches, and consequently they might have a higher risk and vulnerability. Clearly, proper adaptive coping strategies and approaches are recommended for health-care workers to minimize the degree of stress, arousal, and possibly secondary trauma, which might require special attention.

The limitations of this work, including a limited number of hospitals, the number of participants for the pilot study, a self-report study, and the findings, may be somewhat dated. Furthermore, data were collected through an online electronic questionnaire, which might hinder an accurate observation of nurses' reactions toward stress regarding COVID-19 and read verbal and nonverbal reactions of coping. Similarly, this study was focused on critical care unit nurses, and extending this study to include nurses among emergency departments would be interesting.

CONCLUSIONS AND RECOMMENDATIONS

This study concluded that more than one-third and one-quarter of the participants had severe and moderate anxiety levels, respectively. In addition, the highest factors causing anxiety were providing care for infected colleagues and worrying about infecting their family. Moreover, more than one-quarter and slightly less than half of the participants had high and moderate stress levels, respectively. More than half of the studied nurses had low coping mechanisms, and one-quarter of them had moderate coping mechanisms. There was a strong positive correlation between anxiety and stress levels and also between coping mechanisms and stress and anxiety levels. The main factors associated with stress in this study included the perceived

risk of infection to themselves and their families, the care of infected colleagues, and wearing protective clothing for a long time.

This study recommends continuous educational programs for nurses on coping mechanisms, which should be adopted together with the framing of preventive measures and a psychological intervention plan within a mandatory occupational health surveillance program. These measures should be supported by policymakers to protect frontline health-care workers during disease outbreaks. Also, nurses should develop personal coping strategies through constant education; regular vacations from their work and psychological stress should be minimized to fulfill high-quality nursing care, aiming at the prevention and reduction of fear and anxiety, and stress. Further research is suggested with a larger sample size, and it would be also interesting to evaluate whether changes occur over time. In addition, this study should be applied to all hospitals in the Kingdom of Saudi Arabia to explore more about stresses and more mechanisms of coping and adaptation. Future research is also suggested about specific stressors and their pathogenesis on health-care workers to be able to develop individual stressor management or the possible treatment of stress.

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 Research Ethics Committee of Jouf University and the Study Approval No 05-06-42. The submission of the answer to the questionnaire was considered as consent to take part in the study. Confidentiality of the study subjects' data was sustained throughout the study by making the mothers' data nameless. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SA and SD contributed to the conception and design of this study, data collection, analysis, interpretation, manuscript writing, and reviewing and revising the manuscript. EE contributed scientific advice and prepared the manuscript for publication and revision. All authors read and approved the final manuscript.

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Knowledge, Attitude, and Practices Associated With COVID-19 Among Healthcare Workers in Hospitals: A Cross-Sectional Study in India

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has caused phenomenal loss of lives and overburdened the health system in India. Low morale, fatigue, and inadequate knowledge among the healthcare workers (HCWs) are the perceived threats to pandemic control. We aimed to assess the COVID-19 related level of knowledge, attitude, and practices (KAP) among our HCWs. A cross-sectional, electronically distributed, questionnaire-based study was conducted which identified the demographics of HCWs and the current KAP related to coronavirus disease 2019 (COVID-19). The descriptive statistics were used to present the demographics of the participants and chi-square test was used to assess the differences in KAP among the participants. Of 1,429 total participants, 71.9% belonged to age group 21–40 years. Only 40.2% received any infection control training and 62.7% relied upon single source of information update. However, 82.9% of the participants had adequate knowledge. Being married, urban dwelling, and higher qualification were associated with knowledge adequacy ($p < 0.001$). Interestingly, the senior HCWs (age 41–50 years) were least likely to have adequate knowledge (74.1%). About 84% had positive attitude toward COVID-19, but 83.8% of the participants feared providing care to the patients with COVID-19. However, 93% of HCWs practiced safety precautions correctly most of the times and training had no influence on practice. In conclusion, more than 80% of HCWs in the study had adequate knowledge, positive attitude, and practiced safely most of the time. However, the pitfalls, such as poor training, knowledge uncertainties, and fear of disease acquisition among the HCWs need to be addressed.

Keywords: knowledge, attitude, practice, COVID-19, healthcare workers, India

INTRODUCTION

The pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has swept through the world causing unprecedented loss of lives and livelihood. Successful outbreak containment requires sound knowledge of the disease and a positive attitude among affected population. Research efforts in China revealed that an optimistic attitude among general population was conducive to gain victory over coronavirus disease 2019 (COVID-19) pandemic (1).

India is the second most populous country on the globe with a population density of 382 persons/square km (2). Recent updates reveal a case load of 33,289,579 with 443,213 COVID-19 deaths; the second highest in the world in the number of cases and the third in the number of deaths (3). Overcrowding and low literacy level establishes India as a fertile ground for COVID-19 propagation. The knowledge, attitude, and practice (KAP) of key stakeholders influence the dynamics of pandemic behavior (4). The human community has seen epidemics before which have evoked anxiety and fear responses among the affected populations (5). Poor knowledge and improper practices of the hospital workers propagate rather than contain the infection. Furthermore, going to war with a tired and demoralized work force spells catastrophe for the healthcare system. As our country battles against the pandemic, KAP of the healthcare workers (HCWs') need to be assessed to identify the knowledge gaps and gauge the psychological impact on them.

The previous research works have either unveiled the KAP of general public or investigated the mindset of the isolated groups (students, doctors, patients, etc.) preferentially (1, 6, 7). The information available so far is piecemeal which cannot be construed into a meaningful representation of the wholesome healthcare team. Therefore, this study was conducted to assess the COVID-19 related KAP for the entire healthcare team.

MATERIALS AND METHODS

Study Method and Participants

A cross-sectional questionnaire-based study was conducted to assess the KAP related to COVID-19 among the HCWs in India. The questionnaire was constructed and distributed simultaneously to multiple COVID-19 treatment centers across the country. All HCWs in the age group of 21–70 years and working in the COVID-19 treatment centers were considered eligible for the study. They were encouraged to answer the questionnaire distributed electronically and those with poor access or ability to use technology were recruited through printed version of the questionnaire. Their responses were recorded strictly on the basis of anonymity to avoid social desirability bias.

Questionnaire

A questionnaire was specifically designed for the study using the fixed response questions, both multiple choice and yes/no types with two parts. Part 1 probed the demographic particulars of responders and their consent to participate. Only those who gave consent could access the second part of the questionnaire. Part 2 contained questions assessing knowledge (nine items),

attitude (eight items), and practices (seven items) of the HCW. The questionnaire was synthesized, scaled, and scrutinized by the study team in cognizance with field experts. The knowledge items covered aspects about the virus, epidemiology, disease pathology, clinical features, and management. The attitude items covered personal perceptions and attitude, such as fear, insecurity, optimism, confidence, and responsibility. The practice items covered appropriate usage of personal protective equipment (PPE) at work and personal/social life. The questionnaire was previously validated and published by part of the research team in Saudi Arabia. Ten researchers from different specialties have individually and collaboratively revised the items on the questionnaire to ensure its face validity for HCWs from different fields and at different levels. In addition, the internal reliability for the KAP scales were acceptable with a Cronbach's α of 0.7, 0.6, and 0.8, respectively. Further details on the scale validity and scoring were presented in the study that was conducted by part of the team in Saudi Arabia (8).

TABLE 1 | The participants demographical characteristics.

Variables	Number (%)
Age	
21–30 years	576 (40.3)
31–40 years	451 (31.6)
41–50 years	270 (18.9)
51–60 years	102 (7.1)
61–70 years	30 (2.1)
Gender	
Male	550 (38.5)
Female	879 (61.5)
Residential settlement area	
Urban	778 (54.4)
Rural	651 (45.6)
Marital status	
Married	461 (32.3)
Single	968 (67.7)
Highest educational qualification	
High school or less	266 (18.6)
Bachelor or associate degree	337 (23.6)
Master degree	372 (26.0)
Professional or doctoral degree	454 (31.8)
Health care professional (HCP)	
No	277 (19.4)
Yes	1,152 (80.6)
Hospital department for health care professionals (n = 1,152)	
Medical	586 (50.9)
Surgical	148 (12.8)
Nursing	203 (17.6)
Laboratory services	138 (12.0)
Other para-clinical services	49 (4.3)
Pharmacy	28 (2.4)

Data presented as frequency (%).

TABLE 2 | Frequency and percentage of the participants with correct responses to the knowledge items on the questionnaire.

Questionnaire items	Number (%)
K1. COVID-19 is a contagious disease that is caused by?	1,425 (99.7)
K2. The most common manifestation for the COVID-19 is?	1,400 (97.9)
K3. The disease can easily spread through?	1,419 (99.3)
K4. What is the longest incubation period for COVID-19 before experiencing any symptoms?	1,319 (92.3)
K5. Severe cases and death are more common among?	1,198 (83.8)
K6. Multiple proven curative treatment options are available now for COVID-19 all over the world?	858 (60.0)
K7. Most COVID-19 cases are mild and can recover with no treatment?	1,201 (84.0)
K8. We know that the pandemic will be over by summer, as the causative microbe is sensitive to high temperature and humidity?	994 (69.6)
K9. Washing hands with soap and water is effective in eliminating the causative microbe.	1,359 (95.1)

Data presented as frequency (%).

TABLE 3 | Frequency and percentage of the participants with positive responses to the attitude items on the questionnaire.

Questionnaire items	Number (%)
A1. In my opinion, all people in the healthcare system and the community are part of this battle against COVID-19, and should be responsible about their role.	1,381 (96.6)
A2. I believe that early detection of COVID-19 cases through mass testing will facilitate or accelerate the control of the COVID-19 pandemic.	1,271 (88.9)
A3. I think people who got infected with COVID-19, including health care personnel, were infected due to negligence *(Reversely scored)*.	677 (47.4)
A4. You have a feel of threat or fear when you become close or provide care to a confirmed or suspected COVID-19 patient *(Reversely scored)*.	232 (16.2)
A5. I think COVID-19 is just a communicable disease which is being given undue importance *(Reversely scored)*.	1,003 (70.2)
A6. I think restricting travels, locking cities, and quarantining all suspected cases are an exaggeration for the current situation *(Reversely scored)*.	1,010 (70.7)
A7. The country's efforts will succeed in the battle against COVID-19 pandemic.	1,048 (73.3)
A8. I think when COVID-19 pandemic is over many benefits and good things will be seen.	1,013 (70.9)

Data presented as frequency (%).

The questionnaire was piloted among the first 50 participants and further refined based on feedback. An electronic survey tool (Google forms) was used to distribute the online survey. The link for accessing the questionnaire was disseminated using e-mail, WhatsApp, and text messages to reach to the HCWs across the nation. Survey tool mandated the participants to respond to all the questions without which the forms could not complete submission process. Furthermore, the questionnaires were designed both in English and the predominant regional language to overcome the language barrier.

Statistical Analysis

The descriptive statistics were used to present the demographics of participants and frequencies of personnel with adequate knowledge, positive attitude, and applying safety practices most of the time. The distribution of the KAP of participants based on their demographics was compared using chi-square test. The α level < 0.05 was used for statistical significance. The data from the questionnaire were coded and analyzed using the SAS software, version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

A total of 1,429 HCWs completed the questionnaire. Most responders belonged to age group 21–40 years (71.9%) and women outnumbered men (61.5 vs. 38.5%). About 80.6% of all the participants were healthcare professionals

(HCPs) [physicians, nurses, pharmacists, and laboratory experts], the remaining 19.4% being non-professional HCW [nursing assistants, para-clinical technicians, and sanitary workers] to represent the supportive staff in the centers. The demographics of participants are presented in **Table 1**. Notably, only 40.2% of the participants had received any infection control training. Additionally, 62.7% of the participants relied solely upon single source of information and the most common source of information was news media channels (22.8%).

Knowledge

The participants answering right to knowledge questions ranged between 60.0 and 99.7% (**Table 2**). The question with the least correct response was "K6: Multiple proven curative treatment options are available now for COVID-19 all over the world" for which only 60.0% responded correctly. Interestingly, 30% of the participants still believed that the pandemic would end in summer because of high temperatures and humidity. Overall, adequate knowledge was documented among 82.9% of the participants. However, only 74.1% of HCW aged 41–50 years had adequate knowledge. Being married, urban dwelling, and higher educational qualification were associated with a higher probability of knowledge adequacy. Paradoxically, receiving an infection control training had a negative impact on the knowledge scores (77.7 vs. 86.4%, $p < 0.01$).

TABLE 4 | Frequency and percentage of the participants who were practicing appropriately based on responses to the questionnaire items.

Questionnaire items	Number (%)
P1. If I or anyone close to me develop any COVID-19 symptoms, I will seek or recommend to others to seek medical attention.	1,347 (94.3)
P2. When I am putting on the personal protective equipment (PPE), I follow the following order: Suit—Mask—Goggles—Gloves.	1,108 (77.5)
P3. I have been careful not to carry my mobile phone/pen, etc.… inside the COVID-19 ward.	1,291 (90.1)
P4. I do not go out unless it is necessary.	1,373 (96.1)
P5. When I finish my shift, I dispose the PPE and scrub thoroughly before entering home/quarters.	1,365 (95.5)
P6. I sanitize my hands with alcohol-based solution before attending to each patient.	1,333 (93.3)
P7. After using my PPE, I dispose them in the appropriate color-coded bins.	1,365 (95.5)

Data presented as frequency (%).

Attitude and Practices

The participants with positive responses to the attitude questions ranged between 16.2 and 96.6% (**Table 3**). The item "A3: I think people who got infected with COVID-19, including health care personnel, were infected due to negligence," evoked a strong agreement from 52.6% of responders. Moreover, 83.8% of the participants feared approaching a patient with COVID-19 despite using PPE. In practice items, the participants following safety practices most of the time ranged between 77.5 and 96.1% (**Table 4**). The lowest response rate was for Part 2, regarding the right sequence of donning PPE, as only 77.5% of participants were doing it correctly.

Most of the participants demonstrated a positive attitude (84.2%) toward COVID-19, and practiced safety precautions appropriately (93.0%). Senior HCW aged 51–60 years had more appreciable attitude scores ($p = 0.009$), and young ones (21–30 years) were the least to follow the safety practices ($p < 0.001$). Hitherto female sex, higher qualification, and affiliation to the clinical departments exerted a significant influence toward positive attitude ($p < 0.001$). The married participants were least likely to have positive attitude or follow the safety practices adequately ($p < 0.001$). The demographic distribution of KAP among the study responders are depicted in **Table 5**.

KAP for the HCPs vs. Non-professional HCWs

The professionals had better level of knowledge ($p < 0.001$) as compared with the non-professional participants (**Table 5**). However, they did not differ based on positive attitude and appropriate practices. Interestingly, the HCPs in the clinical departments had significantly better knowledge and positive attitude than those of para-clinical departments ($p < 0.001$). However, there was no significant difference in safety practices between the workers in the clinical and para-clinical department.

DISCUSSION

The invasion of human race by SARS-CoV-2 has claimed more than 4,636,153 lives (3), besides causing economic devastation of the developing countries. Presently, India is cruising through a very strong second wave of pandemic (3). Realistic appreciation of the situation warrants critical assessment of the mental preparedness of the frontline HCWs who take the heat of the onslaught. We therefore aimed to assess the KAP of Indian HCWs of the COVID-19 treatment centers. We found that 82.9% of the HCWs had adequate knowledge, 84.2% displayed positive attitude, and 93.0% adhered to safety practices most of the times.

In this study a cumulative 82.9% of the participants possessed adequate knowledge about COVID-19, and the HCWs who were married, professionals, urban dwellers, and with higher educational qualification had more probability of adequate knowledge than the rest. Interestingly, it was observed that the HCWs of age group 41–50 years were lagging far behind others in knowledge aspect. The HCWs of this age are generally senior doctors, nursing superintendents, and senior supervisors of the paramedical departments. Probable reason for this deficit could be predominant administrative engagements rather than clinical exposure in this group. Relative knowledge inadequacy among the senior HCWs is a cause for concern as they are decision makers in most institutes. A survey conducted at Mumbai among HCP also revealed only 71.2% adequacy of knowledge and akin to our study, the administrative and paramedical staff performed poorly in knowledge (9). In Pakistan, Saqlain et al. reported that 93% of the HCWs possessed adequate knowledge (10). The knowledge figures appeared less in our survey probably because of confounding effect of 19.4% of the non-professional HCWs.

Our survey showed that 62.7% of the HCWs relied only upon single source of information for knowledge update. Disturbingly, the most frequent source was news media channels (22.8%). In the era of evidence-based medicine, the reliance of HCW on non-scientific sources of information is deemed less beneficial for the patient community. This observation could not be dispensed as a regional phenomenon because Saqlain et al. also endorsed the same finding in his survey (10). Of concern was that only 40.2% of HCWs ever had any infection control training at the time of the study. A similar report from a multicenter study in India highlighted that only 56.18% of doctors received training related to COVID-19 and <50% were satisfied with the quality of the training (11). Ironically training had a significant negative impact on the knowledge scores in our study population ($p < 0.001$). Resource and time shortage make the HCW's training, the Achille's heel of health regulatory bodies, more so during pandemic times. Yet this lacuna cannot be left unaddressed, and we recommend decentralization of training programs at the institute level with feedback evaluation by the Ministry of Health.

Among the significant knowledge gaps, notable ones were regarding the treatment aspects and pandemic myths (K6 and K8 of **Table 2**). Forty percent of the participants believed that many

TABLE 5 | Distribution of adequate knowledge, positive attitude, and appropriate practices based on the demographics and characteristics of the participants.

Variables	Category	Adequate knowledge (7/9 points)		Positive attitude (9/16 points)		Appropriate practices (11/14 points)	
		N (%)	p*	N (%)	p	N (%)	p
Overall		1,185 (82.9)	–	1,203(84.2)		1,329 (93.0)	
Age (in years)	21–30	491 (85.2)	**<0.001**	475 (82.5)	**0.009**	509 (88.4)	**<0.001**
	31–40	386 (85.6)		393 (87.1)		428 (94.9)	
	41–50	200 (74.1)		221 (81.9)		262 (97.0)	
	51–60	83 (81.4)		93 (91.2)		102 (100)	
	61–70	25 (83.3)		21 (70.0)		28 (93.33)	
Gender	Male	455 (82.8)	0.875	418 (76.0)	**<0.001**	512 (93.1)	0.917
	Female	730 (83.1)		785 (89.3)		817 (93.0)	
Marital status	Single	777 (80.3)	**<0.001**	835 (86.3)	**0.002**	932 (96.3)	**<0.001**
	Married	408 (88.5)		368 (79.8)		397 (86.1)	
Residential area	Urban	703 (90.4)	**<0.001**	665 (85.5)	0.143	723 (92.9)	0.908
	Rural	482 (74.0)		538 (82.6)		606 (93.1)	
Received infection control training	No	783 (86.4)	**<0.001**	712 (83.4)	0.305	786 (92.0)	0.082
	Yes	447 (77.7)		491 (85.4)		543 (94.4)	
Health care professional	No	167 (60.3)	**<0.001**	243 (87.7)	0.059	263 (94.9)	0.158
	Yes	1,018 (88.4)		960 (83.3)		1,066 (92.5)	
Educational achievement	≤High school	152 (57.1)	**<0.001**	228 (85.7)	**<0.001**	258 (97.0)	**<0.001**
	Bachelor or associate	265 (78.6)		250 (74.2)		319 (94.7)	
	Master	338 (90.9)		308 (82.8)		324 (87.1)	
	Doctoral	430 (94.7)		417 (91.9)		428 (94.3)	
Hospital department for HCP (n = 1,152)	Medical	533 (91.0)	**<0.001**	500 (85.3)	**<0.001**	531 (90.6)	0.097
	Surgical	137 (92.6)		132 (89.2)		139 (93.9)	
	Nursing	173 (85.2)		162 (79.8)		195 (96.1)	
	Laboratory	124 (89.9)		113 (81.9)		127 (92.0)	
	Other para-clinical	31 (63.3)		31 (63.3)		48 (98.0)	
	Pharmacy	20 (71.4)		22 (78.6)		26 (93.0)	

Data presented as frequency (%).
*p-values were from chi-squared test and the values in bold represent significant results.

curative treatment options are available for COVID-19 which reflects poor reliance on authenticated information source. Also, 30.4% believed the pandemic would end in summer due to humid climate. Despite the fact that the WHO houses a section on "Myth Busters" in its official website (3), such misbeliefs floating among the HCWs is worrisome.

This survey identified positive attitude among 84.2% of the responders. Among all, 96.6% confirmed having a sense of responsibility towards their role in the pandemic. It was encouraging to note that 73.3% recorded an optimistic outlook of COVID-19 outcome in our country. However, it was offset by 84.8% of the participants harboring deep rooted fear when caring for the patients with COVID-19. The medical fraternity often find it difficult to come to terms with looming uncertainties during an outbreak. A nationwide survey conducted among the doctors identified depression and anxiety among 35% of the responders (12). The Middle East Respiratory Syndrome (MERS) epidemic of 2012 had seen a phenomenal impact on the psychosocial well-being of the doctors involved in patient care activities (13). Disease acquisition fear among the HCWs jeopardizes delivery of optimal care to the patients and forecasts adverse outcome (14, 15). Singh et al. observed that shortage of resources and endless hours of COVID-19 duties have wreaked havoc on the morale of HCWs in India (11). In our study, we were able to identify the factors conducive to negative attitude which included age (61–70 years), male sex, being married, lower educational qualification, and working in the para-clinical departments ($p < 0.05$). Caregiver fatigue is an ominous sign and we urge the Ministry of Health to look into this need as a priority. Stress relieving maneuvers for the HCWs, such as Yoga, peer group activities, and adequate off-duty hours could be our insurance in this regard.

The study found that 93% of the participants reported good adherence to the safety practices and the relative lack of training did not seem to adversely affect the same. However, the younger aged (21–30 years) and married HCWs were less likely to follow sound safety practice; probably due to inexperience and heightened confidence ($p < 0.001$). The weakest link in the chain was donning procedure which only 77.5% of the HCWs practiced properly. A related study among the doctors in India revealed that 94% used face masks appropriately and 95% regularly resorted to hand hygiene

(12). The efforts of the Ministry of Health in promulgating awareness among the HCWs about the safety practices deserves commendation at this juncture. Interestingly, we observed that good practices were uniformly followed by the entire spectrum of HCW population with insignificant differences between the professional and non-professional groups. This was in contradiction to the results observed in Pakistan where the pharmacists adhered to infection control practices more than other HCWs (10). Interestingly, the HCWs with the lowest qualification were the best safety practitioners ($p < 0.001$). This paradox is a pseudo phenomenon since most of these staff are of lower cadre [stretcher bearers, nursing assistants, etc.] who are constantly monitored and perform healthcare activities under supervision.

Majority of the study participants (80.6%) were HCP and only 19.4% constituted lower cadre staff (technicians, nursing assistants, sanitary workers, etc.). Hence, caution should be exercised in extrapolating the findings of this study to the entire HCW population. However, the only difference between the two groups was in the knowledge aspect which is something that we would expect. Furthermore, the study recruited participants working in high case load COVID-19 centers spanning the country. Their KAPs are shaped by intense exposure which distinguishes them from the workers in the non-COVID-19 hospitals and primary care setup. The study results largely reflect the KAP of HCWs involved in the care of patients with COVID-19 and the recommendations therein are applicable to this subset only. Therefore, generalization of these findings to all HCWs would lose validity.

The study found the vast majority of HCWs had adequate level of knowledge, positive attitude, and were practicing safely most of the time. However, there were many uncertainties in the KAP of our target population which need to be resolved. First, infection control training status of the HCWs was far from satisfactory. Second, fear of disease acquisition among the HCWs was recognized and may negatively impact patient care. Finally, considerable demographic heterogeneity was revealed in the KAP of HCWs which can be targetted by focused educational and psychological training programs. Summing up, the study identified important knowledge gaps, attitudinal differences, and practice variations among the HCWs in India which leaves a lot of space for improvement. The authors conclude that there is scope for improvement in this aspect of pandemic control strategy of the country which could pave the way for better outcomes.

Remedial measures suggested include targeted training and mental health programs for the HCWs, capacity building of health facilities and curb on social media disseminating fear. With SARS-CoV-2 still on the rampage, it is time that the country takes a second look at the weak links disabling the COVID-19 warriors.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Ethics Committee of Government Villupuram Medical College and Hospital, Tamil Nadu, India. The Ethics Committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

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Predictors of Shift Work Sleep Disorder Among Nurses During the COVID-19 Pandemic: A Multicenter Cross-Sectional Study

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Background: Nurses have a high incidence of shift work sleep disorder, which places their health and patient safety in danger. Thus, exploring the factors associated with shift work sleep disorder in nurses is of great significance in improving their sleep health, nursing personnel staffing, and scheduling during the COVID-19 pandemic.

Objectives: The purpose of this study was to investigate the incidence of shift work sleep disorder during the COVID-19 pandemic and explore the factors associated with shift work sleep disorder in Chinese nurses.

Methods: This was a multicenter cross-sectional study using an online survey. Stratified cluster sampling was used to include 4,275 nurses from 14 hospitals in Shandong, China from December 2020 to June 2021. Stepwise multivariate logistic regression analysis and random forest were used to identify the factors associated with shift work sleep disorder.

Results: The prevalence of shift work sleep disorder in the sampled shift nurses was 48.5% during the COVID-19 pandemic. Physical fatigue, psychological stress, shift work more than 6 months per year, busyness during night shift, working more than 40 h per week, working more than four night shifts per month, sleeping more than 8 h before night shift, using sleep medication, irregular meals, and high-intensity physical activity were associated with increased odds of shift work sleep disorder. Good social support, good work-family balance, napping two or three times per week, resting more than one day after shifts, intervals of 8 days or more between shifts, and taking turns to rest during the night shift were associated with decreased odds of shift work sleep disorder.

Conclusions: Shift work sleep disorder may be associated with scheduling strategies and personal behavior during the COVID-19 pandemic. To reduce the incidence of shift work sleep disorders in nurses, nursing managers should increase night shift staffing, extend rest days after shift, increase night shift spacing, and reduce overtime, and nurses need to seek more family and social support and control their sleep schedules and diet.

Keywords: China, cross-sectional studies, nurses, personnel staffing and scheduling, shift work sleep disorder

INTRODUCTION

The National Sleep Foundation defines shift work as a work that takes place outside the traditional daily schedule of 09:00–17:00 (1). Shift work is very common in the healthcare sector, in which nurses are usually involved. A previous longitudinal study showed that shift work schedules had no effect on lifestyle (2). However, shift work interferes with biological rhythms, and can lead to a wide variety of health problems, with sleep problems being the most common health problem (3). Thus, shift work sleep disorder (SWSD) is considered a chronic condition that is directly related to work schedule (4). Previous studies have shown that nurses are taking more frequent shifts, with heavier workloads and a sharp increase in fatigue and mental stress during the COVID-19 pandemic (5). Large numbers of patients, long working hours and the definition of new roles for healthcare workers in the context of the COVID-19 pandemic have led to insufficient breaks and sleep, and reduced job satisfaction (6). However, previous studies have lacked reports on the prevalence of SWSD for nurses during the COVID-19 pandemic. Therefore, nursing managers and nurses themselves should improve their awareness of the incidence and harm of SWSD during the COVID-19 pandemic, and pay more attention to the possible factors associated with SWSD in the physical, psychological, environmental, occupational, social, and behavioral aspects, so as to improve professional identity and happiness and ensure the health and safety of nurses on duty.

In 2014, the third edition of ICSD (ICSD-3) defined SWSD as a circadian rhythm disorder and updated the ICSD-2 criteria for this condition (7, 8). Major changes from ICSD-2 include linking insomnia/sleepiness to a reduction in the total sleep time associated with work schedules. In addition, the minimum duration of symptoms increased from 1 month to at least 3 months (9). The incidence of SWSD among nurses is reported to be between 24.4 and 37.6% using ICSD-2 criteria, accounting for a quarter of the total number of nurses (10, 11). In a Norwegian study using ICSD-3 criteria, 45.6% of nurses reported previously experiencing SWSD during 2 years of follow-up (4). However, a recent study in Finland reported that using ICSD-3 criteria led to a lower incidence of SWSD diagnosis compared to using ICSD-2 criteria (12). Thus far, few studies have investigated the prevalence of SWSD according to the latest criteria, and its prevalence according to country and occupation remains to be determined (13).

SWSD is associated with serious adverse consequences for individuals, employers, and society, and can damage health (1). In addition, there are many health problems that occur with SWSD, such as anxiety or depression (14), headaches (15), and impaired cognitive function (16). SWSD is associated with lower alertness, reduced attention, and increased likelihood of sleepiness-related accidents, all of which can reduce work performance, patient safety, and quality of life (13, 17–19). In addition, SWSD leads to loss of productivity and increased economic costs (20). The dissonance between endogenous circadian rhythms and sleep and work schedules of shift workers may be the mechanism responsible for SWSD (17). In addition, short rest periods (<11 h) between two shifts have

also been reported to be associated with the presence of SWSD (21). Previous reviews have also pointed to the importance of investigating the association of shift work schedules and lifestyle factors with SWSD and exploring preventive measures for SWSD (1, 20). Jang proposed interventions to manage SWSD, including adjusting the shift work schedules and working hours, providing shift workers with adequate sleep health education, and providing the opportunities to take naps and breaks during night shifts (20). However, specifics of the factors and interventions, including periods between two shifts, staffing, frequency and duration of naps, sleep duration before and after night shifts, and dietary adjustments, remain unclear (13, 17).

Therefore, in this study we first aimed to measure the incidence of SWSD in nurses based on the latest diagnostic criteria. Second, we aimed to explore the comprehensive factors of SWSD in shift nurses from physical, psychological, environmental, occupational, social, and behavioral perspectives based on the Integrated Framework for Population Health Risk Management (22) to fill the gaps in extant research. Furthermore, random forest was used to rank the importance of the factors. Currently, nursing management emphasizes on making full use of strengths and avoiding weaknesses, and our study intended to find approaches that will aid in scientifically and effectively organizing shift schedules for nurses to reduce the incidence of SWSD, promote health, and improve the quality of life of shift nurses.

MATERIALS AND METHODS
Design, Setting, and Participants

In this multicenter cross-sectional study, we used data from the first survey of Chinese nurses conducted between December 2020 to June 2021 from the Nurses' Health Cohort Study of Shandong. The cohort study mentioned above is an ongoing prospective cohort study of Chinese nurses conducted in Shandong province, China (registration number: ChiCTR2100043202). The study adopted a multistage sampling method for a more extensive sample coverage. The steps are as follows: (a) Shandong was categorized into eastern, western, southern, northern and central regions; (b) hospitals were selected by convenience sampling (at least one secondary and one tertiary hospital were selected from each region); and (c) participants were selected through cluster sampling.

Registered nurses with nurse qualification certificates who worked in shifts, and agreed to participate in this study were included in the present study. Retired nurses, refresher nurses, and student nurses; nurses who had been working for a duration of <6 months; and nurses who were on leave during the investigation were excluded from the present study.

Measures

The questionnaire consisted of the following four parts: demographic and lifestyle variables; SWSD assessment; shift work characteristics; standardized questionnaires.

Demographic and Lifestyle Variables

The basic demographic variables included sex, age, marital status, children, educational background, department, hospital level, professional title, and income. The body mass index was calculated as body weight (kg) divided by the squared height (m^2), and nurses were categorized on the basis of their body mass index as underweight ($\leq$18.4), normal weight (18.5–23.9), and overweight ($\geq$24) (23). Lifestyle variables included drinking caffeinated beverages at work (yes/no), sleep duration before and after the night shift, use of sleep-promoting drugs (yes/no), changes in diet during shift work, and the frequency and duration of naps.

Shift Work Characteristics

Shift work characteristics included shift schedule (two shifts/three shifts/other), direction of shift rotation (clockwise/counterclockwise), intervals between night shifts, number of years working in shift work, number of hours of working/overtime per week, number of months of shift work per year, number of night shifts per month, busyness during night shift (yes/no), psychological burden during shift work (yes/no), and physical discomfort during shift work (yes/no).

SWSD Assessment

SWSD was assessed with the following three questions: (a) Do you have a work schedule that sometimes overlaps with the time you usually sleep? (b) If yes, does this cause insomnia and/or excessive sleepiness due to reduced amount of sleep? (c) If yes, has this lasted for at least three months? Participants who responded "yes" to all three questions were classified as having SWSD (4).

Work-Family Balance Scale

The work-family balance was assessed using a 14-item work-family balance scale, which is widely used to measure the work-family inter-relation based on four domains, namely, work-family conflict, family-work conflict, work-family enrichment, and family-work enrichment (24). This scale was adopted and modified by Chinese researchers and had good reliability and validity (25). Each item is rated on a 5-point Likert scale from 1 (definitely disagree) to 5 (definitely agree). Based on the total score, work-family balance was recategorized as high (>42) and low ($\leq$42). In the present study, the Cronbach's alpha coefficient of the scale was 0.811.

Perceived Social Support Scale

Social support was assessed using the 12-item perceived social support scale, which is a reliable instrument for measuring perceived support from family, friends, and others (26). Responses for each item range from 1 (definitely disagree) to 7 (definitely agree). Based on the total score, shift nurses were categorized as having low (12–36), medium (37–60), and high (61–84) levels of perceived social support. The Chinese version has shown good psychometric properties with a Cronbach's alpha coefficient of 0.91 and a test-retest reliability of 0.85 (27). The Cronbach's alpha coefficient of the scale in this study was 0.980.

Fatigue Scale

The fatigue scale was used to measure the severity of fatigue (28). This 14-item questionnaire includes two dimensions: physical fatigue and mental fatigue. Nurses were categorized into different levels of fatigue on the basis of their total score on the scale: low (0–4), medium (5–9), and high (10–14). The Chinese version of the scale has been widely used with had good reliability and validity (29). The Cronbach's alpha coefficient of the scale in this study was 0.803.

Perceived Stress Scale

The 10-item perceived stress scale was used to assess nurses' perceptions of stress (30). The Chinese version of the perceived pressure scale adopted in this study has been verified to have good reliability and validity (31). Each item is measured on a 5-point Likert scale from 0 (never) to 4 (always), and the perceived stress level was divided into three categories: low (0–13), medium (14–27), and high (28–40). The Cronbach's alpha coefficient of the scale in this study was 0.741.

Circadian Type Inventory

A 11-item circadian type inventory was previously developed to measure circadian rhythms (32). In the current study, we used the Chinese version of the scale to assess circadian flexibility and languidity (33). The two subscales used in this scale were divided into low, medium, and high levels based on the one-third and two-third cutoff points of the theoretical subscale score. A higher level on the flexibility subscale indicated greater adaptability to shifts, while a higher level on languidity indicated greater difficulty in overcoming sleepiness. The Cronbach's alpha coefficient of the scale in this study was 0.838.

International Physical Activity Questionnaire

The international physical activity questionnaire has been widely used to study the physical activity level (34). The questionnaire includes five parts: occupation, housework, transportation, leisure, and sitting. We used the Chinese version of the questionnaire, which has good reliability and validity (35). We divided the physical activity into three levels by calculating the total metabolic equivalent: low, medium, and high.

Data Collection

Baseline information was collected through the Wenjuanxing network platform between December 2020 to June 2021. The survey included eight electronic questionnaires, each of which would take about 10–15 min to complete. Nurses were sent these questionnaires via WeChat (a widely used instant messaging app used in China) in batches to avoid impatience. Subjects who did not participate in the survey within 1 week of sending the questionnaires received a WeChat reminder to complete the survey once per week until the questionnaires were completed. Liaisons were set in every hospital involved in this study, functioning as regulators for questionnaire completion and communicators with the researchers when facing unsolved problems. Only professionals who signed nondisclosure agreements had direct access to the data. To ensure data quality,

we adopted the required questions and data logic control design for the electronic questionnaires.

Ethical Considerations

This study was carried out in accordance with the International Guidelines of Good Epidemiology Practice and the Declaration of Helsinki principles. The nurses' participation was voluntary, and written informed consents were obtained from all the respondents. The study was approved by the Ethics Committee of Scientific Research of Hospital with the registration number (KYLL-202011-085).

Data Analysis

All the variables in this study, including one dependent variable and 43 independent variables, were categorical variables. Descriptive statistics included frequency and percentage for them. The distribution of characteristics between shift nurses with and without SWSD was assessed using the chi-squared test or Fisher's exact test for categorical variables. Bonferroni correction was applied for correcting the multiple test and $p < 0.0012$ was considered statistically significant for the univariate analysis. Statistically significant variables in the univariate analyses were all considered for inclusion in a forward and backward stepwise multivariate logistic regression analysis to identify the main factors associated with SWSD and to estimate the adjusted odds ratios (ORs) and 95% confidence intervals (CIs). The final logistic regression model with Akaike Information Criterion (AIC) minimization was used, and variables in the final model with $p < 0.05$ denoted statistically significant differences. Logistic regression was used because this classic classifier has been widely used in disease prediction and it is easy to interpret the results.

In order to more accurately explore the importance of factors, we adopted a machine learning method, random forest. The random forest is a tree-based ensemble classification algorithm, which has been widely used to build disease prediction models with small variable sets and high generalization ability. We use grid search for hyperparameter adjustment when training the model. The data was divided into 7:3 training data and test data. The training set was used to train and obtain the final model, and the test set was used to draw receiver-operating characteristic (ROC) curves to determine the prediction performance of the model. The random forest was implemented using Python 3.7.4 (Python Software Foundation, USA) with Scikit-learn (Packt Publishing, UK). Other statistical analyses were carried out using R software version 4.0.5 (R Development Core Team, Vienna, Austria).

RESULTS

Respondent Characteristics and SWSD Prevalence

The participants ($n = 4,655$) of the present study were recruited from nurses participating in shift work in 14 hospitals across six cities in Shandong, China. Of these, nurses who did not complete the questionnaire or those whose questionnaires contained logical inconsistencies were eliminated, leading to the exclusion

of 8.17% of respondents, leaving 4,275 participants. The study participants ranged in age from 21 to 55 years and 93.2% (3,985) were women. The average age of the respondents was 31.19 ± 5.48 years, and the average working duration was 8.62 ± 5.16 years. In this study, the prevalence of SWSD among participating nurses was as high as 48.5%. **Table 1** shows all the respondents' features and univariate analysis of SWSD in detail.

Stepwise Multivariate Logistic Regression Analysis of Factors Associated With SWSD

Table 2 shows the final forward and backward stepwise multivariate logistic regression model with adjusted OR and 95% CI of the main variables. In terms of physical and psychological factors, compared to nurses who reported a low level of fatigue, those who reported a moderate or high level of fatigue were significantly more likely to experience SWSD (OR = 1.35, 95% CI: 1.08–1.67; and OR = 2.50, 95% CI: 2.02–3.10, respectively). A high perceived stress level (OR = 4.63, 95% CI: 2.60–8.63) had a statistically significant association with SWSD. Additionally, shift nurses who experienced physical discomfort during their night shift (OR = 2.05, 95% CI: 1.74–2.43) or experienced psychological stress before or after the night shift (OR = 1.51, 95% CI: 1.14–2.01; and OR = 1.52, 95% CI: 1.30–1.77, respectively) were more likely to develop SWSD than shift nurses who did not have such experiences.

In terms of environmental and occupational factors, nurses who worked shifts of 7–9 or 10–12 months per year were significantly more likely to experience SWSD than those who worked shifts of ≤3 months per year (OR = 1.55, 95% CI: 1.03–2.35; and OR = 1.79, 95% CI: 1.26–2.58, respectively). Furthermore, 5–9 and >10 night shifts per month showed a detrimental effect to the sleep of shift nurses, with ORs of 1.34 (95% CI: 1.10–1.64) and 1.91 (95% CI: 1.41–2.58), respectively. Shift nurses who worked more than 40 h per week were also more likely to develop SWSD than those who worked less (>40 h per week for more than 4 weeks/month: OR = 2.36, 95% CI: 1.88–2.95). Compared to nurses who rested for 1 day after each night shift, those who took 1.5 days and ≥2 days off after each night shift were significantly less likely to experience SWSD. (OR = 0.76, 95% CI: 0.61–0.95; and OR = 0.77, 95% CI: 0.65–0.91, respectively). Nurses with ≥8-day intervals between shifts were less likely to develop SWSD than those with ≤4-day intervals (OR = 0.69, 95% CI: 0.52–0.92). Busyness during night shift was also associated with SWSD (OR = 1.30, 95% CI: 1.09–1.55), and shift nurses are less likely to experience SWSD when two clinical nurses were on the night shift and took turns to rest (OR = 0.69, 95% CI: 0.52–0.92).

In terms of social and behavioral factors, nurses who had a good work-family balance (OR = 0.41, 95% CI: 0.29–0.56) or good social support (OR = 0.74, 95% CI: 0.60–0.91) were less likely to experience SWSD. Nurses who responded that they could get >8 h of sleep before night shift were statistically significantly more likely to have SWSD (OR = 1.95, 95% CI: 1.08–3.55) than those who got <3 h of sleep before night shift. In addition, napping 2–3 times per week was a protective factor for SWSD (OR = 0.77, 95% CI: 0.63–0.94). Shift nurses who often

TABLE 1 | Respondent characteristics and univariate analysis of factors related to shift work sleep disorder in shift nurses.

| Variables | N (%) | Shift work sleep disorder | | χ^2 value | p value[†] |
		No, N (%)	Yes, N (%)		
Total	4,275 (100.0)	2,202 (51.5)	2,073 (48.5)		
I. Physical and psychological factors					
Gender					
Male	290 (6.8)	136 (6.2)	154 (7.4)	2.650	0.104
Female	3,985 (93.2)	2,066 (93.8)	1,919 (92.6)		
Age					
≤25 years	678 (15.9)	414 (18.8)	264 (12.7)	43.898	**<0.001***
26–30 years	1,124 (26.3)	603 (27.4)	521 (25.1)		
31–35 years	1,711 (40.0)	843 (38.3)	868 (41.9)		
36–40 years	609 (14.2)	276 (12.5)	333 (16.1)		
>40 years	153 (3.6)	66 (3.0)	87 (4.2)		
Body mass index					
Underweight	461 (10.8)	234 (10.6)	227 (11.0)	2.117	0.347
Normal weight	2,651 (62.0)	1,388 (63.0)	1,263 (60.9)		
Overweight	1,163 (27.2)	580 (26.3)	583 (28.1)		
Circadian rhythms[‡]					
Flexibility					
Low	433 (10.1)	212 (9.6)	221 (10.7)	1.283	0.527
Moderate	2,673 (62.5)	1,387 (63.0)	1,286 (62.0)		
High	1,169 (27.3)	603 (27.4)	566 (27.3)		
Languidity					
Low	530 (12.4)	258 (11.7)	272 (13.1)	2.243	0.326
Moderate	3,000 (70.2)	1,564 (71.0)	1,436 (69.3)		
High	745 (17.4)	380 (17.3)	365 (17.6)		
Fatigue					
Low	903 (21.1)	677 (30.7)	226 (10.9)	461.458	**<0.001***
Moderate	1,335 (31.2)	809 (36.7)	526 (25.4)		
High	2,037 (47.6)	716 (32.5)	1,321 (63.7)		
Physical discomfort during night shift					
No	1,427 (33.4)	1,037 (47.1)	390 (18.8)	384.021	**<0.001***
Yes	2,848 (66.6)	1,165 (52.9)	1,683 (81.2)		
Psychological stress before night shift					
No	466 (10.9)	364 (16.5)	102 (4.9)	148.191	**<0.001***
Yes	3,809 (89.1)	1,838 (83.5)	1,971 (95.1)		
Psychological stress during night shift					
No	503 (11.8)	395 (17.9)	108 (5.2)	166.633	**<0.001***
Yes	3,772 (88.2)	1,807 (82.1)	1,965 (94.8)		
Psychological stress after night shift					
No	1,765 (41.3)	1,170 (53.1)	595 (28.7)	262.919	**<0.001***
Yes	2,510 (58.7)	1,032 (46.9)	1,478 (71.3)		
Perceived stress					
Low	541 (12.7)	390 (17.7)	151 (7.3)	193.251	**<0.001***
Moderate	3,579 (83.7)	1,794 (81.5)	1,785 (86.1)		
High	155 (3.6)	18 (0.8)	137 (6.6)		
II. Environmental and occupational factors					
Hospital level[§]					
Secondary hospital	1,415 (33.1)	764 (34.7)	651 (31.4)	5.226	**0.022**
Tertiary hospital	2,860 (66.9)	1,438 (65.3)	1,422 (68.6)		

(Continued)

TABLE 1 | Continued

Variables	N (%)	Shift work sleep disorder		χ² value	p value†
		No, N (%)	Yes, N (%)		
Departments					
Internal medicine	1,317 (30.8)	723 (32.8)	594 (28.7)	39.945	**<0.001***
Surgery	995 (23.3)	476 (21.6)	519 (25.0)		
Emergency	292 (6.8)	122 (5.5)	170 (8.2)		
Gynecology and obstetrics	312 (7.3)	160 (7.3)	152 (7.3)		
Pediatrics	390 (9.1)	215 (9.8)	175 (8.4)		
Operating room	282 (6.6)	164 (7.4)	118 (5.7)		
Intensive care unit	330 (7.7)	144 (6.5)	186 (9.0)		
Others	357 (8.4)	198 (9.0)	159 (7.7)		
Professional title					
Primary	2,878 (67.3)	1,573 (71.4)	1,305 (63.0)	35.250	**<0.001***
Medium	1,365 (31.9)	613 (27.8)	752 (36.3)		
Senior	32 (0.7)	16 (0.7)	16 (0.8)		
Monthly income, Chinese Yuan					
<3,000	346 (8.1)	198 (9.0)	148 (7.1)	27.034	**<0.001***
3,000–5,999	2,534 (59.3)	1,362 (61.9)	1,172 (56.5)		
6,000–8,999	1,155 (27.0)	537 (24.4)	618 (29.8)		
≥9,000	240 (5.6)	105 (4.8)	135 (6.5)		
Work schedule					
Two shifts	2,286 (53.5)	1,206 (54.8)	1,080 (52.1)	14.330	**0.001***
Three shifts	1,833 (42.9)	938 (42.6)	895 (43.2)		
Others	156 (3.6)	58 (2.6)	98 (4.7)		
Direction of shift rotation					
Clockwise	2,740 (64.1)	1,458 (66.2)	1,282 (61.8)	8.860	**0.003**
Counterclockwise	1,535 (35.9)	744 (33.8)	791 (38.2)		
Shift work experience					
0–5 years	1,371 (32.1)	795 (36.1)	576 (27.8)	65.905	**<0.001***
6–10 years	1,532 (35.8)	818 (37.1)	714 (34.4)		
11–15 years	999 (23.4)	433 (19.7)	566 (27.3)		
16–20 years	288 (6.7)	120 (5.4)	168 (8.1)		
>20 years	85 (2.0)	36 (1.6)	49 (2.4)		
Months of shift work per year					
1–3 months	209 (4.9)	147 (6.7)	62 (3.0)	73.364	**<0.001***
4–6 months	385 (9)	248 (11.3)	137 (6.6)		
7–9 months	432 (10.1)	242 (11.0)	190 (9.2)		
10–12 months	3,249 (76.0)	1,565 (71.1)	1,684 (81.2)		
Night shifts per month					
≤4	884 (20.7)	561 (25.5)	323 (15.6)	92.829	**<0.001***
5–9	2,963 (69.3)	1,486 (67.5)	1,477 (71.2)		
≥10	428 (10.0)	155 (7.0)	273 (13.2)		
Days off after night shift					
1 day	2,524 (59.0)	1,164 (52.9)	1,360 (65.6)	76.881	**<0.001***
1.5 days	538 (12.6)	297 (13.5)	241 (11.6)		
≥2 days	1,213 (28.4)	741 (33.7)	472 (22.8)		
Interval between night shifts					
≤4 days	1,388 (32.5)	635 (28.8)	753 (36.3)	38.403	**<0.001***
5–7 days	2,412 (56.4)	1,276 (57.9)	1,136 (54.8)		
≥8 days	475 (11.1)	291 (13.2)	184 (8.9)		

(Continued)

TABLE 1 | Continued

Variables	N (%)	Shift work sleep disorder		χ^2 value	p value[†]
		No, N (%)	Yes, N (%)		
Night shift staffing					
1	1,248 (29.2)	643 (29.2)	605 (29.2)	23.532	**<0.001***
2 (take turns)	1,601 (37.5)	891 (40.5)	710 (34.2)		
2 (take no turns)	649 (15.2)	301 (13.7)	348 (16.8)		
≥3	777 (18.2)	367 (167)	410 (19.8)		
Busyness during night shift					
No	1,146 (26.8)	754 (34.2)	392 (18.9)	127.923	**<0.001***
Yes	3,129 (73.2)	1,448 (65.8)	1,681 (81.1)		
Working >40 h/week					
Never/rarely	772 (18.1)	550 (25.0)	222 (10.7)	253.197	**<0.001***
1 week/month	796 (18.6)	480 (21.8)	316 (15.2)		
2 weeks/month	713 (16.7)	367 (16.7)	346 (16.7)		
3 weeks/month	462 (10.8)	215 (9.8)	247 (11.9)		
4 weeks/month	1,532 (35.8)	590 (26.8)	942 (45.4)		
Working during off-hours per month					
≤1 day	3,173 (74.2)	1,746 (79.3)	1,427 (68.8)	62.278	**<0.001***
2 days	613 (14.3)	263 (11.9)	350 (16.9)		
≥3 days	489 (11.4)	193 (8.8)	296 (14.3)		
III. Social and behavioral factors					
Education[¶]					
Secondary vocational degree	697 (16.3)	347 (15.8)	350 (16.9)	6.034	**0.049**
Associate's degree	2,744 (64.2)	1,451 (65.9)	1,293 (62.4)		
Bachelor's degree	834 (19.5)	404 (18.3)	430 (20.7)		
Marital status					
Unmarried	1,272 (29.8)	720 (32.7)	552 (26.6)	22.235	**<0.001***
Married	2,926 (68.4)	1,452 (65.9)	1,474 (71.1)		
Others	77 (1.8)	30 (1.4)	47 (2.3)		
Children					
0	1,705 (39.9)	933 (42.4)	772 (37.2)	12.048	**0.002**
1	1,323 (30.9)	646 (29.3)	677 (32.7)		
≥2	1,247 (29.2)	623 (28.3)	624 (30.1)		
Work-family balance					
Low	358 (8.4)	62 (2.8)	296 (14.3)	182.864	**<0.001***
High	3,917 (91.6)	2,140 (97.2)	1,777 (85.7)		
Social support					
Low	726 (17.0)	347 (15.8)	379 (18.3)	78.836	**<0.001***
Moderate	1,452 (34.0)	633 (28.7)	819 (39.5)		
High	2,097 (49.1)	1,222 (55.5)	875 (42.2)		
Naps during the night shift					
Never/rarely	3,209 (75.1)	1,634 (74.2)	1,575 (76.0)	7.247	0.123
≤1 h	125 (2.9)	66 (3.0)	59 (2.8)		
1–2 h	353 (8.3)	171 (7.8)	182 (8.8)		
2–3 h	355 (8.3)	200 (9.1)	155 (7.5)		
>3 h	233 (5.5)	131 (5.9)	102 (4.9)		
Sleep duration before night shift					
<3 h	2,842 (66.5)	1,364 (61.9)	1,478 (71.3)	53.094	**<0.001***
3–5 h	1,227 (28.7)	735 (33.4)	492 (23.7)		
6–8 h	136 (3.2)	75 (3.4)	61 (2.9)		
>8 h	70 (1.6)	28 (1.3)	42 (2.0)		

(Continued)

TABLE 1 | Continued

| Variables | N (%) | Shift work sleep disorder | | χ^2 value | p value[†] |
		No, N (%)	Yes, N (%)		
Sleep duration after night shift					
<3 h	1,375 (32.2)	590 (26.8)	785 (37.9)	65.071	**<0.001***
3–5 h	2,398 (56.1)	1,327 (60.3)	1,071 (51.7)		
6–8 h	389 (9.1)	231 (10.5)	158 (7.6)		
>8 h	113 (2.6)	54 (2.5)	59 (2.8)		
Naps per week					
Never/rarely	912 (21.3)	434 (19.7)	478 (23.1)	32.000	**<0.001***
≤1 day	1,022 (23.9)	484 (22.0)	538 (26.0)		
2–3 days	1,615 (37.8)	862 (39.1)	753 (36.3)		
4–5 days	509 (11.9)	283 (12.9)	226 (10.9)		
6–7 days	217 (5.1)	139 (6.3)	78 (3.8)		
Using sleep medication before night shift					
Often	152 (3.6)	30 (1.4)	122 (5.9)	268.113	**<0.001***
Sometimes	800 (18.7)	240 (10.9)	560 (27.0)		
Never/rarely	3,323 (77.7)	1,932 (87.7)	1,391 (67.1)		
Using sleep medication after night shift					
Often	149 (3.5)	21 (1.0)	128 (6.3)	274.766	**<0.001***
Sometimes	666 (15.6)	190 (8.6)	476 (23.0)		
Never/rarely	3,460 (80.9)	1,991 (90.4)	1,469 (70.9)		
Food intake during shift work					
More	515 (12.0)	197 (8.9)	318 (15.3)	151.815	**<0.001***
Normal	1,439 (33.7)	924 (42.0)	515 (24.8)		
Less	2,321 (54.3)	1,081 (49.1)	1,240 (59.8)		
Time of meal during shift work					
Early	746 (17.5)	330 (15.0)	416 (20.1)	151.621	**<0.001***
Regular	1,591 (37.2)	1,014 (46.0)	577 (27.8)		
Delayed	1,938 (45.3)	858 (39.0)	1,080 (52.1)		
Drinking caffeinated beverage at work					
No	2,995 (70.1)	1,603 (72.8)	1,392 (67.1)	16.240	**<0.001***
Yes	1,280 (29.9)	599 (27.2)	681 (32.9)		
Water intake during work					
≤500 mL	2,279 (53.3)	1,073 (48.7)	1,206 (58.2)	38.898	**<0.001***
501–1,000 mL	1,598 (37.4)	897 (40.7)	701 (33.8)		
1,001–1,500 mL	260 (6.1)	152 (6.9)	108 (5.2)		
>1,500 mL	138 (3.2)	80 (3.6)	58 (2.8)		
Whole day water intake					
≤500 mL	690 (16.1)	314 (14.3)	376 (18.1)	17.118	**0.001***
501–1,000 mL	2,008 (47.0)	1,026 (46.6)	982 (47.4)		
1,001–1,500 mL	956 (22.4)	531 (24.1)	425 (20.5)		
>1,500 mL	621 (14.5)	331 (15.0)	290 (14.0)		
Physical activity					
Low	1,397 (32.7)	791 (35.9)	606 (29.2)	40.527	**<0.001***
Moderate	878 (20.5)	484 (22.0)	394 (19.0)		
High	2,000 (46.8)	927 (42.1)	1,073 (51.8)		

Bold value for p < 0.05.
*Statistically significant differences after application of Bonferroni correction (p < 0.0012).
[†]p value for chi-squared test.
[‡]Circadian rhythms include both circadian flexibility and languidity.
[§]Hospital level management divides hospitals into primary, secondary, and tertiary hospitals.
[¶]Secondary vocational degree: A 4-year senior high school for professional training; associate degree: A 3-year college course for professional training; bachelor's degree: A 4- or 5-year undergraduate training course.

TABLE 2 | Stepwise multivariate logistic regression analysis of factors associated with shift work sleep disorder in shift nurses.

Variables	Adjusted OR	95% CI	p value
I. Physical and psychological factors			
Fatigue (ref: Low level)			
Moderate	1.35	1.08–1.67	**0.007**
High	2.50	2.02–3.10	**<0.001**
Physical discomfort during night shift (ref: No)			
Yes	2.05	1.74–2.43	**<0.001**
Psychological stress before night shift (ref: No)			
Yes	1.51	1.14–2.01	**0.004**
Psychological stress after night shift (ref: No)			
Yes	1.52	1.30–1.77	**<0.001**
Perceived stress (ref: Low level)			
Moderate	1.23	0.97–1.57	0.094
High	4.63	2.60–8.63	**<0.001**
II. Environmental and occupational factors			
Monthly income, Chinese Yuan (ref: <3,000)			
3,000–5,999	0.96	0.72–1.28	0.777
6,000–8,999	1.16	0.85–1.58	0.345
≥9,000	1.36	0.90–2.06	0.143
Shift work experience (ref: 0–5 years)			
6–10 years	0.93	0.75–1.15	0.506
11–15 years	1.26	0.98–1.61	0.072
16–20 years	1.42	1.00–2.02	0.051
>20 years	1.55	0.88–2.74	0.133
Months of shift work per year (ref: 1–3 months)			
4–6 months	1.18	0.78–1.81	0.435
7–9 months	1.55	1.03–2.35	**0.038**
10–12 months	1.79	1.26–2.58	**0.001**
Night shifts per month (ref: ≤4)			
5–9	1.34	1.10–1.64	**0.005**
≥10	1.91	1.41–2.58	**<0.001**
Days off after night shift (ref: 1 day)			
1.5 days	0.76	0.61–0.95	**0.018**
≥2 days	0.77	0.65–0.91	**0.003**
Interval between night shifts (ref: ≤4 days)			
5–7 days	0.93	0.79–1.09	0.359
≥8 days	0.69	0.52–0.92	**0.011**
Night shift staffing (ref: 1)			
2 (take turns)	0.70	0.58–0.84	**<0.001**
2 (take no turns)	0.96	0.76–1.21	0.736
≥3	1.05	0.83–1.31	0.704
Busyness during night shift (ref: No)			
Yes	1.30	1.09–1.55	**0.004**
Working >40 h/week (ref: Never/rarely)			
1 week/month	1.26	0.98–1.61	0.067
2 weeks/month	1.59	1.24–2.05	**<0.001**
3 weeks/month	1.95	1.47–2.60	**<0.001**

(Continued)

TABLE 2 | Continued

Variables	Adjusted OR	95% CI	p value
4 weeks/month	2.36	1.88–2.95	**<0.001**
III. Social and behavioral factors			
Children (ref: 0)			
1	1.14	0.92–1.40	0.226
≥2	0.88	0.70–1.10	0.244
Work-family balance (ref: Low level)			
High	0.41	0.29–0.56	**<0.001**
Social support (ref: Low level)			
Moderate	0.88	0.70–1.09	0.233
High	0.74	0.60–0.91	**0.005**
Sleep duration before night shift (ref: <3 h)			
3–5 h	0.88	0.75–1.04	0.136
6–8 h	1.26	0.82–1.92	0.290
>8 h	1.95	1.08–3.55	**0.027**
Naps per week (ref: Never/rarely)			
≤1 day	0.83	0.67–1.03	0.090
2–3 days	0.77	0.63–0.94	**0.010**
4–5 days	0.93	0.71–1.21	0.582
6–7 days	0.75	0.51–1.08	0.123
Using sleep medication before night shift (ref: Never/rarely)			
Sometimes	1.45	1.14–1.85	**0.002**
Often	2.40	1.39–4.20	**0.002**
Using sleep medication after night shift (ref: Never/rarely)			
Sometimes	1.52	1.17–1.97	**0.002**
Often	3.25	1.86–5.89	**<0.001**
Food intake during shift work (ref: Normal)			
More	1.73	1.32–2.26	**<0.001**
Less	1.15	0.95–1.39	0.144
Time of meal during shift work (ref: Regular)			
Early	1.34	1.07–1.70	**0.012**
Delayed	1.39	1.15–1.68	**0.001**
Physical activity (ref: Low level)			
Moderate	1.14	0.93–1.40	0.202
High	1.39	1.17–1.64	**<0.001**

CI, confidence interval; OR, odds ratio; ref, reference group.
Bold value for p < 0.05.

used sleep medication before or after night shifts were more likely to experience SWSD than those never used sleep medication (OR = 2.40, 95% CI: 1.39–4.20; and OR = 3.25, 95% CI: 1.86–5.89, respectively). Excessive eating and irregular eating were also main factors for SWSD. Finally, high-intensity physical activity was associated with increased odds of SWSD (OR = 1.39, 95% CI: 1.17–1.64).

Feature Importance Ranking of the Factors Associated With SWSD on the Random Forest Model

Before analyzing the predictors, we evaluated the performance of the two models. The results showed that the predictive efficiency

FIGURE 1 | Receiver-operating characteristic curves for each predictive model.
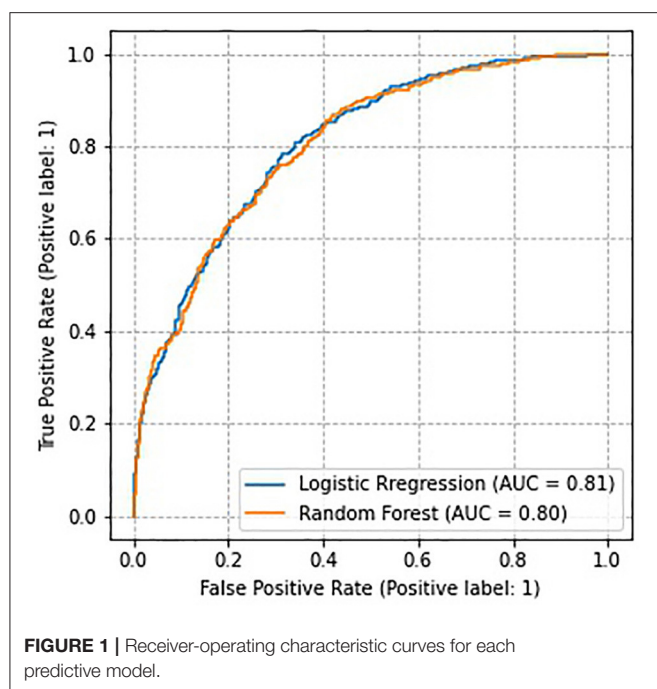
of logistic regression model (sensitivity = 0.73, specificity = 0.71, accuracy = 0.72, area under the receiver operating characteristic curve [AUROC] = 0.81) was similar to that of random forest model (sensitivity = 0.72, specificity = 0.71, accuracy = 0.72, AUROC = 0.80) (**Figure 1**). Therefore, the model prediction performance were guaranteed in our study.

To illustrate the contribution of each factor to predictive capacity, we calculated the feature importance based on random forest. The feature importance of the top 50% of factors was visualized in **Figure 2**, including fatigue, physical discomfort, working overtime per week, using sleep medication, mental stress, diet, length of rest days, work-family balance, and departments. We found that the results of the two statistical methods were consistent, which can indirectly prove the robustness of the results of the logistic regression model.

DISCUSSION

Prevalence of SWSD Among Nurses

The incidence of SWSD among participating nurses was 48.5%, which is higher than the rates of 37.6% (11) and 35.2% (4) reported in two studies in Norwegian nurses, and the rate of 24.4% reported by The Nurses' Sleep Health Project in Japan (10). Previous studies on the prevalence of SWSD in different populations have reported a prevalence of 23.3% in Norwegian oil rig shift workers (36), 19.9% in Chinese textile shift workers (37), 12.7% in Australian shift workers (38), and 8.1% in American shift workers from the community (39).

This discrepancy in the prevalence among the different studies could be attributable to the different shift schedules of the target populations, different national conditions or different times. Although China and Japan have similar nurse shift schedules, we collected data from 14 hospitals of different levels in areas of

different economic levels, so as to more comprehensively reflect the prevalence of SWSD in nurses. Moreover, the incidence of SWSD may be higher since the time of our survey was the COVID-19 pandemic. Our result was somewhat supported by a systematic review stating that 36.36% of healthcare workers experienced work-related sleep problems during the COVID-19 pandemic (40). In addition, differences in disease definitions or questionnaire content might also reflect this divergence. In 2009, some scholars developed a self-administered questionnaire based on the ICSD-2 (36). In 2014, ICSD-3 updated the criteria for SWSD, and Waage et al. updated the questionnaire content according to the updated criteria (4). In ICSD-2, SWSD is defined as insomnia and/or excessive sleepiness that overlaps with shift work hours and cannot be explained by other diseases (7). In ICSD-3, the criteria for SWSD included a reduction in total sleep time as a symptom and increased the minimum duration of symptoms associated with shift work scheduling from 1 to 3 months (8). ICSD-3 was more rigorous in terms of duration and total sleep time was added as an indicator to make the diagnosis more sensitive, leading to significant differences between the two criteria in estimating the incidence of SWSD. Unlike most previous studies based on ICSD-2 (10, 11, 36), we used the latest questionnaire based on the ICSD-3 criteria to obtain a more rigorous and sensitive diagnosis of SWSD.

Physical and Psychological Factors

Similar to the results of previous studies, characteristics of physical and psychological factors showed a statistically significant relationship with the prevalence of SWSD among nurses; however, there were some differences in specific variables. For instance, SWSD is essentially a circadian rhythm disorder that has been associated with polymorphisms in various molecular clock genes (41). Languidity and flexibility are two characteristics of the circadian rhythm, and several previous studies have shown that fatigue may influence SWSD, while flexibility is a protective factor (19, 42, 43). Contrary to our hypothesis, we found no relationship between SWSD and circadian rhythm characteristics. One possible reason for this unexpected finding could be that approximately 70% of the circadian rhythms of shift nurses measured by the questionnaire in this study were at a moderate level, suggesting that a more objective and sensitive measurement method could help explore the relationship between SWSD and circadian rhythm characteristics in greater detail. Furthermore, in our study, nurses who reported experiencing fatigue and physical discomfort (e.g., headache, heart discomfort, gastrointestinal symptoms) during their night shifts were more likely to develop SWSD than those who did not, supporting the results reported previously (15, 23, 42, 44). Interestingly, high work stress during shift work and difficulty in falling asleep were previously found to be the typical symptoms of SWSD (45), consistent with our findings. In addition, the sensitivity of sleep to stress is a known predictor of SWSD (19, 46, 47), suggesting that reducing the mental burden of nursing work has potential benefits in reducing the incidence of SWSD. In addition, Afshari et al. reported that nurses have low levels of psychological resilience during the COVID-19 pandemic (48). Therefore, it is necessary to improve psychological resilience

FIGURE 2 | Feature importance ranking of the factors associated with shift work sleep disorder.
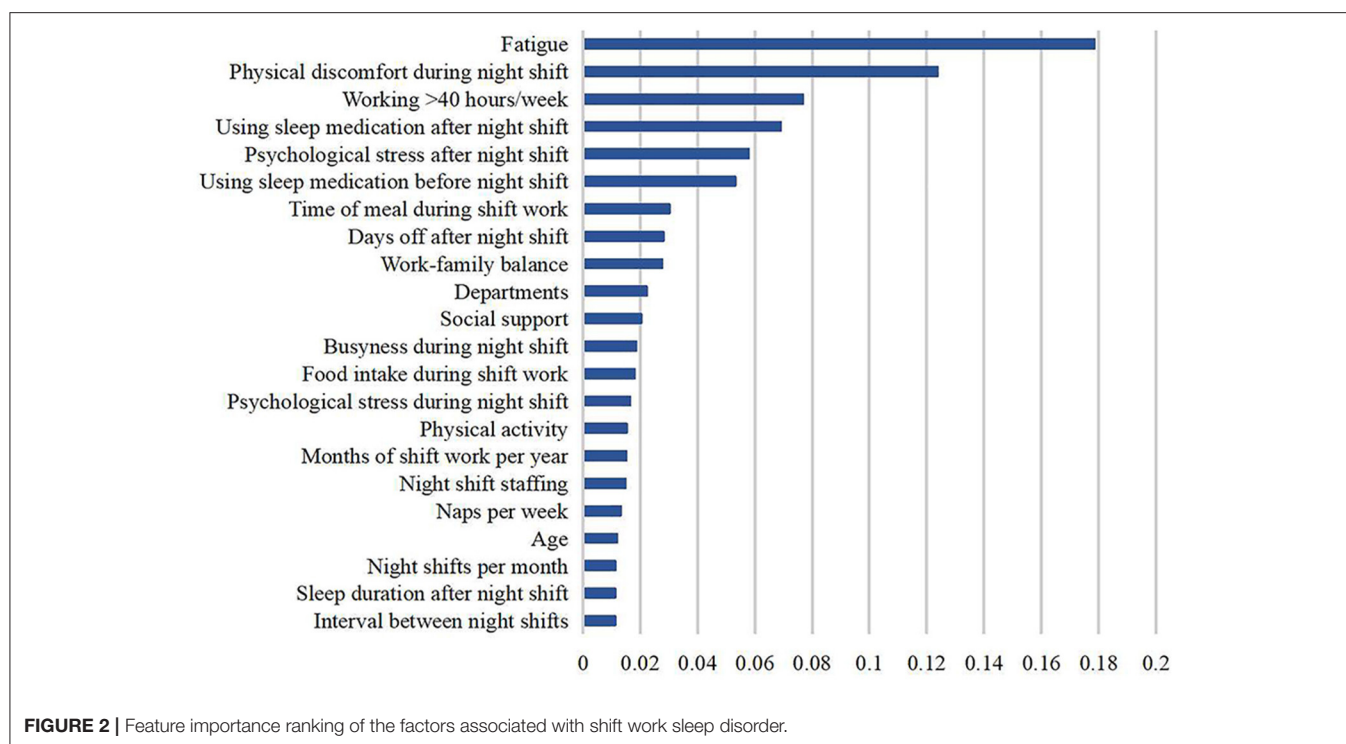
to relieve stress levels and indirectly reduce the impact of stress on SWSD.

Environmental and Occupational Factors

Haile et al. proposed that three shifts are statistically significantly related to SWSD (49), which is different from our finding. We found that nurses on two shifts had a higher prevalence of SWSD than nurses on three shifts, although the results of the stepwise multivariate logistic regression analysis showed no statistically significant correlation between SWSD and rotation schedule, which supported the results of Vanttola et al. (19). Thus, we will continue to investigate the effect of shift schedule on SWSD with prospective follow-up data to verify the current results. An interesting finding of our study was that the number of shift years had no effect on SWSD, but more than 6 months of shift scheduling per year was associated with a higher likelihood of having SWSD. In addition, SWSD was correlated with the average number of nights per month, and more than four night shifts were detrimental to nurses' sleep, which is similar to that reported in other studies (21, 49). This suggests that in nursing management, the head nurse should schedule no more than four night shifts per month to prevent SWSD among nursing staff. Short rest periods (<11 h) between work shifts have been shown to increase the likelihood of SWSD in nurses (44, 50). This supports our finding that more than 1 day of rest (>12 h) after a night shift was a protective factor for SWSD in our study. Moreover, our study reported a novel finding that a busy night shift with one nurse can easily lead to SWSD, but a night shift where two nurses take turns to rest reduces the odds of SWSD. An interval of 8 days or more between night shifts helps nurses

adapt to shifts and reduces the odds of SWSD. Working overtime (>40 h/week) for more than a week per month affected sleep. Di Milia et al. also found a statistically significant association between SWSD and weekly work hours (43).

Social and Behavioral Factors

In our study, the marital status of nurses and whether or not they had children had no association with SWSD, but a higher work-family balance or social support (i.e., family support and friend support) was associated with a lower likelihood of SWSD. Among nurses, the level of social support was statistically significantly and negatively associated with insomnia and daytime sleepiness (51), which supported our conclusions. Our results differed from those of previous studies (49), which only took into account marital status and children, possibly ignoring the more important variable of work-family balance. Afshari et al. reported that nurses have increased demands for social support and work-family balance in the context of the COVID-19 pandemic (48). Therefore, future research can focus more on the influence of psychological factors related to family and society on SWSD.

Numerous studies have repeatedly identified the use of multiple hypnotic agents (such as exogenous melatonin and injectable sleep medications) as predictors of SWSD (21, 49, 52), which is consistent with the findings of our research. We also investigated the role of sleep time before and after the night shift, rest taken during the night shift, and weekly naps. Those with SWSD had greater sleep debt on shift days and slept less compensatory sleep on days off than those without SWSD (19). Hence, our results suggest that effective sleep supplementation should include sleeping for <8 h before the night shift, with

2–3 compensatory naps per week. It is vital to raise awareness and education on sleep hygiene practices among nurses (53). We innovatively explored the effects of diet on SWSD during shifts. In our study, we found that irregular eating during the shift was a predictor of SWSD, but the results should be interpreted with caution and studies should be carried out in the future to verify our findings. Our results show that high-intensity physical activity was positively correlated with SWSD. However, a previous study contradicted our findings (54). One possible reason for the contradictory results is that we used a self-administered questionnaire to assess physical activity whereas Hajo et al. used objective ActiGraph GT3X accelerometers for data collection (54, 55). Therefore, future studies can combine self-reporting and objective monitoring to further explore the effect of physical activity on SWSD.

Limitations

One limitation is the cross-sectional nature of this analysis. Further studies should collect longitudinal data to better understand the causal relationship between factors and SWSD. In addition, this study only included hospitals in Shandong Province in China; therefore, caution should be exercised when generalizing the study's findings to other regions. Our study lacks objective indicators; thus, future studies with objective measurements will help to verify the accuracy of the results of the current study.

CONCLUSION

The prevalence of SWSD in the sampled shift nurses was 48.5% during the COVID-19 pandemic. To reduce the incidence of SWSD for nurses, head nurses and health care organizations need to develop more rational and scientific scheduling strategies and health education for nurses on the basis of the Integrated Framework for Population Health Risk Management. For example, fatigue, perceived stress, and body discomfort were among the physical and psychological factors associated with SWSD. Therefore, nursing managers should pay attention to the physical and mental health of nurses and offer timely interventions. In terms of environment and occupation, good scheduling strategies included placing two nurses on night shifts and allowing them to take turns to rest, arranging for shift nurses to rest for more than 1 day after night shifts, and controlling shift intervals for more than 8 days. However, arranging nurses in continuous shifts for more than 6 months, scheduling more than four night shifts per week, and working overtime were all bad scheduling strategies. Positive social and behavioral factors

included 6–8 h of supplementary sleep after the night shift, 2–3 naps per week, eating regularly and ensuring adequate water intake per day, and improving family and social support. Therefore, health education for nurses should include good sleep strategies and maintenance of good family and social relations.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the data from the Nurses' Health Cohort Study of Shandong needs time for data clearing and establishment of guidelines. We are planning on opening this data to the public in the future. Requests to access the datasets should be directed to caoyj@sdu.edu.cn.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

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Job Satisfaction Among Employees After a Merger: A Cross-Sectional Survey in the Local Health Unit of Sardinia Region, Italy

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Job satisfaction plays an important role in healthcare organization and management; it is critical for maintaining and improving staff efficiency and consequently the quality of care provided. Organizational restructuring processes, including mergers, are likely to affect job satisfaction levels, but evidence of the impact they have is surprisingly scarce. The aim of the study was to describe a methodology used to measure job satisfaction of the employees at a Local Health Unit (LHU) in Italy immediately after a merger and to assess the determinants associated with any reduction in worker satisfaction. The study was conducted among employees of the LHU of the Sardinia Region in July 2018, after a merger of eight subregional LHUs had taken place. The entire staff was enrolled, of which a total of 1,737 employees were surveyed. We used a questionnaire exploring socio-demographic and working characteristics of the employees, the various areas related to job satisfaction and interviewee opinions on the merger process. Multivariable stepwise backward logistic regression models were built to identify factors independently associated with lower job satisfaction. The results of a multivariable analysis showed that lower job satisfaction was more likely in employees with an administrative role (aOR: 2.34, 95% CI: 1.37–4.00) or a career demotion (aOR: 1.84, 95%CI: 1.11–3.03). High levels of mental stress were strongly associated with lower job satisfaction (aOR: 5.64, 95%CI: 4.16–7.64). "More equity of employee rewards" was the only example of a set of responder suggestions found to be associated with lower job satisfaction (aOR: 2.30, 95%CI: 1.51–3.47). Generally, responders showed a good level of job satisfaction—and this was also the case following the merger—but some job profile determinants were strongly associated with low employee satisfaction. The results of the study highlighted several challenging areas and critical issues relating to working conditions. Further surveys are required to confirm these results and to monitor their evolution over time.

Keywords: job satisfaction, merger & acquisition, employees, local health units, occupational well-being, survey

INTRODUCTION

Job satisfaction represents an important issue for healthcare management and organization, as it is well known to be associated with both patient and staff outcomes. Thus, healthcare worker satisfaction is positively associated with patient satisfaction and healthcare quality, such as patient adherence to treatment protocols and hospital-adjusted mortality ratios (1–3). On the other hand, job dissatisfaction seems to have an impact on job-related outcomes, such as burnout, turnover and absenteeism (4–6). Issues relating to working conditions (7, 8), including psychological factors, wages, job security, relationships with colleagues and supervisors, and career opportunities (9) have been identified as potential determinants of job satisfaction. Therefore, any event leading to a change in working conditions, like an organizational restructuring, could influence job satisfaction (10, 11).

Among such events, the merger of healthcare structures is highly likely to modify the organizational climate and thus job satisfaction (12). Although in recent decades many countries have undertaken mergers of healthcare institutions, little is known about the impact of such mergers on job satisfaction, either in the hospital setting or in local health units (LHUs) (13, 14). Moreover, most quantitative studies have focused only on the impact on costs and efficiency (15), such that data on staff perception are limited (16). However, the small amount of evidence available from qualitative research suggests that mergers can lead to a loss of trust in the psychological contract (i.e., the implicit obligations and expectations between employers and employees) because of poor communication (17), delays in service development, and difficulties in learning and sharing "good practice" (12). Furthermore, various unfavorable consequences and potential disadvantages have been described as resulting from a merger, including lower morale, stress due to the fear of job loss and clashes of corporate culture (18).

Recently in Italy, there has been a policy of merging LHUs to obtain economies of scale and thereby to reduce pressure on healthcare budgets (19). However, to our knowledge there have been no studies of the effect of this LHU unification process on the job satisfaction of workers. In this paper, we focused on the case of the Italian LHU "Azienda Tutela della Salute" (ATS) of the Sardinia Region, which arose from the merger of eight subregional LHUs (ASSL Cagliari, ASSL Carbonia, ASSL Lanusei, ASSL Nuoro, ASSL Olbia, ASSL Oristano, ASSL Sanluri, ASSL Sassari) and covers a population of 1,653,135 residents. The purpose of the study was to describe the methodology used to assess the job satisfaction of LHU employees immediately after the merger. We then explore and assess socio-demographic and job-related variables associated with lower worker satisfaction in the context of the new institutional arrangements.

METHODS

Data Collection

We studied the "Azienda per la Tutela della Salute" (ATS), the Local Health Unit (LHU) of the Sardinia Region, which was established in accordance with Italian Regional Law 17/2016 and began operating on 1 January 2017 after the merger of eight previously existing LHUs. The entire staff of the ATS (16,000 employees) was invited to take part in the study through the administration of an online questionnaire in July 2018, 18 months after the merger came into effect.

Researchers generated alphanumeric codes that were matched to individual pay slips by ATS personnel. To access the survey, the respondents used their alphanumeric code and an anonymous link, which were provided in their pay slip together with a cover letter giving details of the project. All precautions regarding privacy protection were taken in accordance with Italian law and all data were processed with due regard to the principles of transparency, proportionality, impartiality and legality. In order to present and explain the questionnaire to LHU Sardinia workers and to make them aware of the aims and purposes of the analysis, on-site training meetings were organized by the researchers in conjunction with LHU management. These meetings, which took place at the headquarters of LHU Sardinia, also aimed to instruct the largest number of "facilitator members" on the objectives and methods of the survey. The trained facilitators were, in turn, asked to inform their colleagues about the opportunity to reply to the questionnaire.

Questionnaire

The questionnaire was adapted to fit the purposes of this study from a version previously developed by Gigantesco et al. (20). It consisted of 58 questions divided into three sections. The first section (11 items) investigated the socio-demographic and working characteristics of the employees in order to assess their job profile. The second section comprised 42 items in six areas relating to working conditions and a further question on overall employee job satisfaction. The items were grouped as follows: (i) work organization (13 items), (ii) work schedule (two items), (iii) relationships (five items), (iv) workplace (three items), (v) physical stress (four items), and (vi) mental stress (15 items). For each question, the answer was structured as a five-point Likert-type scale, ranging from one (worst condition) to five (best condition). To quantify the overall job satisfaction of the employee, an item providing an answer on a 10-point analog quantitative scale (1: the worst working conditions; 6: acceptable working conditions; 10: the best working conditions) was adopted. The third section consisted of three items that assessed interviewee opinion on the merger process, together with a final open-ended question. Specifically, these questions investigated changes in professional profile and a judgement of the quality of the healthcare services provided. Lastly, at the end of the questionnaire, the interviewee was invited to make suggestions that might help improve working conditions.

Statistical Analysis

Descriptive statistics for socio-demographic variables, working condition items and employee suggestions were calculated. For each group of questions, the overall score was calculated and dichotomized according to the 75th or 25th percentile to identify the more- and less-satisfied groups of employees: in particular, the 75th percentile was used to identify the more-satisfied employees in the areas of work organization,

relationships, environmental conditions and work schedule in order to assess how positive perception in these areas protects against dissatisfaction; the 25th percentile was used to identify the less-satisfied employees in the areas of mental and physical stress, in order to assess how stress contributes to dissatisfaction. For the item on overall job satisfaction (scored on a 10-point analog scale), the 25th percentile was used as the cut-off to identify employees with lower job satisfaction.

Univariate analysis was performed to assess possible associations between each variable and having a lower job satisfaction. Multivariable stepwise backward logistic regression models were built to identify factors independently associated with lower job satisfaction (Model 1) and to assess employee suggestions independently associated with it (Model 2). Variables were included in the models when the *p*-value derived from the univariate analysis was lower than 0.25 or when they were considered relevant to the outcome. Adjusted odds ratio (aOR) and 95% confidence intervals (CIs) were calculated. All statistical analyses were performed with STATA 15 (StataCorp LLC, 4905 Lakeway Drive, College Station, Texas, USA). A *p*-value <0.05 was considered statistically significant.

RESULTS

The socio-demographic characteristics of the 1,737 respondents are summarized in **Table 1** (response rate: 10.8%). The mean age was 51.4 years (standard deviation: 9.2 years), with the most represented age category being 51–60 years (42.4%). Over 60% of the workers were women, and more than half of the entire sample had a university degree (56.5%), whereas only 9.0% had an elementary-middle school educational level. As for job type, the participants were mainly healthcare workers (77.4%), followed by administrative staff (13%), and showed a similar distribution between the hospital (50.9%) and the health districts (49.1%). Almost 29% of the respondents had worked for LHUs for <5 years and the vast majority had a permanent employment contract (92.2%) with no change in professional profile due to the merger (91.3%). The largest category of workers were formerly at the Cagliari LHU (26.3%) followed by those from Sassari LHU (17.6%). There were 303 (17.4%) employees who had a management role.

Regarding employee responses to the section on working conditions, in nine out of 13 items on work organization more than half of the respondents scored 1 or 2 on the five-point Likert scale. Items showing more dissatisfaction were "availability of training and updating tools" and "fairness and justice in the recognition and progress of career," with 80.2% and 75.0% of respondents scoring 1 or 2 points. The distribution of responses under 'relationships' was more heterogeneous. The highest percentage of one- or two-point scores was shown by the items "receive sufficient and non-contradictory advice from superiors" and "definition of role/responsibility," which reached 40.3% and 39.5% respectively. Conversely, for all the mental stress items, less than half of the respondents scored one or two.

Employee suggestions were grouped into 10 areas: increase in staff availability, additional resources, greater compensation and benefits, additional employee development, additional training,

TABLE 1 | Socio-demographic and occupational characteristics of the respondents (N = 1,737).

Variables	N	%
Age		
<40	249	14.3
41–50	465	26.8
51–60	736	42.4
>60	287	16.5
Gender		
Male	650	37.4
Female	1,087	62.6
Educational level		
Elementary-Middle school	156	9.0
High school	599	34.5
University degree	982	56.5
Job qualification		
Healthcare workers	1,345	77.43
Vocational	7	0.40
Technician	158	9.10
Administrative	225	12.95
Other	2	0.12
Local Health Unit		
Sassari	306	17.6
Olbia	260	15.0
Nuoro	202	11.6
Lanusei	75	4.3
Oristano	208	12.0
Sanluri	94	5.4
Carbonia	136	7.8
Cagliari	456	26.3
Area (N = 1,371)		
Hospital	698	50.9
Health district	673	49.1
Years of work*	14.2	10.7
Years of work		
< 5	510	29.4
6–10	340	19.6
11–15	196	11.3
16–20	203	11.7
>21	488	28.1
Employment contract		
Fixed-term	136	7.8
Permanent	1,601	92.2
Management role		
No	1,434	82.6
Yes	303	17.4
Healthcare facility managed (N = 303)		
District	8	2.6
Department	6	2.0
Complex care unit	79	26.1
Simple care department unit	32	10.6
Simple unit managed by complex care unit	41	13.5
Professional engagement	116	38.3
Other	21	6.9
Changes in job profile		
Promotion	30	1.7
Demotion	122	7.0
No change	1,585	91.3

Mean and standard deviation.

effective collaboration with supervisors, better healthcare service, more flexible schedule, more rights, more equity of employee rewards. Descriptive analysis of employee suggestions ($N = 935$) shows "additional resources" to be the improvement most requested by participants (21%) followed by "effective collaboration with supervisors" (20.5%), "increase in staff availability" and "more equity of employee rewards" (both 18.6%). More details on descriptive statistics of the individual items in each category and employee suggestions are reported in **Supplementary Tables 1**, **2**.

Regarding the section that queried employee opinion on the merger process, the vast majority of respondents scored the first item one (66.5%) or two (28.2%), expressing a poor opinion of the improvement in quality of the services offered to the population as a result of the merger, whereas participants had a better view of improvements in their own job and the department, with the majority scoring three for both items (77.7 and 67.5% respectively) (**Supplementary Table 3**).

Determinants of Lower Job Satisfaction

Among socio-demographic characteristics, univariate comparisons revealed statistically significant differences according to age (p-value = 0.04), pre-merger LHUs (p-value = 0.04), working area (p-value < 0.001), management role (p-value < 0.001) and changes in job profile (p-value < 0.001) (**Supplementary Table 4**). Specifically, the highest percentages of less-satisfied employees were found among those who originally worked at the Carbonia LHU (31.6%) and those who received a demotion/downgrade (45.1%). Conversely, the lowest percentages of less-satisfied individuals were found among those employees who worked in a health district (19.5%), were older than 60 years (19.9%) and had a management role (15.2%). Employees with a poor experience in one of the six areas pertaining to working conditions more frequently reported lower job satisfaction, and the difference was statistically significant for each area (p-value < 0.001) (**Supplementary Table 5**). In particular, employees reporting higher levels of mental stress had the highest prevalence of lower job satisfaction (58.0%). Concerning employee suggestions, workers who requested additional resources showed the lowest frequency of lower job satisfaction (18.9%), whereas those who requested "more equity of employee rewards" showed the highest (47.1%), with both differences reaching statistical significance (**Supplementary Table 5**).

According to the results of the univariate analyses, variables initially included in the logistic regression model, which examined the associations between working conditions, socio-demographic variables and lower job satisfaction, were working conditions, sex, age, job qualifications, LHU, area (hospital or health district), years of work, management role, change in position after merger. **Table 2** presents the results of the final logistic regression model after backward selection. After adjusting for potential confounders, employees more likely to experience lower job satisfaction were those with an administrative role (aOR: 2.34, 95%CI: 1.37–4.00) and a career demotion (aOR: 1.84, 95%CI: 1.11–3.03), compared to healthcare workers and employees with no change in professional profile

TABLE 2 | Multivariate analysis model to identify association between factors contributing to working conditions and lower job satisfaction ($N = 1,370$).

Variables	OR	CI 95%	p-value
Areas*			
Work organization	0.16	0.08–0.34	< 0.001
Work schedule	0.93	0.45–1.90	0.837
Relationships	0.42	0.25–0.70	0.001
Environmental conditions	0.93	0.59–1.48	0.766
Physical stress	1.18	0.86–1.63	0.306
Mental stress	5.64	4.16–7.64	< 0.001
Role/job qualification			
Healthcare workers	Ref.	–	–
Administrative employee	2.34	1.37–4.00	0.002
Vocational	12.15	0.60–249.4	0.105
Technician	0.74	0.41–1.32	0.301
Other	Omitted		
Area			
Hospital	Ref.	–	–
Health district	0.72	0.52–0.99	0.041
Years of work	0.99	0.97–1.00	0.037
Changes in job profile			
No change	Ref.	–	–
Demotion	1.84	1.11–3.03	0.017
Promotion	1.17	0.23–5.87	0.852

OR, Odds Ratio; CI, Confidence Interval.
*For work organization, work schedule, relationships and environmental conditions, the OR refers to the more satisfied employees (75° percentile vs. other employees). For physical and mental stress, the OR refers to the less satisfied employees (25° percentile vs. other employees).

after the merger, respectively. Working in a health district (OR: 0.72, 95%CI: 0.52–0.99) and having more years of work (OR: 0.99, 95%CI: 0.97–1.00) were associated with a decreased likelihood of lower job satisfaction. Regarding working conditions, a high degree of satisfaction in the work organization (aOR: 0.16, 95%CI: 0.08–0.34) and relationships (aOR: 0.42, 95%CI 0.25–0.70) were negatively associated with lower job satisfaction, while high levels of mental stress were positively associated with the outcome (aOR: 5.64, 95%CI: 4.16–7.64).

A second multivariate logistic regression model (**Table 3**) was built to investigate the association between employee requirements and lower job satisfaction. Among the 10 suggestions, the only variable found to be statistically significant was "more equity of employee rewards" with an adjusted OR of 2.30 (95%CI: 1.51–3.47). None of the socio-demographic variables showed a significant association with employee satisfaction. By contrast, a job demotion was significantly associated with lower job satisfaction (aOR: 3.40, 95%CI: 1.91–6.06).

DISCUSSION

The aim of this study was to implement a methodology for evaluating employee satisfaction in a population of healthcare

TABLE 3 | Multivariate analysis model to identify association between employee suggestions and lower job satisfaction (N = 741).

Variables	OR	IC 95%	p-value
Suggestions			
Increase in staff availability	0.98	0.65–1.48	0.918
Additional resources	0.67	0.43–1.05	0.078
Greater compensation and benefits	0.86	0.50–1.49	0.549
Additional employee development	1.29	0.84–2.00	0.249
Additional training	0.90	0.54–1.48	0.671
Effective collaboration with supervisors	0.83	1.51–3.46	< 0.001
Better healthcare service	0.95	0.52–1.73	0.867
More flexible schedule	1.04	0.57–1.87	0.909
More rights	0.86	0.50–1.50	0.605
More equity of employee rewards	2.30	1.51–3.47	< 0.001
Years of work	0.99	0.98–1.01	0.413
Sex			
Male	Ref.	–	–
Female	1.22	0.84–1.76	0.296
Role/job qualification			
Administrative	Ref.	–	–
Vocational	Omitted		
Technician	0.53	0.23–1.24	0.144
Healthcare workers	0.58	0.32–1.07	0.083
Other	Omitted		
Changes in job profile			
No change	Ref.	–	–
Demotion	3.40	1.91–6.06	< 0.001
Promotion	0.77	0.15–4.02	0.757
Area (N = 1,371)			
Hospital departments	Ref.	–	–
Territorial departments	0.61	0.42–0.88	0.009

OR, Odds ratio; CI, Confidence interval.

and non-healthcare workers after a merger process and to assess factors associated with lower job satisfaction, providing management with a tool for subsequent planning.

Responders showed a good level of job satisfaction overall and with regard to the merger process, with more than 75% of employees finding a moderate improvement in their job after the merger and more than 66% a moderate improvement in their ward/service. This may reflect when the survey was administered, i.e., 1 year after the merger took place, a period in which there was probably a high degree of acceptance of the necessity of organizational reconfiguration so as to improve patient services and the hospital's performance (13). However, the Hawthorne effect could have played a role in the responders because of the knowledge of survey participation. Conversely, only 5% found a moderate improvement in the quality of service offered to the population. This result is in line with the literature, which demonstrates that the first aim of a merger is cost-saving and increased efficiency rather than improvements in the quality of care (21).

The response rate was low, at 10.8% of the total employee population. Furthermore, the respondents did not accurately represent the whole staff population, according to the Sardinia LHU organizational chart. In fact, healthcare workers and administrative staff were over-represented in our sample, while technicians were under-represented. The reasons for the different response rates among different sectors of the target population are difficult to determine without further information, although the use of a web survey could be a factor. Moreover, since this is, as far as we are aware, the first survey to take into account the job satisfaction of both healthcare and non-healthcare workers, there are no other studies with which we might make a comparison (22, 23).

Administrative staff were more likely to be associated with lower job satisfaction than healthcare workers and technicians. Considering that technicians were mainly social workers, it can be hypothesized that direct involvement in patient care is associated with a greater job satisfaction (24). In our sample, employees who worked in a health districts were more satisfied than those who worked in a hospital. A possible explanation of this finding may be the difficulties experienced when working in hospital settings, such as working long shifts, dealing with unscheduled tasks or facing high levels of stress due to the emotional involvement of direct patient care (25, 26).

A statistically significant negative association was found between number of years worked and lower job satisfaction. Evidence in the literature about the effect of years worked on job satisfaction is mixed (24). However, one study has previously shown similar results in nurses, suggesting that work experience may lead to increased competence and familiarity with job tasks and thus reduce the level of occupational stress (27).

Regarding working conditions, more than half the respondents expressed a negative opinion of some aspects of work organization. The high prevalence of negative answers in this category could reflect the profound effect that the policies, procedures and contextual factors of the organization have on how staff view the quality of their work life (28). Since the merger process has a marked impact on work organization (12), it is reasonable to suppose that these results largely reflect the effects of the merger.

Among items showing more dissatisfaction, some relate to the need for recognition and career progression. These findings are consistent with the request for "more equity of employee rewards," which is one outcome of the second multivariable model, highlighting the importance of improving the relationship between employees and superiors as a determinant of job satisfaction (29). It should also be noted that mergers can frequently cause resource reallocation with consequent changes in career pathways, possibly leading to a worse perception on equity of employee rewards (12).

In contrast to items dealing with work organization, less than half the respondents scored all mental stress items very low and mental stress was strongly associated with lower job satisfaction. It is well known that job satisfaction is linked to individual outcomes such as work-related stress and a previous study has shown that the higher the level of work-stress employees experience, the lower the job satisfaction expected (30). These findings suggest the importance of improving not only those aspects of working life with which most employees

are dissatisfied, but also those more likely to be associated with job dissatisfaction.

Our study has some strengths and limitations. The main strength is the development of a valuable method for assessing the well-being of employees in a healthcare setting, which we demonstrate to be particularly useful in the context of reorganization and restructuring programs. This methodology may be a reproducible instrument for stakeholders to discover where intervention is required to improve the working conditions of healthcare workers; a healthy workplace in fact correlates with health system quality (26, 31). The limitations of our research are mostly due to the low response rate, so our sample might not be representative of the entire LHU population. Future studies should take into account the possibility of a low web-survey response rate and put in place actions to improve it. Additionally, due to the cross-sectional design of our study, causal interpretations must be made with caution. Moreover, we only analyzed a single LHU and therefore our results may have limited generalizability. However, these findings should be representative of the situation at regional level and thus could be useful for comparing job satisfaction among similar workers in the various Italian regions.

CONCLUSIONS

To our knowledge this is the first study that assesses job satisfaction among the employee population of an LHU after a merger. Local Health Units are complex systems, as are the processes in which they are involved, and this means that any merger of LHUs is likely to have complex ramifications, including potentially detrimental effects on staff members. The exploratory analysis represented by this study is important in that it highlights challenging areas and critical working conditions affected by a merger. These areas should be further investigated over time by repeated surveys to confirm the current results and to analyse their evolution over time.

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 Azienda per la tutela della salute Sardegna. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

CI, AN, PS, AZ, MG, AS, and DM drafted the manuscript, handled the data management, and conducted the analyses. VB, GM, CM, and PV critically revised the manuscript for important intellectual content. CD, RM, GS, and FM conceived the study and critically revised the manuscript. All authors reviewed, read, and approved the final version of the manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh. 2021.798084/full#supplementary-material

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Occupational Stress and Mental Health Among Healthcare Workers Serving Socially Vulnerable Populations During the COVID-19 Pandemic

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The purpose of this study was to analyze occupational and personal stressors, mental health indicators, perceived discrimination and help-seeking behaviors among healthcare workers and providers (HCWPs) serving socially vulnerable groups such as immigrants, refugees, farmworkers, homeless individuals, people living in poverty, and other disadvantaged populations in the United States (U.S.) during the COVID-19 pandemic. Using a cross-sectional descriptive approach, we gathered information between July and September 2020, from a sample of 407 affiliates of two national organizations of clinic-based HCWPs who worked at federally funded and community safety-net clinics. Informed consent was obtained from all participants who completed a self-administered online survey available in English and Spanish. Our results indicated that the HCWPs serving vulnerable groups in the midst of the pandemic experienced high levels of occupational and personal stressors as well as anxiety and depressive symptomology. Major occupational stressors were excessive workload, long working-hours, and institutional barriers to refer and follow-up on their clients' access to needed social services. High-rated personal stressors included sleep disorders, lack of and child-care, partner's loosing job, and other family related situations. Our findings suggest that HCWPs working with vulnerable populations need specialized interventions that bolster their mental health and well-being as the pandemic continues to unfold. We recommend implementing initiatives that encourage HCWPs' to be actively involved in clinic decisions regarding employee safety and protection as well as in management decisions to improve work place infrastructure and capacity to respond to the social needs of their clients. Lessons learned from the pandemic are useful tools in designing protocols for addressing the mental-health needs of HCWPs in health-care organizations that attend to socially underprivileged populations.

Keywords: occupational stress, healthcare workers, health providers, COVID-19, mental health, anxiety, depression, vulnerable groups

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has generated international concern as vaccination efforts continue worldwide and contagion rates persist with new variants endangering the lives of millions. Global social disparities and their underlying social determinants have exacerbated during the pandemic, striking harder on socially marginalized groups, leaving them exposed and frequently unprotected, from a deadly virus (1–3). As reported in studies conducted pre-COVID-19 pandemic, caring for underprivileged populations who have been systematically excluded from society and healthcare systems imposes an additional burden on the well-being and mental health of healthcare providers, many of whom feel a loss of control at work and an inability to help their vulnerable clients (4–6).

Since COVID-19 was declared a pandemic in March 2020, healthcare workers and providers (HCWPs) worldwide have operated under unprecedented pressure to contend with the influx of both types of patients in healthcare facilities: those infected with SARS-Cov-2 and others presenting a diversity of health ailments not directly related to the new virus. International studies conducted during the pandemic in hospital and clinical settings have found that the increased workload, shortage of personal protective equipment (PPE)—especially at the beginning of the health emergency—and heightened risk of exposure have caused many HCWPs to experience significant levels of stress, sleep disturbances, and burnout (7–12). International systematic literature reviews and other original research reports have consistently found that COVID-19 represents a risk factor for stress, depression, anxiety, and post-traumatic stress disorder (PTSD) among healthcare personnel (13–17). Other recent studies reported that HCWPs are more vulnerable to psychological distress manifested in high levels of uncertainty, insecurity, depression, stress, anxiety, anger, fear, insomnia, and PTSD (11, 12). Furthermore, poor sleep quality occurs nearly twice as frequently among HCWPs as it does in the general population, most likely due to sleep disturbances, which have also been linked to depression and distress (9). Nurses and those who work more closely and for more extended periods with COVID-19 patients seem to be one of the most affected groups (7, 18).

Despite its importance, only recently was a global call made to health systems and leaders to protect the mental health of HCWPs, as long-term exposure to COVID-19 and their clients is a risk factor affecting both their mental health and quality of services they provide (19–21). Furthermore, organizations of healthcare professionals in the United States (U.S.) and worldwide have drawn attention to clinicians' mental health and other HCWPs during the pandemic (22–25).

Research conducted prior to the COVID-19 pandemic suggests that HCWPs assisting populations living in socially vulnerable conditions often feel anguished at being unable to provide appropriate and sufficient resources to the population they serve because a number of their clients do not qualify for certain services as they lack medical insurance, documentation to reside in the U.S., or may have English language limitations (4, 5,

26). In addition, HCWPs are at risk of burn-out, which has been recently reconceptualized by the World Health Organization (27) as a condition resulting from being exposed to chronic stress in the workplace that has not been successfully managed. Its three major characteristics are feelings of energy depletion, increased mental distance from one's job, or feelings of negativism or cynicism related to one's job, and reduced professional efficacy. Burn-out is not classified as a medical condition, but it is included in the 11th Revision of the International Classification of Diseases (ICD-11) as an occupational phenomenon (27). Burn-out has been reported as a common problem among health and social service providers along with other mental health affections, such as secondary trauma and compassion fatigue, from listening to the traumatic experiences of the vulnerable groups they serve. For example, a study examining rates of secondary trauma among caregivers working with Mexican and Central American refugees revealed that more than half experienced emotional numbness, trouble sleeping, intrusive thoughts, and irritability (5). Another study on the mental health of front-line workers serving homeless populations, identified feelings of helplessness and frustration by their perceived inability to improve the situation of their patients and a high prevalence of burnout, traumatic stress, and diminished compassion satisfaction (i.e., inability to derive innate positive feelings from helping others) (6).

To mitigate the adverse effects of stress and protect themselves from burnout and secondary trauma, HCWPs seek support from family and friends who are regarded as essential resources for self-care, they also engage in physical activities and favorite pastimes (4, 28). Another way of coping is to increase the distance between themselves and their patients by "shutting down" their emotional responses (5, 6). It must be noted that not all HCWPs look for professional help in times of crisis due to a number of reasons that include among others, feeling that they can cope alone with the problems they face, social stigma, and personal, financial and institutional barriers to access needed mental health services (28).

To our knowledge, little research exists on how the COVID-19 pandemic accentuated occupational stressors and undermined mental health of HCWPs based in community clinics serving socially vulnerable groups. In this study, conducted amid the COVID-19 pandemic, we sought to describe and assess the occupational and mental health challenges faced by HCWPs attending to the healthcare needs of migrants, refugees, farmworkers, homeless individuals, people living in poverty, and other socially vulnerable groups in the U.S.

MATERIALS AND METHODS

We collected original data through a web-based cross-sectional study of clinic-based HCWPs affiliated with two national organizations in the U.S. serving migrants and other socially vulnerable populations. All affiliates to these two organizations work at federally funded and community safety-net clinics (Federally Qualified Health Centers-FQHC) that provide health care to uninsured individuals regardless of their ability to pay. We sent affiliate members email invitations to participate in

our research that included information about the purpose and procedures of the study as well as a link to the brief online survey. The invitation was distributed through the listserv of each organization, comprising HCWPs, administrators and advocates. Inclusion criteria for participation included having worked in a healthcare setting for at least two weeks prior to the survey and having interacted with patients in one of the following healthcare roles: case manager/case coordinator, behavioral health worker, healthcare provider, community health worker, outreach worker, patient navigator, medical assistant, certified nurse assistant, nurse specialist, dietitian or clinical pharmacist. Informed consent was obtained electronically prior to accessing the survey link. Every seven days for up to four weeks, we sent follow-up email reminders to listserv recipients regarding study eligibility and participation. Upon survey completion, we sent participants a small electronic monetary incentive ($5 USD). Data was collected from July 1, 2020 to September 14, 2020. The project was submitted to and approved by the Institutional Review Boards (IRBs) of the organizations involved.

In total, 801 respondents clicked on the link to the Qualtrics survey, with 551 consenting to complete the survey (68.7%). There was some overlap in listserv recipients across both partner organizations; as such, a participant could complete the survey more than once. Duplicates were rare ($n = 33$ of 801 or 4.1%) and removed by verifying participant email addresses and birthdates. Because the organizational listservs included HCWPs who did not work directly with patient populations, it was impossible to calculate a response rate. Among the 768 non-duplicate participants who started the survey, 518 were eligible and consented to participate in the study. In the end, 407 completed the majority of the survey (79.0%).

The online survey was especially created for this study by designing our own questions and drawing on items from existing studies. The 15-min survey was available in English and Spanish and was self-administered using Qualtrics, a web-based survey platform. It included questions on sociodemographic characteristics, self-rated health and mental health symptoms, stress, substance use, COVID-19-related occupational and personal stressors, perceived discrimination and coping mechanism such as help-seeking behaviors and self-care practices during the pandemic.

Participants were asked to rate their overall physical and mental health (1 = Excellent to 5 = Poor) using two separate questions. We assessed mental-health symptoms using the Patient Health Questionnaire for Depression and Anxiety (PHQ-4), a brief screening tool that measures burden of depressive and anxiety symptoms (29). Participants were asked how frequently in the past 14 days they were bothered by specific symptoms such as (1) feeling nervous, anxious or on edge, (2) not being able to stop or control worrying, (3) feeling down, depressed or hopeless and (4) having little interest or pleasure in doing things (ranging from 0 = Not at all to 3 = Nearly every day). The PHQ-4 results in two subscales, anxiety (items 1 and 2) and depression (items 3 and 4) symptoms. The subscales have good internal consistency with Cronbach's alpha values of 0.84, and 0.81, respectively. Prior

research suggests that a total score of 3 or greater on these subscales identifies potential cases of anxiety and depression (29, 30).

Substance use during the previous seven days was measured using the Substance Use questions of the Understanding America Study—Coronavirus in America COVID Survey (31). Participants were asked to report the number of days they drank alcohol, used cannabis products, consumed other recreational drugs, smoked cigarettes, or used electronic cigarettes (e.g., vape pen). We calculated the average number of days per week each participant consumed these substances (range: 0–7 days and created a dichotomous variable using scores of at least one SD above the sample mean (0 = Low, 1 = High).

We assessed perceived stress in the 14 days using the Perceived Stress Scale-4 (PSS-4) (32). Items included: (1) being unable to control important things, (2) feeling confident about handling personal problems, (3) feeling things were going their way, and (4) difficulties were piling up (0 = Never to 4 = Very Often). Items 2 and 3 were reverse coded. A total score was calculated for each participant, with a higher score suggesting higher perceived stress (alpha = 0.61). We created a separate dichotomous variable that specified whether a participant scored at least one SD above the sample mean (0 = Low, 1 = High).

Based on the available literature regarding the impact of COVID-19 on HCWPs (7–9, 22, 23), we developed two short scales specifically for this study, that measured occupational and personal stressors associated with the COVID-19 pandemic (response options ranged from 0 = Not stressful at all, to 5 = Very stressful) during the 14 days prior to the survey. The occupational and personal stressors scales were constructed based on face validity and demonstrated good internal consistency (alpha = 0.88 for occupational stressors and alpha = 0.78 for personal). Occupational stressors were 11 items and included: long working hours, work overload, interpersonal problems with co-workers, communicating bad news to patients and their family members, inability to communicate directly with patients due to cultural and language barriers, scarcity of PPE, fear of bringing the virus home, voluntary isolation from the family, lack of proper safety protocols at the clinic, inability to connect patients with appropriate social services (e.g., food bank, rent or legal assistance), and lack of resources to follow-up on patients after visit. Personal stressors included six items: insufficient sleep, employment loss by their partner/spouse, insomnia, immigration problems related to oneself and/or family members, and lack of proper child care arrangements. For each stressor scale, we calculated the mean score. We also created separate dichotomous variables indicating whether or not participants experienced high levels of stress (at least one SD above the sample mean for each scale: 0 = Low level of stress and 1 = High level of stress).

Perceived discrimination among CHWPs was also assessed in our study, which had been previously studied in the USC national survey (31). This is another form of tension experienced by HCWPs, particularly because of disinformation at the beginning of the pandemic (33, 34) and because it coincided with a period of time where social division prevailed in the U.S. Participants were asked whether or not they had experienced discrimination in the

last 14 days using items especially developed for our study based on face validity and to identify their perceptions for their feeling discriminated against (e.g., race/ethnicity, immigrant status and their role as a healthcare worker) during the pandemic: people treated them less courteously, they were provided poorer service at restaurants and stores, people were afraid of them, or subjected them to threats/harassment (No = 0 or Yes = 1). We counted the number of perceived discriminatory experiences reported by participants.

Finally, respondents were asked to reflect on their coping responses such as mental health help-seeking and self-care behaviors during the pandemic. We asked HWCPs if they sought support from a mental-health professional in person and/or virtually during the pandemic (0 = No, 1 = Yes). Likewise, HWCPs reported on the number of days over the past seven days they engaged in the following self-care behaviors: practicing meditation, exercising, finding time to relax, and socializing with family and friends either online or in person. We computed the mean number of days engaged in all self-care behaviors. We also constructed a dichotomous variable for the level of self-care behaviors the participant engaged in (0 = None or few, 1 = High—at least one SD above the sample mean).

We report descriptive statistics including means, SDs and percentages with 95% confidence intervals to examine self-rated health, mental health indicators (anxiety and depressive symptomology, substance use, and stress), occupational and personal stressors, perceived discrimination, help-seeking, and self-care behaviors of HCWPs during the COVID-19 pandemic. All descriptive estimates were adjusted for age.

Additionally, a series of multivariable regression analyses (e.g., linear, logistic, or count regressions depending on the outcome variable of interest) were performed to examine how the demographic characteristics of HCWPs (i.e., age, gender, Latinx identity, marital status, family size, and educational attainment) and type of healthcare provider (e.g., community health worker, behavioral health provider etc.) were associated with mental health, occupational stressors, and well-being outcomes (see **Appendices A–E** in **Supplementary Material**). There were no statistically significant differences across type of healthcare providers for the outcomes of interest, with the exception of help-seeking behaviors and potential exposure to COVID-19 (these results are highlighted in the results section). For parsimony, we present the multivariable analyses that only include the demographic characteristics. Both descriptive analyses (n = 407) and multivariable regressions (n = 387) presented only use complete cases.

RESULTS

Sociodemographic Characteristics of Participants

Table 1 presents the sociodemographic characteristics of the study participants. Most respondents were women, who self-identified as Latinx, living with a partner, with a mean age of 44.40 years, had earned an undergraduate degree, and performed

TABLE 1 | Sociodemographic characteristics of total sample (N = 407).

Participant Characteristics	Total Sample (N = 407) % or Mean (SD)
Age (19–79 range)	44.40 (13.09)
Participants 50+ years old	33.66%
Female	86.88%
Latinx	75.43%
Married/living with partner	65.36%
Family size	2.45 (1.69)
Highest Level of Education	
Undergraduate degree	27.52%
Graduate degree	40.79%
Primary Health Care Role	
Community health worker	49.39%
Health provider (nurse, physician)	19.41%
Behavioral health provider	12.29%
Case manager/Case coordinator	11.06%
Medical assistant	6.88%
Dietician	0.98%
State of residency	TX, CA, AZ, CO, VA, GA, PR

duties of community health workers. The majority of participants worked in clinics located mostly in the Southwestern states of the U.S. such as Texas, California, Arizona and Colorado.

Self-Rated Health, Anxiety and Depression Symptoms, Substance Use, and Perceived Stress

Table 2 presents the age-adjusted results obtained for the patterns of mental health symptoms, stress and substance use among HCWPs. A small proportion of respondents appraised their general physical and mental health conditions as "poor to fair" (8.78 and 13.00%, respectively). In all cases, they rated their mental health as being worse than their physical health. Although the HCWPs had experienced low levels of anxiety and depressive symptoms, one-quarter reported high levels of anxiety symptoms, while 13.39% experienced high depressive symptoms—that is, they met the threshold of likely having an anxiety or depressive disorder. Thus, a sizeable proportion of HCWPs were at high-risk for mental health problems related to anxiety and depression. Most respondents in this high-risk group were women, under 50 years of age, had a graduate degree, and had been working longer shifts during the pandemic. The PSS-4 had an age-adjusted perceived stress mean value of 5.64, with 14.32% of respondents experiencing high levels of stress. Substance use was generally low among HCWPs, with participants consuming alcohol, cigarette products and marijuana less than once a week, on average. Approximately one in 10 reported using substances more than one day per week.

Multivariable linear regressions were conducted to examine how the demographic characteristics of HCWPs were related to the continuous mental health outcomes (**Appendices A,B** in **Supplementary Material**). Net of the covariates, married/cohabiting HCWPs compared to those

TABLE 2 | Age-adjusted means, standard deviation, and percentages for self-rated health, symptoms of anxiety and depression, substance use, and perceived stress (N = 407).

	Mean (SD)	95% CI	High Outcome %
Self-Rated health (1 = Excellent to 5 = Poor)			
Physical health	2.36 (0.09)	[2.28, 2.44]	8.78%[a]
Mental health	2.46 (0.26)	[2.37, 2.56]	13.00%[a]
PHQ-4 (Total score range: 0–6)			
Anxiety subscale	2.01 (0.48)	[1.84, 2.17]	25.67%[b]
Depression subscale	1.35 (0.32)	[1.20, 1.49]	13.39%[b]
Substance use scale (# days/week)	0.40 (0.05)	[0.34, 0.46]	12.48%[c]
PSS-4 Perceived Stress Score (Total score range: 0-16)	5.64 (0.40)	[5.37, 5.94]	14.32%[c]

[a] Percent of participants in the total sample who reported fair or poor self-rated health.
[b] Percent of participants in the total sample reporting a total score ≥ 3.
[c] Percent of participants in the total sample reporting a score at one or more standard deviations above the sample mean.

never married reported lower ratings of self-rated physical and mental health—that is, they indicated better physical and mental health (**Appendix A** in **Supplementary Material**). In general, older HCWPs were protected against anxiety and depressive symptoms and substance use than younger HCWPs. Latinx vs. non-Latinx HCWPs reported fewer days of using substances during the pandemic (**Appendix B** in **Supplementary Material**). In contrast, males and those with dissolved marriages (e.g., divorced, widowed) reported more frequent substance use than females and the never married, respectively. No demographic characteristics were related to perceived stress.

Similar patterns were observed for high risk of mental health problems (**Appendix C** in **Supplementary Material**). Logistic regressions examined how the demographic characteristics were associated with fair/poor self-rated physical and mental health, risk of anxiety and depressive problems, frequent substance use, and high perceived stress. Older vs. younger ages, being married or divorced/separated/widowed compared to never married, and identifying as Latinx vs. not were protective against fair/poor self-rated mental health (only for age), high anxiety, high depression (only for age), and substance use (Latinx identity only; **Appendix C** in **Supplementary Material**). Larger family size was also protective of frequent substance use. In contrast, larger family size and having high educational attainment (a bachelors or graduate degree vs. high school or less) were associated with higher risk of anxiety problems. HCWPs with dissolved marriages were four times more likely to engage in frequent substance use than HCWPs who have never been married (**Appendix D** in **Supplementary Material**). No demographic characteristics were associated with high perceived stress.

COVID-19 Potential Stressors and Perceived Discrimination

As indicated in **Table 3**, HCWPs reported higher mean stress levels associated with occupational than personal stressors. The

TABLE 3 | Age-adjusted means, standard deviation, and percentages for COVID-19 related stressors, perceived discrimination, mental health help-seeking and self-care behaviors (N = 407).

	Mean (SD)	95% CI	High Outcome %
COVID-19 related stressors			
Occupational stressors	2.01 (0.08)	[1.93, 2.10]	17.64%[a]
Suspected contact with COVID patient			46.04%
Personal stressors	1.23 (0.06)	[1.15, 1.31]	13.61%[a]
Perceived discrimination			
Number of discriminatory events	0.59 (0.10)	[0.49, 0.67]	15.54%[a]
Treated with less courtesy (n = 151; no/yes)			72.23%[b]
Received poorer services (n = 151; no/yes)			26.46%[b]
Others were afraid of them (n = 151; no/yes)			43.04%[b]
Threatened or harassed (n = 151; no/yes)			17.19%[b]
Mental health help-seeking and self-care behaviors			
In-person mental health appointment (n = 406; no/yes)			7.39%[c]
On-line mental health appointment (n = 406; no/yes)			23.02%[c]
Self-care behaviors (# days/week; n = 406)	2.78 (0.41)	[2.64, 2.93]	14.29%[c]

[a] Percent of participants in the total sample reporting a score at one or more standard deviations above the sample mean.
[b] Percentage for the type of discriminatory events participants experienced during the past 14 days, only among those that reported any discrimination.
[c] Percent of participants in the total sample who engaged in help-seeking or self-care behaviors.

occupational stressors with high stress ratings, scoring 4 and 5 (not shown in **Table 3**) were excessive workload (44.23%), long work hours (39.06%), fear of bringing the virus home (36.85%), lack of resources to follow-up with patients (35.62%), the inability to connect immigrant patients with needed social services such as food banks and assistance with rent or legal matters (34.65%). At least one-fourth of the respondents associated high stress levels with situations such as communicating bad news to their clients (26.04%) and lack of adequate PPE (25.06%). Interpersonal problems with other staff members and lack of proper safety protocols in their place of employment were also reported as very stressful by 22.36 and 22.85% of the HCWPs, respectively. Linear regressions revealed that males and HCWPs with high educational attainment experienced more job-related stressors than females and HCWPs with a high school education or less, respectively (**Appendix E** in **Supplementary Material**). Moreover, males and HCWPs with dissolved marriages were found to be nearly three times more likely than females and those never married to experience high job stressors, net of the covariates (**Appendix F** in **Supplementary Material**).

In regards to personal stressors with high-stress ratings (not shown in **Table 3**), insufficient sleep (39.06%), insomnia

(21.14%), and job loss by a partner/spouse (15.23%) were the highest rated (scoring 4 and 5). Other stressors reported with high ratings by fewer respondents were not having proper childcare arrangements while working (8.81%), and concerns about family members' immigration status (9.58%). The multivariable analyses showed that Latinx HCWPs, being married, and family size were associated with more personal-related stressors during the pandemic (**Appendix E** in **Supplementary Material**). However, when examining risk of high personal stressors—that is, at least one standard deviation above the sample mean—Latinx HCWPs vs. not and higher family size were associated with greater odds of experiencing this high level of personal stressors (**Appendix F** in **Supplementary Material**).

Overall, more than one-third of the sample perceived at least one discriminatory event, with an average of experiencing almost two discriminatory events during the past 14 days. Nearly one in five HCWPs experienced high levels of discrimination (at least one SD above the sample mean). Among those perceiving some form of discrimination, the most common events reported were being treated less courteously or respectfully than others (72.23%) and being feared (43.04%). Experiencing these two events was most often attributed to their role as a HCWP (32.10 and 70.82%, respectively). In multivariable analyses, only males were found to experience greater counts of discriminatory events than women, controlling for the other demographic characteristics (**Appendix E** in **Supplementary Material**). However, these demographic characteristics were not significantly related to risk of experiencing high discrimination (**Appendix F** in **Supplementary Material**).

Having had direct contact with at least one patient diagnosed with or suspected of having COVID-19 was considered, in and of itself, an additional source of stress: nearly half of respondents indicated having had such contact. Male HCPWs were twice more likely than females to be potentially exposed to COVID-19 at their workplace (**Appendix F** in **Supplementary Material**). Other characteristics associated with increased odds of exposure included family size and higher educational attainment. In general, HCWPs that had a health provider role (e.g., doctor, nurse) were more likely to be potentially exposed than community health workers, behavioral health providers, and other HCWPs (not shown; results available upon request).

Help-Seeking and Self-Care Behaviors

Most HCWPs reported having engaged in mental health help-seeking behaviors and self-care activities. While <10% sought mental-health support from a professional in person, nearly one-quarter did so virtually. Latinx HCWPs were more likely to seek in-person mental health support than non-Latinx HCWPs (**Appendix G** in **Supplementary Material**). No differences across demographic characteristics were found for remote mental health visits. However, case managers/coordinators and behavioral health providers had greater odds of seeking remote mental health support than traditional health providers (e.g., doctors, nurses), net of the demographic characteristics (not shown).

Participants reported engaging in self-care behaviors aimed at enhancing their well-being, such as meditation and physical exercise, on average almost three days a week. The most commonly performed self-care activity (i.e., behaviors practiced at least four days a week) included socializing with others whether virtually or in-person (52.3%), and taking time to relax (34.9%). Less than one-third of HCWPs engaged in meditation (23.9%) or physical exercise (29.2%) for at least four days a week. Overall, almost 15% practiced these behaviors more than four days a week. Controlling for the model covariates, the multivariable analyses demonstrated that older HCWPs reported more days of engaging in self-care behaviors than younger HCWPs (**Appendix E** in **Supplementary Material**). Additionally, behavioral health providers reported more self-care days than healthcare providers (not shown). Older HCWPs were 5% more likely to engage in frequent self-care activities (**Appendix G** in **Supplementary Material**). No other characteristics were associated with self-care.

DISCUSSION

The current study communicates findings on a very pertinent and timely issue that to our knowledge, has not been addressed in previous published research: the analysis of how attending socially vulnerable clients during the COVID-19 pandemic has undermined the well-being and mental health of HCWPs. The research reported in this study aims at describing the mental health indicators and occupational and personal stressors that HCWPs in the U.S. encountered during the initial months of the COVID-19 pandemic.

During the pandemic, HCWPs are considered frontline, essential, and critical infrastructure workers; and those providing services to vulnerable groups seem to be working under higher pressure and occupational stress because COVID-19 has hit the socially vulnerable harder than other populations. Socially disadvantaged groups in the U.S. have experienced disproportionate COVID-19 morbidity and mortality rates due to persistent inequities in underlying conditions such as wealth, poverty, employment, housing, health status, access to health care, and exposure to the virus related to occupation, among and others (35).

Our findings suggest that HCWPs serving vulnerable groups in the midst of the pandemic suffer adverse mental health repercussions that are reflected in a self-perception of poor mental health status, high levels of stress, and the manifestation of anxiety and depressive symptomatology possibly related to occupational and personal stressors. Research has shown that in general, one year into the pandemic, HCWPs are being confronted by feelings of anger, uncertainty, and insecurity in addition to sleeping disorders, anxiety, depression, grief, and even suicide [i.e., (13, 17, 36)]. In our study, participants with high scores of anxiety and depression symptoms are considered a high-risk group for developing serious mental health problems. This group at risk was comprised of mostly Latina women, under 50 years of age who worked longer shifts during the pandemic. Similar findings have been reported, for instance, in a study conducted in Mexico with a large sample of frontline health workers who reported clinically significant symptoms of anxiety,

depression and somatization among female providers, under the age of 50 with long-exposure to COVID-19 patients (17).

HCWPs in our study experienced high levels of stress associated with occupational situations. They also perceived being the target of discrimination because of their role as healthcare providers. The high levels of stress associated with occupational situations could be related to the fact that the COVID-19 pandemic has exposed, exacerbated, and confirmed existing inequalities in society as well as unveiled new ones, placing socially vulnerable populations at greater risk during this health emergency [i.e. (37, 38)]. Serving high-risk populations, in and of itself, is a stressful job (38). Additionally, the longer than expected duration of the pandemic along with the impossibility to predict the end of this health crisis, has placed at stake the long-term mental well-being of health workers attending populations with high healthcare needs.

The personal stressors we identified with higher scores were mostly related to sleep disorders and concerns about nuclear and extended family members. The occupational and personal stressors seemed to potentiate each other to create an amplifying negative effect impacting on the HCWPs mental health. Other studies (11, 17) have reported similar findings of daily stress accumulation and consequential manifestation of psychological problems such as depressive symptoms, anxiety and other forms of mental discomfort, including suicidal ideation. Recent publications have documented that responding to the health needs of others during the pandemic has been consistently identified as a source of significant stress and a mental health challenge among HCWPs (1, 12). Many HCWPs find it difficult to work under extreme pressures such as deciding how to allocate limited resources to equally needy patients, how to find a balance between their own mental health care needs and those of their clients, and how to align their duty to patients with their own personal responsibilities to family and friends (12, 26). Listening to concerns and having compassion toward those more severely affected by the pandemic seems to lead to additional stress resulting in fear, anger, frustration, hopelessness, guilt, depression, and even suicidal ideation (36).

In our study, we also found that a small proportion of HCWPs, actively sought mental health resources in person or virtually to help them cope with their stressful occupational and personal situations. A larger number, however, reported emotional support and companionship from family and friends to try to find comfort and emotional well-being. Similar findings have been reported in previous research that emphasize the crucial supportive role of family and close friends as coping responses when facing stressful situations (4, 5, 39). Getting involved in activities known to help reduce stress, such as exercise and meditation, were reported only by a small proportion of our participants, perhaps due to their demanding work schedules and lack of time to attend both family- and job-related responsibilities. Our findings suggest the need to develop and implement strategic interventions to protect the mental health of HCWP working with socially disadvantaged groups, as these providers seem to use limited resources to reduce their emotional discomfort.

The World Health Organization (19) highlighted the importance of protecting the rights of HCWPs regarding working hours and the prevention of psychological distress, fatigue, occupational burnout, stigma and physical/psychological violence. Organizations of healthcare professional, alike, have pledged to implement specific measures to improve occupational safety and protect the physical and mental health of health workers (24, 25). However, focusing on the needs of patients affected with health problems derived from coronavirus and its variants, while at the same time continuing with vaccination-related actions (i.e., providing information and education on vaccines and actual immunizations) have increased the demands upon health personnel, making it difficult to lighten their workloads.

Preventing burnout and psychosocial problems among this essential group of healthcare workers require individual interventions and appropriate organizational policies, as well as infrastructure capable of meeting their needs. Moreover, supporting HCWP mental health requires developing a systemic, multi-level approach that includes access to a variety of individual- and group-level mental health interventions and a coordinated organizational response (20, 21). Professional associations, healthcare facilities and other employment sites should offer accessible in-person and virtual mental-health-crisis interventions for their staff using digital platforms, online networks and telemedicine communications. Though, it should be noted that not all HCWPs will have access to, or be willing to utilize mental-health services due to feeling thy can deal with their own problems, stigma, the cost of professional counseling, –given that some already face financial burdens associated to their partners' losing their employment. Nevertheless, healthcare organizations may help by making available brief self-care strategies and the use of rapid mental health screeners to self-monitor their well-being. Also important is to teach HCWPs new and efficient coping strategies to deal with stress and mental discomfort associated with both occupation and personal stressors. Organizations can also contribute to reducing the occupational stressors by for instance, facilitating a safe and healthy work environment with access to PPE and supplies, allocating additional time to rest and recuperate, stipulating clear communication lines, roles and expectations of all clinic staff members, and engaging HCPWs and other staff in decision-making that involves their personal safety.

Previous research shows that providers working with vulnerable populations (37) report high levels of stress primarily related to having insufficient institutional resources to care for their patients, which is consistent with our own findings. This is why a potential way to mitigate the occupational stress resulting from the pandemic is to assure that HCWPs have access to effective and efficient referral systems for their clients by improving their work place infrastructure and capacity to respond to the social needs of their patients (26). Working with the clinics' management on ways of improve services for their clients without compromising the mental health of HCWPs could prove a useful cost-effective strategy for occupational stress reduction.

This contribution has several limitations. First, it was a cross-sectional design with a modest non-representative sample of health workers, which posed some limitations on the scope of our analysis, our findings' generalizability and, more importantly, in establishing a cause-effect relationship. Second, all responses to the measures were self-reported by HCWPs and clinical diagnostic tools were not used to assess mental health status. However, our study utilizes robust mental health symptoms and distress measures that are highly correlated with mental disorders and have been validated for use with the general U.S. population. Third, we did not have a comparison group of HCWP not working with vulnerable populations that would allow us to analyze differences and similarities between the two groups of HCWPs. Finally, the survey did not include questions about the type of labor contract (i.e., fixed-term, permanent) HCWPs had with their employers, nor about commuting, which may have influenced their responses to the variables considered in this study.

Despite these limitations, this study makes a valuable contribution to the research literature because it provides baseline, descriptive data on the mental health, and stress levels of safety net providers, who have been likely dealing with the brunt of COVID-19 with their socially vulnerable clients since the initial months of the COVID-19 pandemic. The findings derived from this study could be of great value for designing protocols within healthcare organizations serving socially vulnerable populations post pandemic and for developing systemic, multi-level approach interventions to protect the mental health of HWPs.

Future research with health providers should consider paying more attention to specific determinants of mental health discomfort and the particular needs of HCWP working with the socially underprivileged. This often-overlooked group of professionals have not received the attention they deserve from policy makers, clinic managers, professional associations, and researchers given the conditions of scarcity they frequently face in their workplace. FQHC in the U.S. often receive limited funds to run their operations and must meet a number of stringent criteria to receive funding, and the lack of resources to help others seems to add pressure to their already demanding commitments to their clients. The growing body of literature focusing on the mental health of health providers must include comparative studies with HCWPs tending the underserved.

Future projects also need to include longitudinal tracking of the social, organizational, and personal factors affecting the mental health of HCWPs as the pandemic continues to unfold worldwide. In closing, we want to emphasize that protecting the mental health of HCWPs is not only a necessary part of providing high-quality health care, but also a global priority and a moral obligation of health care leaders, health systems, and health organizations whose staff is exposed to COVID-19-related risks.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available upon request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board (IRB) at the University of Texas at Austin.

AUTHOR CONTRIBUTIONS

VS conceived the project and wrote the manuscript's original draft. AV and MM worked on the data analyses. AV, MM, DG, AO, and DP-M contributed to the writing of this manuscript. AV was affiliated to the Latino Research Institute of the University of Texas at Austin when data collection for this study was conducted. All authors read and approved the final version of this contribution.

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Users' Perception of Violence and Conflicts With Professionals in Primary Care Centers Before and During COVID-19. A Qualitative Study

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Background: Workplace violence is a social problem of special interest in both intervention and research. Among the sectors that most perceive this type of violence, health care professionals stand out. The most common type of violence for this professional group is the one perpetrated by the users or patients themselves. It has been reported that one out of every four acts of violence in the workplace occurs in the healthcare setting. Within the health sector, the Mental Health, Emergency and Primary Care services have been widely reported as being among the most vulnerable, with Primary Care being the least addressed of the three. Although the available literature is extensive, there are hardly any studies that explore from a qualitative perspective what are the sources of conflict in this sector from the perspective of the users, the most common being to work with professionals.

Objective: The aim of this study is to examine those aspects derived from the organization, the professionals or the users of Primary Care that, from the users' point of view, cause violent situations and how they think these could be avoided.

Method: The sample consisted of 80 users of the Primary Care services of the Health Service of Murcia. For data collection, a qualitative study was conducted through 10 focus groups and a subsequent thematic analysis of the data.

Results: The results have allowed us to identify that, from an organizational point of view, the uncertainty in waiting times, the need to adapt the telematic or telephone appointment to the different types of users, or the management of emergencies in Primary Care are the aspects that cause most conflicts between users and professionals. In this sense, suggested improvements are aimed at providing information in the mobile application updated on the opening hours or maintaining the telephone appointment for those who need or request it, among many others. As for the professionals, users point out that the medical staff is perceived as distant and sometimes does not provide

enough information on the health status of users. Another professional group widely addressed in the focus groups was the administrative staff, being described as lacking in communication skills, assertiveness, or empathy. Users recognize the existence of a demanding/aggressive profile among users, who makes instrumental use of violence to achieve privileges over users in general. We have also identified the profile of the user who makes use of Primary Care as a way of socializing or managing conflicts of a socioemotional nature. As proposals for this thematic block, users suggest group therapies, the use of audiovisual material complementary to the information provided by professionals or community interventions in psychoeducation.

Conclusion: This study allows to explore conflicts between users and professionals from the Primary Care patients' perspective. Our results are complementary to the available evidence that has used the professional's approach to study the phenomenon of workplace violence. The identification of sources of conflict and the assessment and contribution of users on possible ways of improvement can serve as a basis for the design of prevention and intervention plans to improve the work environment in Primary Care centers.

INTRODUCTION

In recent decades, both at the level of care and research, there has been an increased interest and concern for the study of workplace violence [1]. In 2016, the ILO (International Labor Organization), defined this type of violence as "any action, incident or behavior that departs from what is reasonable by which a person is assaulted, threatened, humiliated or injured by another, in the exercise of their professional activity or as a direct consequence of it" [2]. The same document refers to two main types of violence: Physical and psychological violence.

International studies indicate that at least 25% of workplace violence occurs in the healthcare setting [2, 3]. In this sector, professionals themselves may perceive violence as inherent to their job performance [4–7]. A recent meta-analysis concluded that workplace violence is observed in all continents in practically the same proportion over the last 30 years, with prevalence ranging from 48.1% in Europe to 70.9% in Oceania [1, 6, 8]. The magnitude of the problem has led international organizations such as WHO, ILO, ICD and IPSO to develop guidelines for creating violence-free healthcare institutions [9].

Workplace violence in the health sector can happen both between colleagues (lateral violence), as well as in hierarchical order or from superiors to other subordinate workers (horizontal violence) and from users to professionals, the latter being one of the most studied [10–12].

Although this type of violence is perceived by practically all health care workers, several studies have shown inequalities in the prevalence of workplace violence depending on the service where the professional belongs. In this sense, professionals in Emergency Services, Primary Care or Mental Health seem to be at greater risk of suffering violent episodes in the workplace. This study focuses on Primary Care services where it is estimated that

at least 50.2% of the personnel are exposed to violence in the workplace [1, 5, 6, 8, 11].

Within Primary Care services, a recent study states that between 54.9 and 78% of the medical personnel are exposed to verbal aggression [13]. These percentages are similar for both nursing and non-health care staff (e.g., clerks), the latter being among the most affected [1, 6, 8, 11, 14].

The exposure of these professionals to violence can have multiple consequences, mainly chronic stress, job dissatisfaction, absenteeism, organizational changes, or burnout [15, 16]. Given the high personal and institutional cost of exposure to workplace violence in health professionals, it is necessary to investigate and find out what factors might be influencing, in order to act on them and minimize the risk. In general terms, the literature focuses on four main blocks: those related to the work context, those related to the staff, those related to the patient and, finally, those related to the system itself [17, 18].

As mentioned above, one of the main manifestations of workplace violence in the health sector is the one perpetrated by users against professionals. Therefore, knowing the perspective of the users themselves on the use of Primary Care and the treatment received by its workers is an interesting and necessary vision for understanding the phenomenon. Previous qualitative studies based on health care personnel have provided relevant information on the experiences, needs, feelings and perceptions of professionals. The importance of staff training, the need to inform the user, the fear of aggression, the lack of reporting and the management of conflictive situations have also been evidenced [7, 19–21].

From the user's perspective, it has been observed that when users feel that they are in a situation of vulnerability, the risk of aggression may increase. These situations can be perceived with relative ease by users who feel disrespect for their integrity

(22, 23). These studies have been focused mainly from a quantitative perspective, and there is little scientific evidence of qualitative studies on users. Among these few previous works, we observe that, sometimes, the user has participated as part of the focus groups along with the staff or has been invited along with them. A precedent in the study of Primary Care using qualitative techniques with users is the work of Dois-Catellón and Bravo-Valenzuela (23). These authors state that a fundamental characteristic is the good treatment received by the professionals. They also describe that, in order to establish a good relationship, it is necessary to have an initial greeting, eye contact, to use understandable language and to consider the users' opinions, among other measures.

It has been observed that, when users are part of the studies, they feel integrated when working together, the results are very positive, and they feel a greater attachment to the health system. These previous studies point to the need to expand the knowledge available on the perception of users in order to propose changes in the system with the aim of reducing violence in Primary Care centers (24, 25). It is important that this body of knowledge is built with both quantitative and qualitative studies, since the latter allow a greater understanding of the lived experience from the point of view of the participants, focusing on the meaning of the thoughts, attitudes, behaviors and practices conferred by them (26).

Nevertheless, with the declaration by the World Health Organization (WHO) in March 2020 of the SARS-CoV-2 or COVID-19 pandemic, important changes and health adaptations were made worldwide due to the great care pressure. Health systems, in general terms, directed a greater number of resources toward hospital care, which led to a lack of human and material resources for crisis management in primary care, with 132 community health centers and 1,152 local clinics being closed in Spain (27).

This study has three objectives: Firstly, it aims to explore those aspects related to the organization, professionals and users that could be potential sources of conflict. Secondly, it will explore the users' proposals and opinions on possible ways of reducing these sources of conflict. Finally, the perception and satisfaction of users with the changes in Primary Care since the emergence of COVID-19 will be explored in depth.

METHODS

Theoretical Paradigm and Study Design

Violence by users toward health care personnel in Primary Care has been extensively studied from a quantitative approach (6, 25). Although this approach is necessary and particularly relevant, it sometimes offers a limited view of the phenomenon because it is based on constructed questionnaires. For this reason, the present study aims to evaluate conflicts between users and professionals in Primary Care from the qualitative paradigm. This approach facilitates to explore with a higher level of specificity, as it lacks a previous explicit framework to guide the obtaining of results. This facilitates the exploration of one's own experience and how it is communicated, which can facilitate deepening the meaning and understanding of the information. In addition, it

avoids the response bias typical of self-reported questionnaires and collects information from multiple verbal and non-verbal channels, impulsive or unpremeditated responses (28, 29).

In the same vein, a qualitative study is proposed from grounded theory with a constructivist approach (30) by conducting focus groups (31). The research team developing this study is made up of professionals with extensive experience in health care, in research and in the publication of scientific articles on violence by users toward health care personnel and in conducting qualitative studies.

Participant Recruitment

The study was carried out in southeastern Spain. Potentially eligible participants for the study were those who made regular use (several times a year) of Primary Care centers. The interviews were conducted between June 2021 and July 2021. A total of 100 users were invited, of whom 80 (63.7% female) finally participated. The mean age of the participants was 48.92 ($SD = 14.95$) and the age range was between 18 and 75 years. 100% were of Spanish nationality, most were in active employment (57.5%), married or in a domestic partnership (48.8%) and visited the Primary Care centers between zero times and once a month (85%). The participants were not required to have been involved in any incident of violence in a Primary Care center; however, 38.8% acknowledged having had a conflict in their assigned center and 71.3% acknowledged having witnessed a conflict between another user and a professional (**Table 1**).

Procedure

The present study was approved by the Research Ethics Committee of the authors' home University (ID: 3555/2021) and conducted following the recommendations of the COREQ guide for focus groups (32). For sample recruitment, snowball sampling was used among users to whom the research staff had access. In all cases, an information sheet was provided along with a verbal explanation of the objectives of the study. Before conducting the focus groups, an informed consent form was provided and completed by 100% of the participants. It provided explicit acceptance of participation and for the audio recording of the focus groups.

Due to the problems derived from COVID-19, there were two alternatives for conducting the focus groups. On the one hand, face-to-face focus groups were conducted in a large, ventilated room that allowed compliance with the sanitary measures imposed at the time they were conducted. On the other hand, for those users who showed their rejection to a physical social meeting (due to COVID-19 restrictions), the focus group was conducted by video call. With both options, a total of 10 focus groups were conducted with a duration between 60 and 70 min and with approximately 8 participants per group. Before conducting the focus groups, users were again asked for their verbal consent before starting the audio recording. In addition, they were reminded that the audio recording would be destroyed after its transcription. In the text file, any data provided that could identify the participant or another person was replaced by a code.

The inclusion criteria used for the selection of participants were: (a) being a user of Public Health Primary Care and (b)

TABLE 1 | Sociodemographic and work-related variables.

Variables	N	%
Sex		
Man	29	36.3
Woman	51	63.7
Nationality		
Spanish	80	100
Employment Status		
Active	46	57.5
Retired	16	20
Sick note	2	2.5
Others	15	18.8
Lost	1	1.3
Marital Status		
Single	25	31.3
Married or cohabitating	39	48.8
Separated or divorced	12	15
Others	4	5
Frequency of visits to the primary care center per month		
0–1	68	85
2–3	6	7.5
4 or more	6	7.5
Have you ever had a conflict in your Primary Care center with a member of the staff?		
Never	48	60
Sometimes	31	38.8
Lost	1	1.3
Have you witnessed any conflict with a staff member at your Primary Care facility?		
Never	23	28.7
Sometimes	57	71.3

being over 18 years old. The exclusion criteria were: (a) being mainly users of Private Health care, (b) not signing the informed consent form, and (c) having some type of disability that impedes comprehension or verbal expression.

Data Collection

Focus groups were chosen because of their wide use in research. For data collection, a script was designed based on previous studies and the professional experience of the researchers and other collaborators. The script was complemented with concept mapping in a group of experts and interviews with key informants. Finally, the script was tested with a group of users not included in the results of this study (33). For the design and development of the groups, the recommendations of Krueger (31) were followed, grouping people with common characteristics related to the topic or research question (Primary Care users).

The focus groups were conducted by the first and second authors with the assistance of the rest of the authors, with no one else present in the room except the interviewees. The authors have demonstrable training and experience in creating and extracting data through focus groups, having applied this

methodology in several of their studies. Before starting the recording, they spent between 5 and 10 min establishing rapport with the attendees through trivial questions. After this, they were told about the functions, objectives and importance of studying violence toward health care workers. The interviewers adopted a neutral attitude, free of bias, assumptions, or interest in the results. The rest of the authors took turns to support during the different focus groups with the same neutral attitude, taking notes and complementing the interviews.

The interviewees were encouraged to provide all the information they knew, whether their own or from someone they knew, avoiding focusing exclusively on their own experiences.

Content of the Interview

All the participants were asked questions related to violent situations in Primary Care centers. These questions were divided into three blocks. First, sources of conflict related to the Primary Care organization or system were explored. Secondly, conflicts involving the professionals themselves were explored. Finally, they were asked about conflicts generated by the users themselves. In all cases, aspects that could improve coexistence and possible solutions to the conflicts raised were also explored. In addition, the users' perception of the changes experienced in Primary Care since the emergence of COVID-19 was explored.

Data Analysis

The data were analyzed with an inductive and constructionist approach through thematic analysis following Braun and Clarke's proposal (34). This method allows the data to be analyzed in six phases. In the first phase, familiarization is performed through the transcription of the group recordings. In this phase, the researchers take notes and mark ideas that can help in later phases.

In the second phase, initial codes are generated and discussed in pairs. These codes are generated using an inductive or bottom-up approach to identify the data, without attempting to fit them into a pre-existing theoretical framework. When there was no consensus, multiple coding was proposed.

In the third phase, topics and sub-topics were proposed by grouping these codes and elaborating maps and tables. For the generation of themes, latent themes were explored using a constructivist perspective, avoiding relying on a simple description of the data. In the fourth phase, the different researchers review and discuss the generated themes. Finally, in the last two phases, the themes were definitively defined and named, discussing data saturation and producing a report.

RESULTS

From the thematic analysis of the focus groups, 4 interrelated thematic blocks have been observed that identify sources of conflict in Primary Care centers from the users' perspective. These are (1.a) Conflicts generated by organizational deficits, (1.b) Conflicts generated by an inappropriate attitude of professionals and users, 1.c) Conflicts derived from a deficit in health care and (1.d) Conflicts derived from changes made after COVID-19 (**Figure 1**). In addition, 5 other thematic blocks
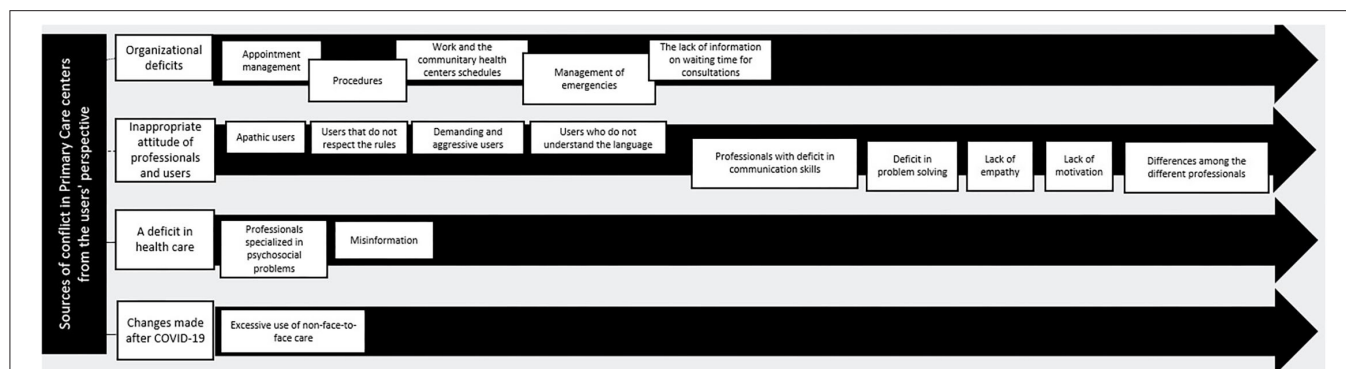
FIGURE 1 | Sources of conflict in Primary Care centers from the users' perspective: topics and subtopics.
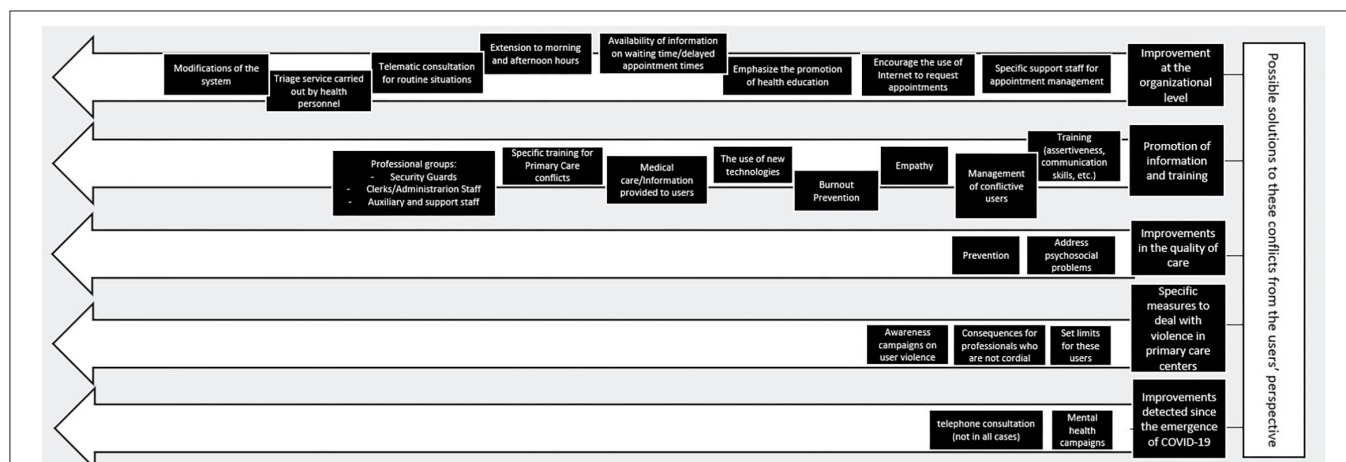
FIGURE 2 | Possible solutions to the conflicts in Primary Care centers from the users' perspective: topics and subtopics.

have been identified that encompass possible solutions to these conflicts according to the users themselves. These are (2.a) Proposals for improvement at the organizational level, (2.b) Promotion of information and training, (2.c) Improvements in the quality of care, (2.d) Specific measures to deal with violence in primary care centers, and (2.e) Improvements detected since the emergence of COVID-19 (**Figure 2**).

Conflicts Generated by Organizational Deficits

All the focus groups stated that one of the main sources of conflict that leads to violence in Primary Care centers is the system's own organizational problems. In this regard, appointment management is a recurring topic, generating feelings of frustration or anger in users. Some of these problems seem to be shared by all the centers, especially four of these problems. In the first place, the management of medical appointments by telephone, with users reporting great difficulties to be attended. Online appointments do not seem to be a suitable alternative for all users, as it is difficult for both low-income and elderly users to use this method. Regardless of the method used, users consider that a major source of annoyance and frustration

is the delay between the request and the consultation with the health professional.

"I believe they should improve the telephone service because, for example, for people who don't know how to make an appointment online because they are elderly or whatever, they don't have any other choice but to go there. Because it's difficult for the people at the community health center to pick up the phone"

"It's really hard for an elderly person to make an appointment over the phone. You are not allowed to go to the [community health] center, also now because of the COVID situation. That already makes the person go with a predisposition of anger towards the community health center, towards their doctor. Then, when they get there, they are given an hour [for the appointment] and that hour is never met, so they arrive with a little bit more anger"

"I have asked for an appointment in ten days and they [the community health center] give you an appointment in 15 days. Any type of consult, minimum 15 days"

Apart from requesting an appointment, users state that they encounter other difficulties when they try to make arrangements at the Primary Care center. In this regard, two frustrating procedures for the user have been pointed out. On the one hand, there is a need to carry out certain formalities in

person when these could be done online (e.g., requesting registration, changing information on the health card or absence notes); and on the other hand, the difficulties in formalizing complaints and claims at the centers, as can be seen in the following extract:

"About the grievances, I also feel like they are not taken into account […] when you take other types of actions, such as a formal complaint, the problem is that there are no witnesses, because you enter [the doctor's office] alone, and it's their word against yours, so, if the attention has not been appropriate, it is very difficult to prove the feeling. They usually hide behind the fact that the technical treatment is correct"

The reconciliation of work and health care in Primary Care is sometimes a source of conflict for users. In this line, the incompatibility of the working day and the attendance schedule has caused problems for users, which can lead to conflicts in the centers. In addition, the management of sick leave is described as a potential source of conflict when it is not granted and the user does not agree with this decision, as shown in the following dialogue:

"The doctor was never at their office when it was their turn. So, it makes me angry because, as I must be at work at a certain hour, they are supposed to be at a certain hour too. Therefore, that makes you upset, as then you don't even have time to do what you were going to do because now you are in a hurry. That makes everybody upset and it gets worse and worse, especially people who have things to do, who have their work schedule"

It has been observed that the management of emergencies in Primary Care is perceived as a source of conflict and violence by almost all the participants in the study. In this regard, they criticize the fact that triage in this service is carried out by non-health administration staff, in a context of low privacy or lack of confidentiality, which generates multiple conflicts and generalized frustration, as shown in the following example: *"Triage cannot be done by a clerk, and people should not talk about these things at the counter"*. Furthermore, they claim that this emergency service is collapsed due to a lack of control, which causes its users to take advantage of the situation by abusing it in order to avoid the wait between the appointment request and the consultation.

"There are many people who continually need to go to the doctor and that is why they abuse the emergency room, but that will always happen and has always happened, especially in adults-sorry, adults or kids, hysterical parents who take their children to the doctor a lot"

"I go directly to the emergency room and that way they doctor sees me and I get everything done, all at once, because otherwise I have to go to the doctor, then they have to order to run some tests, which takes a lot of time, then etcetera, etcetera, so I get all that done at once and that's it"

Finally, in this block, the lack of information on waiting time for consultations is particularly relevant. In this regard, users report that, despite having an appointment at a specific hour, they often do not see the doctor at that time and are not informed of the additional waiting time. A variant of this also happens in telematic consultations, with no certainty as to when the call will be received. In addition, once they have

been attended, they state that the consultation time is excessively short, so they feel that they are not attended and informed with sufficient quality.

"I was surprised, because at the family doctor, every time that I go, it takes me 1 hour, hour and a half and even 2 hours to wait for the doctor to see me"

"My mother has been booking doctor appointments over the phone for the last few months and the doctor assigned her, for instance, at twelve thirty, but then called her at two thirty. In other words, the call schedule was not respected either. They give you an appointment, but, in the end, the doctor would call you when they could. That was not respected either"

"In the end, they stick to the time they have to attend you, if in the end I saw… I think that's it… it's the time they have to attend you because I don't think any doctor wants to attend you in 5 minutes as some do, some do it in more time and that's why you have to wait two hours"

Conflicts Generated by an Inappropriate Behavior of Professionals or Users

The user-professional relationship is perceived by the participants as one of the most determining aspects in the emergence or not of violent situations in Primary Care centers. In this line, sometimes the climate of the centers can be perceived as "unpleasant" and this can be triggered both by the users and by the professionals. Regarding users, apathy, patients who do not respect the rules, demanding, aggressive and users who do not understand the language well have been identified as the main sources of conflict in this regard.

"And the user can have an infinite patience, a wonderful character and know how to manage conflicts, but when it is continuous, when you see one injustice after another, in cases that are medically speaking quite difficult, the patient finally explodes because they are not giving you the minimum treatment that a patient needs"

"There is a type of patient who, when they go to the emergency room or their community health center, thinks that they are the first one to be seen, that they decide on the medication and the tests that are going to be run"

"I have seen in the waiting room people who wanted to enter whenever they wanted, people who don't allow the professional to fail, all this kind of stuff"

"And the problem is that we live in an infantilized society, that is, I have the right to everything. And if not, in the end, we will get the 'I pay your salary' ".

On the part of the professionals, the interviewees point out a deficit in communication skills, problem solving, empathy and a certain lack of motivation. In addition, they point out that there are differences among the different professionals, especially among administrative, nursing and medical staff, as can be seen in the following examples:

"Another thing I see is the simple fact that, just because they wear a white coat, they have authority […] And then they acquire that, that paternalistic tone, that you can't talk, if it's not what they tell you, there is no possible alternative "

"Doctors go with little time, but sometimes saying a kind word, a word that makes you feel good and that helps you, helps them to tell you something harder, to have a little more empathy towards the other person, I believe that all of that is very important. The people at the counter are not empathetic at all to people who come with a problem"

"Sometimes it's also the security guards who cause those difficult situations"

Conflicts Arising From a Health Care Deficit

The participants in the focus groups exemplified various deficits in the health care offered by Primary Care services. Among all of them, there is a need to incorporate professionals specialized in psychosocial problems, since many users make use of Primary Care for these reasons (feelings of loneliness, work problems, etc.) and, generally, the only alternative proposed to them is medicalization.

"There is no way to make an appointment with a psychologist at Primary Care, it takes 7 years to have an appointment, the issue of fundamental psychosocial support".

"There are also people who have mental health problems and maybe the solution is not pharmacology but another type of approach."

"Social workers are necessary because they give you advice, they provide different care in comparison to doctors or nurses".

On the other hand, a general feeling of misinformation has been observed. The users interviewed think that they are not given enough information about waiting times for consultation or their therapeutic process.

"I believe that the information phase or the perception of lack of information on the user side can generate anger, a feeling that something is happening and you are missing something, dissatisfaction"

"what we lack is that the professional, the practitioner in the exercise of their profession, apart from humanity, which is what has been claimed, what they have to be clear about is that their obligation in this case is to inform the patient and their family, if there is one, of what therapeutic options the patient has, according to the patient's age, the consequences of using certain options or not, and to respect the patient's right, in this case, to decide whether they want to accept them or not, due to their age and the consequences that the therapeutic options may have".

Conflicts Arising From Changes Made After COVID-19

Finally, some of the conflicts observed by the participants in this study are specifically derived from the changes experienced in Primary Care since the emergence of COVID-19. In general terms, users consider that the system has not adapted properly. An excessive use of non-face-to-face care has been pointed out, generating a feeling of insufficient attention.

"I think they have also accommodated themselves, because my mother for example, she had a wound on her foot, and I said 'mom, go to the doctor', and she said, 'but they only give me an appointment by phone".

"There are people who need face-to-face consultation and they are not being given it, because of this.... Because of the existence of the telephone and telematic consultation, and they really need a face-to-face consultation".

Proposals for Improvement at the Organizational Level

In the focus groups conducted, alternatives were also proposed that users consider appropriate to solve some of the conflicts mentioned above. In this sense, they propose incorporating specific support staff for appointment management, unloading the administration service. In addition, they propose to encourage the use of Internet to request appointments and extending this to other services but bearing in mind that some users (especially the elderly) have difficulties, carrying out campaigns in this regard. Finally, they emphasize the promotion of health education with the aim of reducing the request for appointments through self-care.

"I see it as very comfortable, because you can take it out, you can choose the day, you can do it whenever you want and I think it would be good too, even if it were to be extended for example, when you are referred for a cytology or an X-ray or something like that, in a case where you do have to go to the counter and have to queue a lot; it would also be interesting if it could be done online".

"The online appointment was present way before COVID, but, well, I think it's alright. As long as everyone has means, because a lot of people don't have one. So, you have to have the phone, or whatever. An alternative for the grandpa who doesn't handle the smartphone".

Regarding the consultation itself, users think that information about the waiting time/delay in the schedule of their appointment should be available, either through the application, a message or in the waiting room itself, as well as the extension to morning and afternoon hours. They think that telematic consultation should be encouraged, especially for routine situations (administrative formalities) or less serious procedures. In-person appointments are essential according to users but should be reserved for consultations where it is really necessary. Along the same lines, they praise the use of electronic prescriptions and recommend training and promoting their use.

"It is an incredible thing and, yes, the truth is that if it sends you a message, 'hey, you won't enter until two hours from now', for example, it would be great, it would be great".

"It is regulated by the workers' statute. Every X hours, there are fifteen minutes of rest, I don't know if it is regulated or not in the medical area, but I don't think it's far-fetched".

"What I have loved is the telephonic consult, for things that are not very urgent, you talk to the doctor over the phone and they prescribe what you need over the phone and it is alright".

The users interviewed consider that a necessary solution to the conflicts mentioned in Primary Care emergencies would be to incorporate a triage service carried out by health personnel.

"No, obviously that is not the clerks' job from my point of view. In other words, not even nursing staff, who have more knowledge, an effective triage would logically be medical".

Finally, in this block the users propose some modifications of the system. They consider that it is necessary to improve the means of communication with senior management, increase human resources, that the professionals' schedules of attention and rest are public, and to include health care in support groups aimed at users with the same pathology.

"I think the problem also lies in the schedules of the community health center, if it only opens during morning hours, there are people who can't miss work and will go to the emergency room in the afternoon".

"I believe that the more controlled the whole system is, the more standardized it is and the more evaluation is done".

"that they encourage groups for these people... a couple of days a week they have some sessions where they are taught to breathe, they are taught to relax, they are taught to calm down. Because I think it's very complicated that you can do it home alone without having done that before".

Promotion of Information and Training

The attitude of the professional toward the user has been previously mentioned as a source of conflict. Along these lines, the interviewees consider that training should be provided to professionals in patient care (assertiveness, communication skills, etc.), management of conflictive users, empathy and burnout prevention. In addition, they consider it necessary to train in the use of new technologies available in the service and the improvement of medical care/information provided to the user.

"So if you get a [female] nurse or a [female] doctor who is more empathetic by nature, then you are lucky, and if not then, you aren't, when it is something, all these types of competencies and skills can be easily developed by including them in training and, kind of continuous because, due to the fact that health professionals are constantly seeing health problems and seeing patients, they generate a kind of layer in which they distance themselves from seeing the person as a person."

"I am an administrative in the autonomous community and I take courses to improve, recycle and everything, so they should also take courses to learn how to treat people better".

"then we will also have to take courses from above to work on emotional intelligence and empathy, and to reduce burnout syndrome, which is the syndrome of being burned out, which professionals, especially in nursing, have a very high level of burnout".

By professional groups, the interviewees consider that security guards should have specific training for Primary Care conflicts. This type of personnel is well perceived by users, but sometimes it can increase the tension of conflicts because they do not have the necessary skills, as shown in the following example: *"I am not saying that the figure should not be there, but maybe I think that they should be people who are... well trained, who have psychological evaluations and then quality reports on treatment. They should also have some supervision".* This training deficit has also been pointed out for the administration staff, who are considered not to have the necessary skills for some of their current functions, such as emergency management. Finally, they request auxiliary and support staff. These staff could help elderly people to request telematic appointments or orient people within the center, among other functions.

"Yes, for example, now, with the COVID issue, I have seen it improve with the person who is at the door. For example, in my community health center now there is a person who, when you arrive at the door, asks you what you need and says, "Look, your office is in this place, you can have your tests done here, if you need a bottle, I will give it to you".

Proposal for Improving Quality of Care

In order to improve the quality of care, the participants consider that it is necessary for Primary Care centers to address psychosocial problems. For this, they request both the incorporation of specialized personnel and the creation of support groups. These support groups should be focused on reducing the medicalization of some pathologies, according to the interviewees. Some of the proposed groups were oriented to relaxation techniques, self-help, yoga or people with feelings of loneliness.

"I would love a support group. There are many things that really don't need consulting, they need support and you go, you go to the doctor, to the doctor, to the doctor because you feel very lonely, very misunderstood."

In general terms, users consider that the focus should be shifted to prevention, which could result in less demand for the service and less conflict. They request that, when treatment is necessary, it should be offered with other alternatives, whenever it is possible, requesting that the existing paradigm expands to a more integrative medicine and that it take into account the variety of health professionals currently available.

"what we lack is that the professional, the practitioner in the exercise of their profession, apart from humanity, which is what has been claimed, what they have to be clear about is that their obligation in this case is to inform the patient and their family, if there is one, of what therapeutic options the patient has, according to the patient's age, the consequences of using certain options or not, and to respect the patient's right, in this case, to decide whether they want to accept them or not, due to their age and the consequences that the therapeutic options may have".

Specific Measures to Deal With Violence in Primary Care Centers

Specifically, for cases of violence, the interviewees have pointed out various measures that they consider "not very effective" and that, in their opinion, should not be implemented. In this line, with regard to the conflictive user, they consider that they should not be punished, nor should the referral professional be changed, as this would not be a real solution to the problem. As an alternative, they propose that the system should set limits for these users, preventing them from benefiting from their own violent behavior by being able to make "attention calls" without the need to punish.

"I believe that the person in need should be attended, and that the system should be restructured so that each person has the attention they need, and do not have to use the emergency room because they are not attended in PC. I don't think anyone should be punished; I don't think punishment is a good alternative."

Just as measures against conflictive users are proposed, the interviewees consider that professionals should have consequences when they do not play a cordial role with the user. In this line they speak of implementing user satisfaction measures by making the results obtained available to the professional.

"when I have left these consultations, I wondered why they aren't evaluated through the assessment of their patients' satisfaction. Ask for our degree of satisfaction, how we feel, if we feel good after having received care, in some way to measure and be able to improve their work or at least put it on trial. The feeling I get is that they are a little accommodating."

Users also speak of the need to implement awareness campaigns on user violence, but these should go beyond signage which, at times, is ineffective on its own. Along with this, they propose the unification of criteria before acting in these cases with the publication of an action protocol for conflicting patients.

"The dissemination and awareness campaigns are not very well thought out, i.e. the leaflets are not read by anyone, the posters on the walls are not read by anyone, I think it has more to do with culture and that at a social level is very much like in the long term".

Improvements Detected Since the Appearance of COVID-19

Finally, the focus groups pointed out the importance of improving some aspects that have not been entirely positive in Primary Care since the appearance of COVID-19. Users consider that mental health campaigns are not being carried out by the centers:

"Mental health at the Primary Care level is the great forgotten, even during COVID. And when you ask for an appointment, they give you an appointment for September-October when a lot of months have already passed. And mental health is also important. Here I go. There are also people who have problems of that type and maybe that would be the solution, not the pharmacological solution but another type of solution or a different approach".

In addition, they believe that the telephone consultation, although it has been an advance for many things, should remain, but not in all cases. In this sense, they speak of the need for the elderly or people with special needs to be attended in person, stressing the need to offer one or the other depending on the type of user.

"Over the phone, I do not consider that the doctor can... Some of them can. But there are others that do not. Well... in the field, I don't know, now as in Primary Care almost everything is treated, in general, I think that there are some appointments that should not be by telephone, that should be face-to-face".

"There should be a filter so that you can call the doctor and then the doctor will tell you 'okay, come tomorrow' or 'come in an hour'".

DISCUSSION

In response to the objectives set out, the users of primary care services consider that the workplace violence perceived in these services is due to organizational deficits, problems with the attitudes of professionals and users, and deficits in the health care received. In order to improve the work environment, these users consider that improvements should be made at the organizational level, promote information and training of users and professionals should be promoted, the quality of care should be improved and specific measures should be proposed to deal with violence in Primary Care centers. Finally, both positive changes were detected in Primary Care since the emergence of COVID-19 and negative changes that worsened the climate in these centers. These results provide evidence of situations that the user is able to identify and perceive that could act as triggers for user-professional aggression in Primary Care. Some of the focal points identified seem to be in line with recent studies carried out within Primary Care from both the user's perspective (23, 24, 35) and the professionals' perspective (6, 36, 37). It should be noted that some of these sources of conflict do not seem to be specific to Primary Care, being present in other fields of health care (11, 20, 38, 39).

Specifically, from the organizational perspective of Primary Care, it was observed that delays in care or in the management of appointments generate great discomfort in the user. This has been previously reported in the literature (11, 35, 38). In this line, authors such as Raveel and Schoenmakers (13) propose increasing the information available to users, this proposal being in line with what was observed in the present study. Along the same lines, users consider that the use of telematics should be strengthened for those issues that do not require face-to-face attendance, in an optional manner, so as not to disadvantage any group. The latter could be useful in reducing the discomfort of users who work, who sometimes find it difficult to reconcile work and health care, as observed in our results. The availability of flexible schedules in care centers could alleviate this problem (13, 20).

In this line, previous studies have reported that, sometimes, users can use emergency services to receive health care without losing work activity, thus not presenting an urgent health problem (20, 35). Users recognize that inappropriate use of the emergency department is one of the main triggers of conflicts in the centers. This seems to be caused by inadequate or non-existent application of health triage (23). The alternatives proposed by the interviewees reflect the need to create specific spaces for health triage and the availability of health personnel (as opposed to the administration personnel, who in some cases currently perform this function). This type of measure can facilitate the user experience, respecting their privacy and avoiding a collapse of the consultations for users who do not really have an urgent problem (37, 40, 41).

Relieving the care burden of Primary Care professionals in order to improve the quality of care seems to be a very important point for users. Finding a balance between reducing the burden of care and improving patient care, understood as an increase in time spent, does not seem easy to achieve. However, in this study, interesting alternatives have been observed in this regard. Therefore, users consider it important to reinforce user information channels and to promote user education in order to establish the criteria for appropriate use of the system (20, 42). In addition, the creation of support groups accessible to the population would provide alternatives to some of the

sources of conflict mentioned so far. This proposal is shared both by the respondents and by previous studies in other healthcare settings with good results on health, reduction of violence and good user acceptance (24, 25, 43). Support groups are proposed within Primary Care to inform the population about the use of the system, about certain frequent pathologies (diabetes, hypertension, smoking...) and even about psychosocial problems. The users thus propose a way of reducing waiting times, improving communication between the user and the center, providing more information on how the system works and improving health education.

A large part of the information provided by the participants in this study refers to these communication deficits in user care. The main focus of these comments is the users' perception of an inadequate attitude on the part of the professionals. They refer to the lack of an initial greeting, depersonalized treatment, lack of collaboration to resolve conflicts, little eye contact, the feeling that they are not listened to attentively, excessively technical language or lack of detailed information on the therapeutic process. These and other aspects have been previously pointed out in the literature, concluding that empathy, assertiveness, friendly language, courtesy and cordiality on the part of the professionals are actions capable of preventing and reducing conflicts (20, 23, 24, 35, 44, 45).

The aforementioned information deficits are associated with users' perception of a paternalistic attitude of certain professionals. This paternalistic attitude seems to be defined by a lack of medical information received, lack of listening and little user participation in their own treatment decisions. The changes demanded by the users in our study are in line with those found in other studies in which community health center personnel are asked to change their professional attitude to allow the user to be an active part of his or her own health (19, 46, 47).

Specifically, in Primary Care, López-García et al. (6) claimed that professional training in these aspects is associated with a lower frequency of violence by users toward health care personnel. In our opinion, specific and continuous training of professionals in these issues as part of their work dynamics seems to be the appropriate way to favor the user-professional relationship and could be an issue to be dealt with more intensively from the basic training in the faculties. Many previous studies have shown that this type of training is an important factor in improving the work environment in the healthcare sector. The proposals made include training guided by professional psychologists, practical training with patient simulation, empowerment techniques, communication and empathy techniques and burnout prevention, among others (19, 20, 48–51). From our results, we also extract a proposal that aims to implement user satisfaction measures. These measures could be an appropriate complement to the training of professionals as they provide direct feedback on their treatment of patients and even on the perception of their professional competence.

The deficits in the care received do not only refer to the treatment provided by the health professional. Our results show the need for care with a biopsychosocial (more person-centered) approach. Users consider that professionals resort to medicalization due to the lack of other resources that can cover the needs for psychosocial problems, either due to lack of training, lack of specialized personnel or lack of time in the consultation rooms. Similar perceptions have been observed in previous studies (36, 52). It has also been indicated that this same idea is shared by professionals, pointing out the need to provide care focused on the user in a comprehensive manner, through a multi-causal approach, with a biopsychosocial perspective, and paying attention to their family conditions (23).

According to our results, users consider that medicalization can generate dependence, and therefore, the system would require a paradigm shift in which resources are invested and alternatives are provided to users so that they can become involved in their own therapeutic process. Thus, one proposal of the participants in this study is the implementation of support groups for psychosocial problems. According to the users, these groups could facilitate emotional management strategies, psychoeducation and health promotion. Evidence shows that coordinated teams in Primary Care in Prevention and Health Promotion avoid numbers of emergency hospital admissions through a focused approach to preventive health care and improve quality of life (36, 53, 54). This proposal should be developed by professionals trained in these aspects, such as psychologists and social workers. Complementarily, users consider that this type of care offer, in addition to alleviating some care deficits, would alleviate waiting lists, the demand of certain types of users or care dependence, among other aspects.

The problems derived from user-professional interaction can also be triggered by the users themselves. The participants in this study refer to demanding or very demanding users as the main cause. The literature points out that this type of users could be the consequence of high levels of stress, deficits in communication skills, advanced age, believing to be the only consumer of the service, family or personal problems, difficulty in following the rules or with severe psychopathology (19, 20, 24, 35). The main problem with these users is that they cause discomfort and frustration in other users. Sometimes, the demanding user is granted what he/she demands to alleviate the situation, but this is perceived by the rest as a favored treatment, thus facilitating the generalization of these behaviors to other users. In this sense, and in accordance with the literature, it is proposed that a culture of "zero tolerance" be created, with the creation of strictly enforced rules and protocols to guide the actions of health care and non-health care personnel (55–57). However, the participants consider that this type of inappropriate actions should not entail punishments such as fines or changes of professional or center. Raveel and Schoenmakers (13) conclude in their systematic review that measures to restrict access to users with a violent history are not a measure with scientific evidence for the reduction of workplace violence. In this regard, it seems that the proposals that have more support are the implementation of clear limits for patients and professionals and the promotion of violence awareness campaigns in Primary Care centers (13, 19, 58). The creation of protocols and the training of professionals in them has been proposed as a necessary violence reduction measure (13, 35, 59). However, no previous studies evaluating the effectiveness of these protocols and programs have been found.

Another noteworthy aspect of the results of the present study has to do with some of the adaptations made in primary

care since the appearance of COVID-19. The lack of face-to-face consultations was undoubtedly one of the most recurrent comments. The user describes the insufficient and impersonal treatment, especially for pathologies not related to COVID-19. They state that they have mostly received assistance via telephone without the option of face-to-face assistance. In spite of this, the opinions regarding health care by telephone are not conclusive, since certain users support telephone consultation because of its convenience and above all for routine procedures, since it speeds up the system and reduces waiting times. No previous studies have been found that evaluate this type of aspect in primary care. As a general conclusion, it seems that users are satisfied with telephone consultations as long as they are given the option of choosing between this and face-to-face consultations.

A variant of this type of consultation is telematic consultation through the "Patient Portal". This is a personal online space where the user can access their diagnostic tests, clinical reports, manage appointments and have a follow-up without waiting or travel. This space existed prior to COVID-19 but there seemed to be a certain lack of knowledge. The promotion of this tool has been well received by the study participants, who consider that it is necessary to carry out information campaigns for its use both for the user and the professional.

Finally, users demand more campaigns to address the psychological discomfort they have suffered during the last few months, especially when they were confined. Epidemiological studies in this line point out that one third of the population needed care by mental health services, mainly for presenting anxiety disorders, post-traumatic stress and depression (60). In this line, users consider that this has not been sufficiently taken into account in the adaptation of Primary Care.

This study allows us to have a specific view of those aspects that can generate conflicts in Primary Care centers before and during the adaptations carried out for COVID-19. Violence by users toward health care personnel is a particularly relevant problem of concern to both professionals and users. Previous studies have focused mainly on the vision of health care personnel in the centers, especially in psychiatric centers and hospital settings (11, 38–40). Furthermore, we found few studies that, in addition to the relationship between health personnel and users, evaluate other professionals, such as security or administrative personnel. This is why the approach focused on Primary Care, taking into account all workers, from the perspective of the users is innovative and necessary for the approach of prevention/intervention plans aimed at improving the work environment of these centers.

STUDY LIMITATIONS

The study is not exempt from the limitations characteristic of qualitative designs. The results should be interpreted as a description and categorization of what was reported by the participants, and it is not possible to make causal inferences between the variables studied. In addition, the generalization of results could be limited. On the one hand, although the healthcare system is similar in different territories, there may

be differences in the management of Primary Care centers depending on their geographical location. However, the opinion of users could be shared since the study variables are, for the most part, general and equivalent aspects between different healthcare systems.

CONCLUSIONS AND FUTURE DIRECTIONS

On the other hand, the measures taken in response to COVID-19 were not similar at the global level. Thus, the authors of this report propose three types of studies. Firstly, studies similar to this work that would allow us to further deepen our understanding of the users' view of the different variables studied in other contexts, for example, other countries. Secondly, quantitative studies, if possible longitudinal, that allow us to know in depth the relationship of the variables studied here with the aim of proposing explanatory models. Finally, we propose the design of violence prevention programs in primary care centers, taking into account the contributions of this type of studies together with the evidence available in the literature, as well as the evaluation of their results once implemented.

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 Research Ethics Committee of the University of Murcia (ID: 3555/2021). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

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The Moderating Role of Personal Resources Between Demands and Ill-Being of Romanian Healthcare Professionals in the COVID-19 Pandemic

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Background and Objectives: The illness caused by the new coronavirus (COVID-19) triggered considerable mental consequences for the medical staff. Our aim was to research whether frontline healthcare workers' positive psychological state—PsyCap—impacts the relationship between anxiety/depression and burnout/mental health complaints.

Material and Methods: One hundred twenty-six medical professionals working on the frontline at the Intensive Care Unit and Emergency Department in Romania took validated surveys between March and April 2020. All information was collected online after accessing a link that was received in an email message. The inclusion criteria concerned the categories of healthcare professionals who came into direct contact with patients during the COVID-19 global epidemic through the performed medical act, as well as time spent in the medical field of ICU an EM, namely at least 1 year in the department. We excluded from the research other categories of employees and auxiliary staff, as well as healthcare workers with <1-year experience in the medical field. The moderating role of personal resources (PsyCap) between demands (such as anxiety and depression) and ill-being (burnout and mental health complaints) of healthcare professionals were tested *via* hierarchical multiple regressions.

Results: We tested the moderating role of PsyCap on the relation between anxiety and ill-being. The results indicated that high anxiety predicts lower emotional exhaustion and a low level of mental health complaints about Romanian healthcare professionals when PsyCap is high. The moderating role of PsyCap on the relation between depression and ill-being was tested in the second hypothesis. The results indicated that high depression predicts lower inefficacy and a low level of mental health complaints about Romanian healthcare professionals when PsyCap is increased.

Conclusions: PsyCap is a crucial variable that may decrease the impact of anxiety and depression on psychological outcomes such as emotional exhaustion, inefficacy,

and psychological problems among Romanian medical professionals working on the frontline during the COVID-19 global epidemic. Thus, psychological interventions that help medical staff gain personal resources are appropriate in the context of the COVID-19 pandemic.

INTRODUCTION

COVID-19 has and will continue to have significant consequences on burnout for medical professionals. Moreover, the Intensive Care Unit medical professionals and emergency medical staff are frontline workers fighting against the COVID-19 global epidemic. They are the first ones to come into contact with any patients with symptoms of coronavirus infection. Thus, the epidemic of burnout may have worsened since the COVID-19 outbreak.

Burnout is a state of fatigue, both mental and physical, a person's reaction to long-term stress after facing emotional and interpersonal stress factors at the workplace (1). It is already recognized as an occupational hazard, manifesting through emotional depletion, depersonalization, and low personal achievement. Emotional depletion covers the experience of both mental and physical fatigue. It is linked to an individual's stressful situation, which is linked to a decrease in mental and physical resources. Depersonalization occurs when employees create a mental distance between themselves and their work by experiencing the dehumanization of coworkers, duties, or clients (2). Finally, personal achievement refers to feeling professionally inefficient, leading to the loss of productiveness (3). As one study shows, a relevant proportion of frontline healthcare staff, namely doctors and the nursing staff who worked with patients with COVID-19 reported increased levels of emotional depletion and different levels of depersonalization, and reduced personal accomplishment (4).

Based on the Job-Demands-Resources (JD-R) theory, the absence of organizational and personal abilities reduces the means to cope with high job demands, leading to burnout (5). According to the JD-R theory, both contextual factors such as work pressure, heavy workload, and personal conditions such as emotional, physical, and psychological demands, are equally strong predictors of engagement and job satisfaction. Thus, employees who count on many work-related and personal abilities have the means to cope better with work challenges and experience the feeling of well-being to a great extent (6). Moreover, the JD-R model, which focuses on employees' health and performance *via* burnout, can be applied perfectly

to the frontline medical staff in the battle with the pandemic. Hence, a positive psychological state such as PsyCap could aid in the already overwhelmed medical system where burnout is commonly met.

Anxiety, Burnout, and Mental Health

Studies during the COVID-19 pandemic demonstrated that frontline healthcare workers were experiencing higher levels of anxiety and depression. Anxiety refers to an unpleasant sense of fear characterized by uneasiness derived from anticipating danger, agitation, impatience, difficulty relaxing, trouble concentrating, restlessness, irritability, and difficulty falling asleep. While more and more persons suffer from COVID-19 in Romania, medical assets, including personal protective equipment (PPE), intensive care beds, medications, and ventilators, have at times been limited. Moreover, the fear of contamination, insecurity, and mental distress may predispose the medical staff to considerable emotional strain. As prior studies already reported, as medical clinicians were during SARS or Ebola outbreaks, frontline physicians, medical residents, nursing staff, and public health professionals during the COVID-19 global epidemic are very vulnerable to psychological problems (7). Thus, the sudden outbreak of the COVID-19 global epidemic could be viewed as a type of danger that may negatively affect mental health and produce high levels of anxiety, depression, and stress.

In addition, as one study uncovers, higher anxiety and burnout prevalence rates than previously published literature may be attributed to the COVID-19 pandemic (8). During this pandemic, frontline doctors and nurses must spend considerable time interacting with patients diagnosed with novel coronavirus infections. A recent cross-sectional study found that one factor that was strongly linked to anxiety in a multivariable linear regression was mental depletion (9). Anxiety interferes with physicians' functioning under stress and may long-term affect their well-being (10). Furthermore, since the coronavirus outbreak, frontline healthcare workers such as physicians and the nursing staff, must cope with significant physical and psychological fatigue while working in normal conditions (11), research suggesting that fatigue is not only triggered by the workload involving physical movement, but also by mental labor (12), anxiety being positively correlated with exhaustion (13). Many studies revealed the prevalence of anxiety signs or symptoms and mental fatigue among doctors, medical residents and nurses in the frontline of the battle with the novel coronavirus crisis (14).

Depression, Burnout, and Mental Health

The studies in this area pointed out that high emotional exhaustion is also correlated with greater mood disruption, such as depression (15). Depression refers to a sense of dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest or involvement, anhedonia, and inertia (16). As one study showed, since the beginning of the COVID-19 pandemic, medical professionals, namely physicians and the nursing staff, were found to show moderate to very severe levels of depression (17). Thus, during the Sars-Cov2 pandemic, the frontline medical staff may display high levels of work-related distress symptoms, such as mental depletion, anxiety, and depression that, in turn, may also expose the clinicians to several psychological problems (18). As healthcare professionals continue to do their duty on the frontline in this pandemic, it is essential to analyze mental and emotional resources in frontline physicians and nurses to decrease the impact of distress in combating the COVID-19 pandemic. However, an increasing number of healthcare professionals manage to transcend these challenges and achieve high professional fulfillment rather than just burnout mitigation (19). Therefore, analyzing the associated factors of the burnout experienced by frontline healthcare workers is essential to alleviate work-related stress symptoms and improve the well-being of frontline healthcare staff.

Psychological Capital as Moderator

As past studies have already shown, people with high mental strength are able to adapt to changing challenges and demonstrate psychological stability in the face of adversity (20). One definition of PsyCap could be "an individual's positive psychological state of development characterized by: (1) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (2) making a positive attribution (optimism) about succeeding now and in the future; (3) persevering toward goals, and when necessary, redirecting paths to goals (hope) in order to succeed; and (4) when beset by problems and adversity, sustaining and bouncing back and even beyond (resilience) to attain success." (21).

According to JD-R theory, PsyCap, as personal resource, plays a significant moderator role between job demands and the well-being of the employees. The JD-R theory highlights the role of personal resources in dealing with job demands. Thus, frontline healthcare workers who have high PsyCap will better cope with the increased demands from the workplace during the COVID-19 pandemic. In addition, when job resources are high, factors such as performance and level of well-being are improved. As other studies demonstrated, high levels of PsyCap help manage negative behaviors and emotions correlated with stressful work environments or life situations (22). For example, according to COR theory, PsyCap helps cope with adverse events at the workplace by allowing employees to adapt in the face of adverse events at the workplace by allowing employees to adapt in high job demands. Therefore, a high level of PsyCap moderates the impact of different demands on well-being (23).

As one study shows, high levels of self-efficacy correlate with low levels of burnout, depression, and stress in vascular surgery trainees, suggesting a complex relationship between stress, burnout, and self-efficacy (24). Very optimistic medical professionals are better equipped to cope with stress and show lower vulnerability to psychological risks and exhaustion (25). In the medical profession, resilience was described as an ability to adapt, an ability to develop psychological capital, inner growth, or a sort of endurance (26). Several studies have consistently found that high levels of resilience are correlated with low levels of emotional exhaustion (27). Furthermore, a healthcare professional with higher levels of hope will be able to distinguish and follow the way to success (28). The persons with high PsyCap show better resilience in front of stressful events, tend to be more optimistic, and therefore set plans and pathways to improve the situation (29). Moreover, prior literature showed that PsyCap triggers positive feelings which boost performance and job satisfaction (30).

According to this rationale, we can say that persons showing high PsyCap also show lower vulnerability to anxiety and depression, and therefore can show lower levels of emotional exhaustion, cynicism, inefficacy, and mental health complaints. Unfortunately, not very much is known about whether a factor such as PsyCap may alleviate an employee's assessment of and reaction to stress at the workplace. This is because most previous studies situated PsyCap as a mediator or as a predictor factor merely investigated PsyCap as a moderator factor.

Previous studies already uncovered that PsyCap may help individuals cope with burnout (31, 32). Thus, PsyCap may moderate the relationship of anxiety and burnout in frontline medical professionals during the COVID-19 global epidemic. However, high levels of anxiety may increase burnout in medical professionals by deteriorating their PsyCap. Therefore, interventions should be developed to enhance PsyCap, to reduce anxiety and emotional exhaustion in frontline doctors and nurses.

Scholars demonstrated the relationship of PsyCap and burnout (33), meaning that high mental strength is negatively related to mental fatigue. Thus, PsyCap is a crucial variable that has the potential to decrease healthcare workers' exhaustion and improve physical and mental well-being (34). Moreover, as one study showed, PsyCap is a state-like positive resource that can be changed (35), and the adoption of strategies can reinforce the PsyCap level, which, in turn, may increase the workers' satisfaction with their job and their performance at the workplace (36). As previous studies have already shown, PsyCap is a malleable resource and is open to development through interventions (37).

Hence, our study's contribution strives to understand the PsyCap as a moderator between anxiety, burnout and psychological problems, as well as between depression and burnout, respectively, psychological problems among medical professionals working on the frontline during the COVID-19 global epidemic (**Figure 1**). Accordingly, we stated the following assumptions:

Hypothesis 1: PsyCap moderates the relationship between frontline medical professionals' anxiety during the COVID-19 global epidemic and: (a) emotional exhaustion; (b) cynicism; (c) inefficacy; and (d) mental health complaints.

Hypothesis 2: PsyCap moderates the relationship between frontline medical staff's depression during the COVID-19 pandemic and: (a) emotional exhaustion; (b) cynicism; (c) inefficacy; and (d) mental health complaints.

PARTICIPANTS AND PROCEDURE

A cross-sectional study was conducted in the County Emergency Clinical Hospital Pius Brînzeu Timi?oara, Romania, during March and April 2020. The sample contains frontline medical professionals, emergency physicians, ICU physicians, and medical nurses from two Hospital Divisions (Emergency and ICU). The time to complete the survey was 2 months, with four reminders every 2 weeks. In this study, 200 frontline healthcare workers were recruited, and a pool of 126 health professionals (32 nurses and 94 physicians) constituted the study sample (response rate = 63%). Similarities were found between ICU and EM, regarding number of working hours per week, and night shifts per month, no holidays, similar schedule regarding the exposure to COVID-19 patients, similar compensations, guidelines, protocols, and training from the managerial team, access to psychological counseling, similarities in the distribution of the socio-demographic variables, such as gender, marital status, and a number of children.

The research meets the ethical guidelines of the Declaration of Helsinki. The Ethics Committee of the County Emergency Clinical Hospital, No. 170/05.08.2019, approved it as a stage of ongoing research on the exhaustion syndrome and the psychological consequences on the medical professions. All data were collected with a confidential nature, while all the participants expressed their willingness to voluntarily take part in the study and their informed consent in writing. Participants did not receive any incentives, and participation was voluntary.

The participants reported the demographic data, as follows: gender (35.7% male and 64.3% female), marital status (42.8% single, 52.3% married, and 4.7% divorced), children (55.5% yes, 44.4% no), profession (74.6% physician, 25.3% nurse), staff category-doctors (45.2% trainee, 15% specialist, 16.6% primary, 23% other), and specialty (36.5% ICU and 63.4% EM).

Before the beginning of the study, we organized a focus group with respondents from the Emergency and ICU Departments. Our research targeted two Hospital Divisions, working on the frontline battle against the Covid-19 crisis in Romania, Emergency Department and ICU. We communicated with the medical staff directly *via* their institutional emails. A written consent was sent via email and signed by each participant in the study. The frontline healthcare workers answered the questionnaires during their working hours *via* their institutional emails. Only completed questionnaires can be submitted and considered for the present study.

All information was collected online after accessing a link that was received in an email message. Therefore, there were no missing data or invalid responses in our study sample. The inclusion criteria concerned the categories of healthcare professionals who came into direct contact with patients during the COVID-19 global epidemic through the performed medical act, respectively, primary physicians, experts, trainees, ICU, and emergency medicine medical nurses. Another important

inclusion criteria is time spent in the medical field of ICU an EM, namely at least 1 year in the department. We excluded from the research other categories of employees and auxiliary staff, as well as healthcare workers with <1-year experience in the medical field.

The County Emergency Clinical Hospital Pius Brînzeu Timişoara, Romania, started receiving the critical patients infected with the new coronavirus by the end of March 2020, following the Romanian Ministry of Health Order number 533/03.29.2020 regarding the Plan of measures for hospitals' preparation in the face of COVID-19 global epidemic. As a result, by May 2020, there were 19,133 patients with COVID-19 in Romania, 98,403 people isolated, and 2993 people officially quarantined. Furthermore, the increase in demand and changes to supply, increase in donning and doffing PPE, redeployment of staff, the restructuring of hospital premises, more work duties, and the implementation of new guidelines and protocols put a heavy psychological pressure on the Romanian frontline medical professionals.

MATERIALS AND METHODS

The dimensions of anxiety and depression were assessed on the Depression, Anxiety, and Stress Scale (DASS-21). The Depression, Anxiety, and Stress Scale (DASS 21) is a reliable and suitable questionnaire to assess symptoms of common mental health problems. The essential function of this scale is to assess the severity of the core symptoms of depression, anxiety, and stress, thus it supports our research hypothesis. The DASS-21 is a self-report questionnaire and assesses the severity of the main symptoms of depression, anxiety, and stress. The scale is consisting of 21 items. In the current study, we used the anxiety and depression scale. Each variable has seven items on each subscale: depression (e.g., "It seems that I couldn't experience any positive feeling whatsoever."; the Cronbach's alpha for this scale on this sample was $\alpha = 0.88$), anxiety (e.g., "I was worried about the moments in which I might have a panic attack and look like a fool."; the Cronbach's alpha for this scale on this sample was $\alpha = 0.88$), and stress. Respondents were asked to evaluate the items on a Likert scale, from 0 (did not apply to me at all) to 3 (applied to me very much) (38).

Psychological Capital was measured with a 12-item Psychological Capital Questionnaire (39) adapted and validated for the Romanian population (40). Psychological Capital Questionnaire is a valid and reliable instrument to assess self-efficacy, hope, resilience, and optimism with good psychometric properties. This questionnaire includes four dimensions: self-efficacy (six items, $\alpha = 0.86$), hope (six items, $\alpha = 0.79$), resilience (six items; $\alpha = 0.81$), and optimism (six items, $\alpha = 0.88$). The items (e.g., "I'm always optimistic about my future."; "Failure just makes me try harder."; "I energetically pursue my goals."; "I enjoy dealing with new and unusual situations.") are rated on a 6-point Likert scale, ranging from "strongly disagree" (1 point) to "strongly agree" (6 points). Higher scores indicate higher levels of PsyCap. Cronbach's alpha value of the PsyCap scale on this sample was $\alpha = 0.89$.

The burnout dimensions were assessed based on the Maslach Burnout Inventory MBI-GS. This tool is a reliable and suitable

questionnaire to evaluate the three elements of the burnout syndrome: emotional exhaustion (EE), depersonalization (DP), and inefficacy (IN). Each element consists of 5 items: exhaustion (e.g., "I feel emotionally depleted from my work."; the Cronbach's alpha for this scale was $\alpha = 0.87$); cynicism (e.g., "I have become more cynical whether my work has any contribution."; the Cronbach's alpha for this scale was $\alpha = 0.80$); and inefficacy (e.g., "I do not deal effectively with people's problems."; the Cronbach's alpha for this scale was $\alpha = 0.78$). The items are evaluated on a seven-point scale from 0- "never" to 6- "always" (3).

Psychological problems were screened with the MHI-5 test. This scale consists of five items (e.g., "During the past month, have you felt calm and peaceful? How much of the time?"). The item assessment was performed using a 6-point Likert scale, from 1–"never" to 6– "always." A high score indicated poor mental health (41). Cronbach's alpha value of the mental health complaints scale on this sample was $\alpha = 0.85$.

DATA ANALYSIS

The moderating role of personal resources (PsyCap) between demands (such as anxiety or depression) and ill-being (burnout and mental health complaints) of healthcare professionals were tested via hierarchical multiple regressions (42). Anxiety or depression had acted as predictors and burnout and mental health complaints were outcomes. We tested the hypotheses with the help of hierarchical multiple regressions with PsyCap as a moderator. Then, we converted the predictors (anxiety and depression) and the moderator (PsyCap) in z-scores and calculated the interaction between predictor × moderator. First, we entered both types of variables in Step 1. After that, Step 2 introduced the predictor, the moderator, and their interaction term. In the first hypothesis (H1), we tested the potential moderating role of PsyCap, as a personal resource, on the relation of anxiety with ill-being. The moderating role of PsyCap on the relation of depression with ill-being was tested in the second hypothesis (H2). We have used the Statistical Package for Social Science (SPSS) v. 21.00 program (IBM Corp., Armonk, N.Y., USA) to test our hypothesis.

RESULTS

Means, standard deviations, and correlations for the study's variables are shown in **Table 1**. The data show a positive correlation between anxiety and emotional exhaustion ($r = 0.70$, $p < 0.001$), cynicism ($r = 0.74$, $p < 0.001$), inefficacy ($r = 0.68$, $p < 0.001$), and mental health complaints ($r = 0.75$, $p < 0.001$). We found positive correlation between depression and emotional exhaustion ($r = 0.71$, $p < 0.001$), cynicism ($r = 0.7$, $p < 0.001$), inefficacy ($r = 0.73$, $p < 0.001$), and mental health complaints ($r = 0.74$, $p < 0.001$).

After mean-centering all the independent variables, we tested eight separate regression models. The results of these moderator analyses are shown in **Tables 2**, **3**. In **Table 2**, in Step 1, anxiety positively predicted emotional exhaustion ($\beta = 0.69$, $p < 0.001$), cynicism ($\beta = 0.64$, $p < 0.001$), inefficacy ($\beta = 0.53$, $p < 0.001$), and mental health complaints ($\beta = 0.58$, $p < 0.001$). Also, PsyCap

predicted negatively emotional exhaustion ($\beta = -0.20$, $p < 0.001$), cynicism ($\beta = -0.19$, $p < 0.001$), inefficacy ($\beta = -0.27$, $p < 0.001$), and mental health complaints ($\beta = -0.30$, $p < 0.001$).

In Step 2, the interaction between PsyCap and anxiety is not significant for cynicism ($\beta = -0.02$, $p > 0.05$) and inefficacy ($\beta = -0.11$, $p > 0.05$), but is significant marginal for emotional exhaustion ($\beta = -0.12$, $p < 0.05$; $F_{(1,122)} = 3.74$, $p = 0.05$; $\Delta R^2 = 0.01$; 95% CI [0.00, 1.27]) and mental health complaints ($\beta = -0.19$, $p < 0.01$; $F_{(1,122)} = 9.51$, $p < 0.01$; $\Delta R^2 = 0.03$; 95% CI [0.31, 1.45]). As a strategy, for each significant relation, we generated the considerable interaction at ±1 SD from the PsyCap mean (43) and simply analyzed the slopes to determine what kind of interactions occurred (see **Figure 2**,).

The simple slope chart in **Figure 2** indicated that high anxiety significantly predicts lower emotional exhaustion about Romanian healthcare professionals when PsyCap is high ($b = 5.58$, $t = 50.53$, $p < 0.001$). Also, when healthcare professionals with a low PsyCap face severe anxiety, they experience severe emotional exhaustion ($b = 4.96$, $t = 11.90$, $p < 0.001$).

The simple slope chart in **Figure 3** indicated that high anxiety significantly predicts higher mental health complaints about Romanian healthcare professionals when PsyCap is low ($b = 3.72$, $t = 8.18$, $p < 0.001$). Also, if healthcare professionals with high PsyCap face severe anxiety, they experience fewer psychological problems ($b = 4.60$, $t = 4.99$, $p < 0.001$). Therefore, data also partially supported Hypothesis 1.

As evident in **Table 3**, in Step 1, depression positively predicted emotional exhaustion ($\beta = 0.72$, $p < 0.001$), cynicism ($\beta = 0.70$, $p < 0.001$), inefficacy ($\beta = 0.61$, $p < 0.001$), and mental health complaints ($\beta = 0.73$, $p < 0.001$). Also, PsyCap negatively predicted emotional exhaustion ($\beta = -0.15$, $p < 0.001$), inefficacy ($\beta = -0.19$, $p < 0.001$), and mental health complaints ($\beta = -0.18$, $p < 0.001$), but not cynicism ($\beta = -0.01$, ns.).

In Step 2, there is not significant interaction between PsyCap and depression for emotional exhaustion ($\beta = 0.007$, $p > 0.05$) and for cynicism ($\beta = -0.01$, $p > 0.05$), but is significant for inefficacy ($\beta = -0.14$, $p = 0.03$; $F_{(1,122)} = 4.66$, $p < 0.01$; $\Delta R^2 = 0.01$; 95% CI [-1.51, -0.06]) and mental health complaints ($\beta = 0.14$, $p < 0.01$; $F_{(1,122)} = 8.08$, $p < 0.01$; $\Delta R^2 = 0.02$; 95% CI [0.19, 1.09]). Also, for each significant relation, we generated the considerable interaction at ±1 SD from the PsyCap mean and simply analyzed the slopes to determine the what kind of interactions occurred.

The slope chart in **Figure 4** indicated that high depression significantly predicts lower inefficacy about Romanian healthcare professionals when PsyCap is increased ($b = 3.08$, $t = 28.16$, $p < 0.001$). Also, if healthcare professionals with low PsyCap face severe depression, they show considerable inefficacy ($b = 3.87$, $t = 8.65$, $p < 0.001$).

In **Figure 5**, the simple slope chart indicated that high depression significantly predicts higher mental health complaints about Romanian healthcare professionals when PsyCap is low ($b = 4.36$, $t = 9.49$, $p < 0.001$). Also, if healthcare professionals with high PsyCap face severe depression, they have fewer psychological problems ($b = 3.57$, $t = 32.58$, $p < 0.001$). Thus, Hypothesis 2 was also partially supported by the data.

TABLE 1 | Means (M), standard deviations (SD), and correlations between the variables ($N = 126$).

	Variables	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Anxiety	3.06	3.70	–								
(2)	Depression	4.00	4.16	0.86**	–							
(3)	Emotional exhaustion	7.41	6.64	0.70**	0.71**	–						
(4)	Cynicism	4.60	6.30	0.74**	0.77**	0.69**	–					
(5)	Inefficacy	4.40	6.82	0.68**	0.73**	0.71**	0.77**	–				
(6)	Mental health complaints	12.63	5.560	0.75**	0.74**	0.77**	0.64**	0.58**	–			
(7)	PsyCap	4.54	0.83	−0.53**	−0.58**	−0.57**	−0.53**	−0.55**	0.61**	–		
(8)	Age	34.86	9.68	−0.17*	−0.20*	−0.22**	−0.20*	0.27*	−0.19*	−0.27*	–	
(9)	Gender	–	–	0.22*	0.25*	0.27**	0.18*	0.12	0.33*	0.41**	−0.24*	–

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

TABLE 2 | Hierarchical multiple regression: The alleviating effect of PsyCap in the relationship between anxiety and outcomes (burnout and mental health complaints).

Steps	Predictors	Emotional exhaustion		Cynicism		Inefficacy		Mental health complaints	
1	Anxiety	0.69**	0.74**	0.64**	0.65**	0.53**	0.48**	0.58**	0.67**
	PsyCap	−0.20**	−0.22**	−0.19*	−0.19*	−0.27**	−0.25**	−0.30**	−0.33**
2	Anxiety × PsyCap		−0.12*		0.02		0.05		0.19*
	Total R^2	0.67	0.68	0.58	0.58	0.51	0.52	0.62	0.65
	Δ R^2		0.01		0.00		0.01		0.03
	Final F	128.61**	3.74*	85.32*	0.18	65.40**	2.44	101.29**	9.51*

*$p < 0.01$; **$p < 0.001$; $N = 126$.

TABLE 3 | Hierarchical multiple regression: The alleviating effect of PsyCap in the relationship between depression and outcomes (burnout and mental health complaints).

Steps	Predictors	Emotional exhaustion		Cynicism		Inefficacy		Mental health complaints	
1	Depression	0.72**	0.73**	0.70**	0.69**	0.61**	0.56**	0.73**	0.78**
	PsyCap	−0.15*	−0.15*	−0.12	−0.12	−0.19*	−0.18*	−0.18**	−0.20**
2	Depression × PsyCap		0.007		−0.01		−0.14*		0.14*
	Total R^2	0.68	0.68	0.61	0.61	0.56	0.57	0.73	0.75
	Δ R^2		0.00		0.00		0.01		0.02
	Final F	131.96**	0.01	96.71*	0.06	78.16**	4.66*	175.97**	8.08*

*$p < 0.01$; **$p < 0.001$; $N = 126$.

CONCLUSION AND DISCUSSION

Since the outbreak of the COVID-19 pandemic, frontline healthcare professionals have experienced unprecedented levels of work-related stress symptoms alongside other psychological implications. Therefore, it is of most importance to determine psychological actions focused on the mental health consequences of the COVID-19 global pandemic, as well as on the moderators of the correlation between anxiety and depression and burnout, respectively, mental health complaints. This study's contribution is to shift the attention on capital, namely PsyCap, rather than shortfalls or challenges when conducting the research on the frontline healthcare workers during the novel coronavirus pandemic. Our study shows PsyCap as a primary variable in decreasing the effect of anxiety and depression on burnout and mental health complaints. Our findings are congruent with prior studies that demonstrated PsyCap's

alleviating role in job-related circumstances (44). The purpose of our research was to determine whether the positive mental state of frontline healthcare workers—PsyCap—influences the correlation between anxiety/depression and burnout/mental health complaints. The results showed a partial concordance with our assumptions.

First, we noticed that a high level of anxiety significantly predicts lower emotional exhaustion when the level of PsyCap is high. Furthermore, when healthcare workers with a low PsyCap face severe anxiety, they experience severe emotional exhaustion. Previous studies have already shown that workers with high levels of PsyCap tend to have more confidence in mobilizing motivation and cognitive resources (45). Furthermore, faced with *uncertain situations*, healthcare workers with high PsyCap are more resilient, able to recover from problems, and follow the way to success (46). However, if frontline health staff is less optimistic, motivated, and resilient at work, they are more prone to

FIGURE 1 | PsyCap moderates the relationship between anxiety/depression and burnout, respectively, mental health complaints.

FIGURE 2 | Interaction effect of anxiety and PsyCap in predicting emotional exhaustion.

FIGURE 3 | Interaction effect of anxiety and PsyCap in predicting mental health complaints.

FIGURE 4 | Interaction effect of depression and PsyCap in predicting inefficacy.

FIGURE 5 | Interaction effect of depression and PsyCap in predicting mental health complaints.

experience emotional exhaustion when confronted with anxiety. Our results align with the JD-R theory (47), which suggests that inner abilities, namely hope, optimism, resilience, and self-efficacy, may alleviate the ways employees experience burnout.

Second, we observed that a high level of anxiety also predicts higher mental health complaints when PsyCap is low. Moreover, when frontline health professionals with high PsyCap face severe anxiety, they show fewer psychological problems. These results are relevant in the context of JD-R theory; a high level of PsyCap helps cope with anxiety and diminish the impact on mental health complaints. This theory indicates that individuals strive to accumulate and preserve resources (48), and therefore,
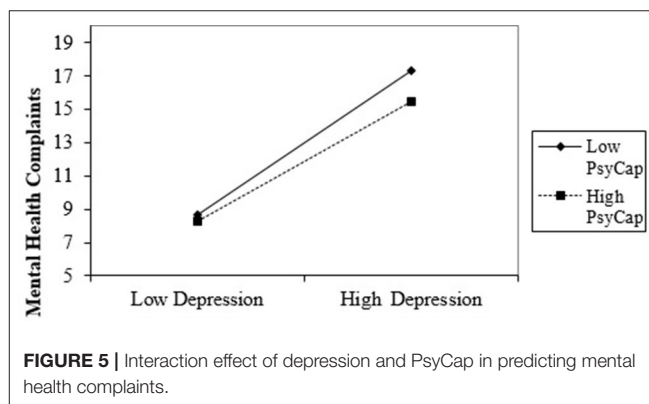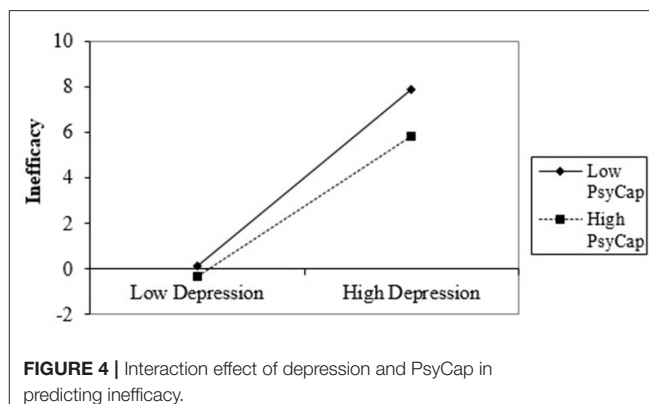
employees with high levels of PsyCap have confidence in their ability to cope with job challenges. Consequently, frontline healthcare workers who are resilient when experiencing stressful job demands show low mental health complaints.

Third, the results revealed that a high level of depression significantly predicts lower inefficacy when PsyCap is high. Furthermore, when frontline healthcare workers with a low PsyCap face severe depression, they become highly inefficient. This finding supports earlier research reporting that PsyCap is positively correlated with performance (49). Thus, PsyCap could play a decisive role in efficacy at work. Romanian frontline doctors and nurses with high levels of personal resources can handle challenges at the workplace, such as depression in the context of the COVID-19 pandemic, and, therefore, have control over their work environment and display efficacy.

Fourth, we found that a high level of depression significantly predicts higher mental health complaints when PsyCap is low. When frontline health staff with high PsyCap faces severe depression, they show fewer psychological problems. According to a meta-analysis already conducted, PsyCap is correlated with health as an element of well-being (50). These findings support previous studies that operationalized PsyCap as an alleviating variable correlated with other variables (51). In the context of JD-R theory, personal resources, such as PsyCap, have a vital role in connecting depression and psychological complaints.

The outbreak of COVID-19 caused considerable psychological implications for frontline healthcare workers. The medical population working on the frontline in the battle with the novel coronavirus displays a high prevalence of stress symptoms, anxiety, depression, which may predispose the clinicians to various other mental health problems. Our research revealed PsyCap as a significant variable in alleviating the impact of anxiety and depression on emotional exhaustion, inefficacy, and mental health complaints. These results are in line with previous empirical studies and conceptual models that supported PsyCap's alleviating role in supporting positive personal and organizational consequences (52).

Limitations

Our aim was to study the moderating role of PsyCap in the relationship between demands and ill-being; further research may contribute to better understanding ways in which the causality relationship regarding anxiety, depression, mental health complaints, burnout, and PsyCap may occur. There are several limits in our study. First, as it was designed as a cross-sectional study, it could not establish the relationship between variables. A further contribution could be obtained through future longitudinal research that could lead to better knowledge of causality between the variables. Second, the study variables were measured by a self-reported questionnaire, which could have had an impact on the results as a consequence of the common bias-variance method. Third, our sample size was too small, therefore, the results might not actually depict the entire situation in Romania. Moreover, further research could expand this topic and investigate the role of PsyCap on other frontline healthcare worker's personal and organizational implications. Further research with a larger sample of participants, such as a nation-wide study should be performed, in order for the results to be completely representative of the situation in Romania and obtain a complete picture of all the short- and long-term health implications on frontline healthcare workers, since the outbreak of COVID-19 crisis. Moreover, further research considering an analysis with structural equations may bring more clarity among the studied variables, if we want to test the mediator role of the PsyCap between demands and ill-being.

Practical Implications

Our results suggest that the significant psychological implications of the COVID-19 pandemic on the frontline healthcare workers, such as anxiety and depression, may have a reduced impact on other consequences, such as emotional exhaustion, inefficacy, and psychological problems based on medical professionals' personal resources, namely PsyCap. Furthermore, those abilities that seem to matter in the ill-being of the health system's staff are flexible. PsyCap can be changed and developed, hence viewed as a state-like variable (53). As one meta-analysis of controlled interventions highlighted, PsyCap allows changes through sessions, coaching programs, and drills at the workplace. PsyCap is the most suitable personal resource to be developed through such interventions (54).

Hence, psychological interventions that help health staff gain personal resources are appropriate during the COVID-19 global epidemic. Moreover, online sessions focused on increasing PsyCap employees have already proved effective before the pandemic (55). Thus, our research suggests that interventions that model PsyCap are appropriate for frontline healthcare workers during this pandemic. Thereby, interventions focused on increasing the PsyCap of frontline medical staff may prove effective in managing anxiety, depression, and work-related stress since the outbreak of COVID-19 global epidemic.

In conclusion, we consider that our research adds to the recent efforts to discover the role of PsyCap as a moderator in the correlation between anxiety/depression and burnout/psychological problems among health professionals working on the frontline since the outbreak of the COVID-19 global epidemic. Furthermore, these results encourage developing human resource management practices, such as programs to increase PsyCap's performance and health for frontline healthcare workers.

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 the County Emergency Clinical Hospital, No. 170/05.08.2019. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

IS, DV, and LB: conceptualization and resources. IS, ZC, and DV: methodology. DV: software. IS, ZC, DV, and TB: validation. IS, DV, TB, and LB: formal analysis. IS and DV: investigation, writing—original draft preparation, data curation and project administration. IS, DV, and TB: writing—review and editing. IS, ZC, DV, TB, and LB: visualization. TB: supervision. All authors have read and agreed to the published version of the manuscript.

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Causes of Hospital Violence, Characteristics of Perpetrators, and Prevention and Control Measures: A Case Analysis of 341 Serious Hospital Violence Incidents in China

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Objective: Hospital violence remains a global public health problem. This study aims to analyze serious hospital violence causes in China and the characteristics of perpetrators. It likewise seeks to understand frontline personnel's needs and put forward targeted suggestions.

Methods: Serious hospital violence cases from 2011 to 2020 in the China Judgment Online System (CJOS) were selected for descriptive statistical analysis. A total of 72 doctors, nurses, hospital managers, and security personnel from 20 secondary and tertiary hospitals in China were selected for semi-structured interviews.

Results: Of the incidents, 62.17% were caused by patients' deaths and dissatisfaction with their treatment results. Moreover, it was found that out-of-hospital disputes (11.14%) were also one of the main reasons for serious hospital violence. The perpetrators were mainly males (80.3%), and had attained junior high school education or lower (86.5%). Furthermore, most of them were family members of the patients (76.1%). Healthcare workers urgently hope that relevant parties will take new measures in terms of legislation, security, and dispute handling capacity.

Conclusion: In the past 10 years, serious hospital violence's frequency in China has remained high. Furthermore, their harmful consequences are more serious. The causes of hospital violence are diverse, and the characteristics of perpetrators are obvious. Frontline healthcare workers urgently need relevant parties to take effective measures in terms of legislation, security, and dispute handling capacity, to prevent the occurrence of violence and protect medical personnel's safety.

Keywords: hospital violence, healthcare workers, perpetrators, prevention and control measures, China, characteristics and measures

INTRODUCTION

Hospital violence can be defined as an incident in which healthcare workers or providers are abused, threatened, or attacked in connection with their work (1). It involves an explicit or implicit threat healthcare workers' safety, well-being, or health (1). Hospital violence exists in many countries in the world. As such, it is still a global public health problem (2). According to the World Health Organization (WHO), about 8–38% of healthcare workers suffered from physical violence at work in 2019 (3). This figure is even higher in Asia (4). This is why workplace violence in China's hospitals has been the focus of many previous studies. Since 2020, the killing of doctors in the emergency department of Beijing Civil Aviation General Hospital (5, 6) and the explosion of the First Affiliated Hospital of Zhejiang University (7) have pushed the vicious violence problem to the forefront of public opinion in China.

There have been many previous studies on hospital violence. A nationwide survey of healthcare workers in China showed that hospital violence incidence was at 65.8%. Verbal violence accounted for 64.9% of the total hospital violence cases, while physical violence and sexual harassment accounted for 11.8 and 3.9%, respectively (8). Workplace violence incidence among healthcare workers in children's hospitals in China is more serious than that in general hospitals. A total of 68.6% of healthcare workers in children's hospitals in China have experienced at least one hospital violence incident (9). Patient factors such as emotional control ability, mental state, education level, and gender may be risk factors for hospital violence. Similarly, medical factors such as work experience, service system efficiency, and healthcare workers' poor communication abilities may be risk factors as well (10–12). Hospital violence's continuous occurrence has had a serious negative impact on healthcare workers' physical and mental health. This resulted in some healthcare workers having negative emotions such as anxiety (13–15), depression (16, 17), job burnout (18), and job dissatisfaction (18). Furthermore, it even directly or indirectly caused medical personnel to have suicidal tendencies. Hospital violence also seriously affects the doctor–patient relationship and makes doctors practice defensive medical behavior. This reduces the quality of health services and makes the trust between doctors and patients extremely fragile. Therefore, the contradiction between doctors and patients is further deepened (19–22). In the long run, hospital violence is bound to have a far-reaching negative impact on China's medical and health system.

In the past few years, the Chinese government has recognized hospital violence's negative impact on China's doctor–patient relationship and the development of China's health cause. Relevant laws were promulgated and a series of measures were taken, but hospital violence still occurs frequently. Thus, it still poses a serious threat to healthcare workers' physical and mental health and their order of diagnosis and treatment in the hospital. This phenomenon further increases the estrangement between doctors and patients, worsening the already fragile doctor–patient relationship (23). It has become the common expectation of all sectors of society to take more targeted measures in effectively preventing and controlling hospital violence.

There have been relatively few previous studies on actual cases of serious hospital violence. The data from these studies came from network reports. Thus, the accuracy and comprehensiveness of the information were poor, making it difficult to reflect the real situation of serious hospital violence in China. The present study will use Chinese court judgments as research data. It will extract real and accurate information related to hospital violence systematically, and comprehensively analyze the factors inducing hospital violence, and explore perpetrators' characteristics. This will provide a basis for relevant parties to aid in preventing and controlling the occurrence of hospital violence. At the same time, based on the analysis of inducing factors and relevant characteristics, this study will select medical personnel and managers of hospitals at all levels for in-depth interviews. This will help us understand frontline personnel's urgent needs regarding the prevention and control of hospital violence. This, in turn, will lead to more targeted and effective prevention and control measures.

METHODS

Sample and Data Collection

This study's qualitative data comes from the judgment documents published in the China Judgment Online System (CJOS), which is operated and maintained by the Supreme People's Court of China. The case judgments of all courts in China's 31 provinces can be retrieved from this website (except for special cases involving national security, juvenile delinquency, and criminal crimes, or cases people's courts should not publish on the Internet). We used January 1, 2011 to December 31, 2020 as the search dates to study the occurrence of serious hospital violence in China. We used keywords such as "hospital," "violence," "hospital violence," "medical dispute," "hospital order," "violent injury doctor," "doctor," "nurse," and "healthcare workers" for single keyword retrieval or combined keyword retrieval. We were able to retrieve 63,262 judgments from our searches. Four graduate students carefully read and screened these judgments, and we excluded repeated cases and those that had nothing to do with hospital violence. For judgments with missing relevant information, we searched the relevant information of the events on Baidu news, Weibo, Netease News, Tencent News, Sina News, and other Internet platforms according to the events' time, place, and other information. The events' missing information were supplemented through a mutual confirmation of news information from multiple websites. After excluding irrelevant judgments, we were left with 341 judgments which involved a total of 873 violent criminals.

Based on the above data, we conducted expert consultation and subject group discussion, and determined the outline of a semi-structured interview. The outline consisted of two parts: basic information and open-ended questions. Basic information included five questions regarding gender, age, education, occupation, and hospital level of the interviewees. There were two open-ended questions (**Appendix 1**). Using this interview outline, we conducted semi-structured interviews with convenient sampling of 72 doctors, nurses, hospital

managers, and security personnel from 20 secondary and tertiary hospitals in China from March 2021 to June 2021. This study sample was chosen as they have a deeper understanding of hospital violence and more experience in preventing such incidents. To avoid bias in the interview results due to different levels of hospitals, our survey included secondary and tertiary hospitals. To a certain extent, Beijing and Heilongjiang Province can represent the current situation of China's economically developed and underdeveloped provinces, respectively. Therefore, we selected medical personnel in medical institutions in these two provinces to ensure that interviews reflect frontline medical personnel's actual need to prevent and control hospital violence. Furthermore, interviews help put forward targeted and effective countermeasures to prevent and control hospital violence.

The researchers explained the study's purpose to the respondents and obtained their informed consent before the interview. The researchers conducted face-to-face interviews in an independent place, with Chinese as the interview language. The entire interview process was recorded. The interview began with an open-ended question: "Can you describe a violent incident in the hospital workplace that impacted you most." The follow-up question was "Based on your personal experience, what measures must be taken to effectively prevent and control such incidents?" Each interview lasted 32–71 min and was conducted during the respondents' free time. A HKUST iFLYTEK Voice Recorder was used to record each interview. HKUST iFLYTEK voice recorder is an intelligent recording device, which can automatically identify the use scene, reduce noise, and safely store the recorded content in the cloud. The respondents' real names were replaced by pseudonyms to ensure their anonymity. After the interview, the recordings were transcribed verbatim.

Variable Coding and Data Analysis

After the screening of judgments, five researchers carefully read 50 judgments and selected relevant characteristic variables of hospital violence. They then conducted group discussions according to their selection results to determine the variables' standard names, types, and specific codes. A total of 18 characteristic variables related to violence were identified. The research team divided these variables into two categories: serious hospital violence incidents and perpetrators. Nine basic information variables (hospital level, department, cause, means of implementation, category of victim, and consequences of violence) were identified regarding serious hospital violence incidents. Similarly, nine characteristic variables (gender, age, education, occupation, criminal record, history of violent crime, mental state, and relationship with patients) were identified for the perpetrators. The five researchers then read 341 judgments in detail according to the selected variables and picked the variable information. The researchers conducted descriptive statistical analysis on the characteristics of hospital violence. All statistical analyses were performed using SPSS 25.0 and Microsoft Excel 2019.

Content analysis is a research method that subjectively explains text data's content through the systematic classification process of coding and identifying topics or patterns. It is used to analyze open problem data (24). In this study, two social medicine doctoral students with qualitative research experience independently coded the data using hybrid inductive and deductive coding methods (24). The inconsistency between the students' codes was solved through a panel discussion to complete the interview materials' coding. The coding of interview data was carried out using the NVivo 12 software.

RESULTS

Basic Information on Severe Hospital Violence

From 2011 to 2020, Chinese courts ruled on a total of 341 hospital violence incidents. China's serious hospital violence showed a trend of first increase and then decrease in the past 10 years (**Figure 1**). Most of these hospital violence incidents occurred in secondary hospitals (54.3%), outpatient departments (47.8%), and emergency departments (25.2%). Doctors and nurses experienced the highest hospital violence frequency. Most perpetrators commit violence by physically assaulting others, laying wreaths, blocking doors, burning papers, placed the corpse, and pulling banners, among others. The largest number of incidents resulted in hospital property losses, disorders, and minor injuries to medical personnel.

Causes of Hospital Violence

The results showed that the main causes of hospital violence were patients' death (50.44%), dissatisfaction with the treatment effect (11.73%), out-of-hospital disputes (11.14%), and dissatisfaction with the arrangement of healthcare workers (7.04%). In contrast, waiting time and medical expenses were only secondary factors (**Figure 2**).

Note: A: Patient died; B: Dissatisfied with the effect of treatment; C: Out-of-hospital disputes; D: Dissatisfied with healthcare workers arrangements; E: The patient's unreasonable request was rejected; F: Medical Dispute; G: Attitudes of medical staff; H: other; I: waiting time; J: Medical expenses.

Characteristics of Perpetrators

Through an analysis of the perpetrators' characteristics, the researchers found that a vast majority of the 873 perpetrators were men (80.3%), under the age of 40 (58.0%), had attained junior middle school education or below (86.5%), and were farmers or unemployed (85.2%). Seventy-two people had criminal records, of which 45 had a history of violent crimes. The main perpetrators were patients' family members (76.1%) (**Table 1**).

Hospital Violence Prevention and Control Measures

A total of 72 people were interviewed, 33 from secondary hospitals and 39 from tertiary hospitals. Most of them were over 35 years old (55.55%) and had a Bachelor's degree (54.17%). Particularly, there were 16 doctors, 22 nurses, 24 managers, and 10 security guards. The interview results show
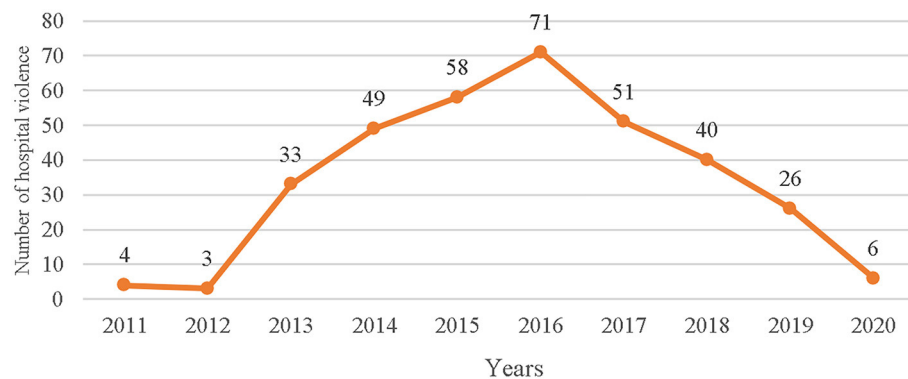
FIGURE 1 | The frequency of serious workplace violence (WPV) between 2011 and 2020.
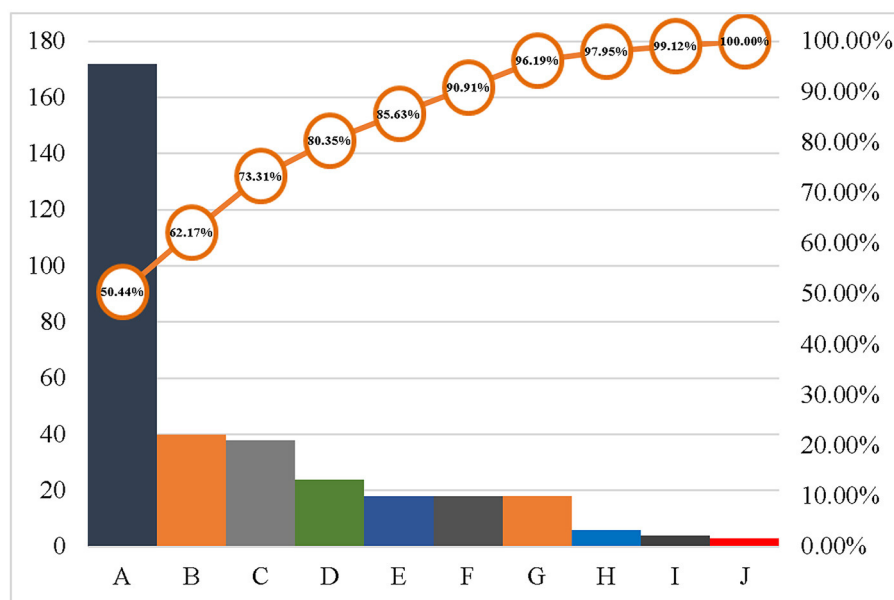
FIGURE 2 | Causes of hospital violence.

that frontline medical personnel believe that hospital violence's effective prevention and control at this stage should be carried out from three different aspects. First, the state should make a special legislation to increase the punishment and cost of malignant and violent medical injuries. At the same time, there must be publicity and education for ordinary people to improve their health and legal literacy. Second, hospitals should constantly improve their doctors' diagnoses, treatment, and security ability. Moreover, they must improve their medical dispute-handling team's abilities and that of their dispute-handling personnel. Third, hospitals should train their medical personnel in doctor–patient communication, risk identification abilities, and knowledge and skills. Healthcare workers should also take the initiative to improve their skills to further avoid the occurrence of hospital violence (**Table 2**).

DISCUSSION

The characteristics of hospital violence events found in this study are consistent with those of previous studies. Most of these cases occurred in secondary hospitals, outpatient departments, and emergency departments (25, 26). Moreover, most perpetrators committed violence by placing wreaths, blocking doors, burning papers, placed the corpse, and physically assaulting others (26, 27). Doctors and nurses experienced the highest frequency of violence (28, 29). The incidents' consequences were mainly minor injuries, property damage, and disorderly disturbances (30, 31). This study will focus on the causes of hospital violence and the characteristics of the perpetrators. It will likewise explore possible hospital violence prevention and control measures to alleviate hospital violence in the future, and provide reference and advice

TABLE 1 | Characteristics of perpetrators.

Variables	Total	
	n	Percentage (%)
Gender		
Male	701	80.3
Female	172	19.7
Age		
≤20	20	2.3
21–40	486	55.7
41–60	326	37.3
≥61	41	4.7
Education level		
Illiteracy	59	6.8
Primary school	393	45.0
Junior high school	303	34.7
High school	102	11.7
≥College degree	16	1.8
Occupation		
Unemployed	246	28.2
Farmer	410	47.0
Individual	18	2.1
Civil servants	13	1.5
Business owners	9	1.0
Retire	9	1.0
Worker	134	15.3
Enterprise employee	22	2.5
Freelancer	7	0.8
Other	5	0.6
Criminal history		
Yes	72	8.2
No	801	91.8
History of violent crime		
Yes	45	5.2
No	828	94.8
Mental state at the time of violence		
Sober	810	92.8
Drunk	56	6.4
Mental disorder	7	0.8
Relationship with patients		
Patient	82	9.4
Relatives of patients	664	76.1
Patient friend	8	0.9
Persons who have disputes with patients	100	11.5
Patient's hometown	19	2.2

for governments and policy-making bodies involved in creating such measures.

Analysis of the Causes of Hospital Violence

Through an analysis of the causes of violence, we found that patients' deaths and dissatisfaction with treatment effects were the main causes of serious hospital violence. This may be caused by patients' or their families' high expectations regarding the effects of diagnosis and treatment (23, 32). Patients often choose hospitals with a good environment and a high expectation regarding treatment effects. Once the treatment effect is poor, the high expectation brought about by the good environment before the treatment and the low perceived value of patients after the treatment will lead to lower patient satisfaction. This will result in the occurrence of hospital violence (33). However, we should also clearly realize that patients' deaths and poor treatment effects may likewise be caused by medical accidents or errors. It is difficult for patients or their families to accept the damage caused to patients. This too, can easily cause hospital violence.

We also found another main reason for serious hospital violence that has never been mentioned in previous studies: out-of-hospital disputes. The results show that out-of-hospital disputes ranked third among serious hospital violence's main causes. Out-of-hospital disputes refer to disputes between patients and third-party personnel (i.e., non-medical personnel) before admission. Such a dispute may have caused damage to the patient's physical and mental health and may have led to the patient's admission. After the patient is admitted to the hospital, the altercation between the two parties is likely transferred to the hospital or healthcare workers, if it is not reasonably resolved. Thus, the hospital becomes a place for patients to take out their negative emotions. Moreover, such emotions are likely vented out on medical personnel. Hospital managers and healthcare workers should always be vigilant during such cases to avoid the transfer and evolution of contradictions.

Dissatisfaction with healthcare workers' arrangements and the failure to meet patients' unreasonable requirements are also main reasons for the occurrence of hospital violence. In the process of seeing a doctor, patients sometimes refuse to listen to healthcare workers' arrangements or put forward unreasonable requirements due to their own needs. Rejection of unreasonable requirements and environmental factors such as long waiting times, increase the likelihood of patients to engage in violent actions to hurt healthcare workers to express their dissatisfaction.

Medical disputes are doctor–patient contradictions caused by patients' disagreement with the diagnosis and treatment process or results. When the doctors and patients have inconsistent negotiations on the disputes, patients may often recourse to violence to express their dissatisfaction with the entire healthcare system, or with specific doctors (32). Moreover, due to the influence of some media on doctors' "stigmatization" and previous violent medical incidents' success, patients or their families tend to imitate others in committing violence to achieve their own goals.

Dissatisfaction with healthcare workers' attitudes is also a main cause of hospital violence. Healthcare workers' attitude problems is in the final analysis of communication problems between doctors and patients. At present, the government and hospitals are carrying out only a few doctor–patient communication trainings for healthcare workers. Moreover, there is a lack of human resources, resulting in the heavy medical tasks undertaken by medical personnel every day. As such, there is a lack of opportunity and sufficient time to receive relevant training. This may result in healthcare workers' insufficient

TABLE 2 | Interview analysis on prevention and control measures of hospital violence.

Theme	Subtopics	Quotes (e.g.)
Strengthening legal construction	Special legislation	"At present, there is no special law to punish the acts of wounding and killing doctors, which makes our safety not guaranteed by law. Moreover, the hospital is a public place, and the existing law does not define the hospital as a public place. Therefore, I think the existing law is not enough for the prevention and control of hospital violence."
	Punishment intensity	"The existing laws have relatively little punishment for the perpetrators of violence. The noisy behavior of some personnel in the hospital and the injury behavior of medical personnel cannot be punished. As a result, people follow this behavior one after the other without fear."
Increased security	Number of security personnel	"I think the number of security personnel in our hospital is too small. As a result, the security personnel in some departments cannot arrive at the place of the incident in time and cannot effectively stop the occurrence of violence in time."
	Quality and stability of security team	"At present, the security personnel of the hospital cooperates with the security company. The security personnel is not employed by the hospital. The salary of the security personnel is low, resulting in their greater mobility. Moreover, most of the security personnel are over 55 years old, and they are older, so they cannot play a deterrent role to the vicious violent medical criminals."
	Security equipment	"We hope that the government can provide us with some equipment to prevent hospital violence. These include installing one-button alarm devices, installing high-quality monitoring equipment, and providing anti-riot tools for security personnel. The shortage of existing hardware leads to the hospital's inability to deal with malignant violent medical incidents."
Improve the ability of medical personnel to prevent risks	communication skills	"The communication ability of medical personnel is very important for the good or bad doctor–patient relationship. As long as the communication ability of medical personnel is strong, they can also appease the perpetrators who may have violent medical injuries and avoid the occurrence of violent medical injuries. A good doctor should not only have superb medical skills, but also have superb doctor–patient communication skills."
	Risk identification ability	"Through my daily observation, I found that healthcare workers who often work long hours suffer less hospital violence, because they can find some signs and signs of violence from patients or their families,. They can likewise resolve this risk according to their own work experience. This is a skill worth learning by every healthcare worker."
	Personal technical level	"We recognize that the causes of violence are both patient factors and medical factors. Sometimes, due to the limited technical level of medical personnel, the patient's condition worsens, causing damage to the patient to a certain extent, which will lead to the violence of the patient or the patient's family members."
Improve the procedure and environment	Hospital environment	"China has a large population, resulting in a large number of patients in Chinese hospitals. However, they only have a few healthcare workers, resulting in an imbalance of the proportion of doctors and patients. Our hospital is an old hospital area with a narrow space. The patients treated every day have been crowded, and there is not even a temporary rest place. It is difficult to keep up with all aspects of hardware facilities, which will lead to dissatisfaction with the hospital before meeting the doctor."
	Hospital treatment process	"When many patients or their family members come to the hospital for treatment, because they are not familiar with the treatment process of the hospital, they repeatedly run around and fail to complete registration, treatment, payment, medicine collection and other matters, which is easy to cause patients' dissatisfaction with the hospital or healthcare workers, resulting in violent medical injuries."
Improve the hospital's dispute resolution capacity	Dispute settlement system	"Some hospitals do not have a complete set of standardized guidelines for dispute handling, so there are no rules to follow in dealing with medical disputes, which is chaotic. The handling scales of disputes are different, which is very easy to further worsen the contradiction between doctors and patients."
	Dispute-handling ability	"The ability of dispute-handling personnel is very important for the settlement of disputes. Some people can solve the events smoothly, while others can't. In addition, the professional composition of the members of the dispute-handling team is also very important, especially in law, psychology, and clinic. Only when all majors understand it can it be conducive to the resolution of the incident."
Strengthen publicity and education for the general public	Publicity and education	"Many patients or their families believe that when they come to the hospital for diagnosis and treatment, the doctor must cure the patient's disease and the patient will not deteriorate. However, this situation is obviously due to the lack of medical knowledge of patients or their families, and the expectation of diagnosis and treatment results is unreasonable. Therefore, it is necessary for the government, hospitals, and even medical personnel to strengthen health education for patients and their families, to make their expectations return to a reasonable range."

humanistic care for patients and lack of empathy. This will further lead to poor effects of doctor–patient communication. When the patient believes that healthcare workers have a poor attitude toward them, hospital violence may occur (23). Research has proven that strengthening humanistic medical education and improving healthcare workers' humanistic medical literacy can effectively promote trust between doctors and patients. This will likewise reduce the conflict between doctors and patients (34).

Long waiting times and high medical expenses have always been important reasons behind violence committed by patients. However, we believe that the hospital violence caused by long waiting times and high medical expenses will gradually decrease with the increasing investment of the Chinese government in the health sector and the continuous improvement of the medical insurance system and the hierarchical diagnosis and treatment system.

Analysis of the Characteristics of Perpetrators

Through a study of the relevant characteristics of 873 perpetrators, it was found that most of the perpetrators were male, 21–40 years old, with junior high school level education or below, and were farmers or unemployed. This finding consistent with previous research results (35, 36). Patients or their families with such characteristics have a low level of overall health literacy and often have high expectations from medical procedures or treatment results. They are more inclined to take extreme violence to vent their negative emotions and exert pressure on the hospital when their expectations or requirements are not met. Furthermore, according to the neutralization theory, "the attraction of higher loyalty obligation is one of the factors that neutralizes internal control and external control and makes the offender embark on the road of misconduct. The perpetrators claim that their actions are in line with the moral obligations of their group, leading to the ineffectiveness of internal control (i.e., self-factors restraining criminal acts) and external control (i.e., social factors restraining criminal acts)" (37). Therefore, people with low educational backgrounds and poor cognitive levels may have a higher sense of identity for group behavior. Similarly, they are more likely to be coerced by the group to resort to violent injury behavior.

The results show that some perpetrators have criminal records and a history of violent crimes. Based on previous studies, it is generally believed that a history of violent crimes is the main factor in predicting patients' or their families' hospital behavior (38–40). Therefore, medical personnel should pay attention to personnel with such characteristics in the process of preventing and controlling hospital violence. However, because the police system is not connected to the hospital system, it is difficult for healthcare workers to judge whether the patient or their family has a criminal record.

The study also found that drunkenness or mental disorders may also be characteristics of violent perpetrators in hospitals. This is consistent with previous research results (36, 40). When patients or their families are not satisfied with the work of healthcare workers or the hospital's diagnosis and treatment process, those in a state of drunkenness or having mental disorders are more impulsive and difficult to control. This results to their violent acts toward healthcare workers.

We also found that most perpetrators were patients' relatives, further confirming previous research (26). We believe that this is caused by a lack of empathy of patients' relatives toward the doctor. Such an inducement lies in their in-group identity. As a social primate, it is instinctual for a man to rely on his group for survival. Under the control of this instinct, people stay close to their group, and trust those in the same group to help and protect each other. However, there is relative indifference to other groups they do not belong to. Moreover, they may be hostile toward individuals or groups that infringe on the interests of their own group. In cases of hospital violence, patients' relatives often consider healthcare workers as parties infringing on their group interests just because their expectations are not fully met. As such, they do not empathize with these healthcare workers and even resort to perpetrating violent injury against them. Healthcare workers also have the same problem. The lack of empathy among healthcare workers leads them to ignore the demands of patients. This results in the creation and escalation of doctor–patient contradictions, leading to further occurrences of hospital violence.

Analysis of Hospital Violence Prevention and Control Measures

The harm caused by hospital violence to hospitals, healthcare workers, and the national health system cannot be ignored. All concerned parties should continue to pay attention to this problem and take active measures to curb the occurrence of violent medical injuries. This study puts forward the following specific measures based on the analysis of the characteristics of serious hospital violence incidents, in-depth interviews with frontline health workers and managers, and the actual situation of hospital violence prevention and control in China. These measures will help provide a reference for the effective prevention and control of hospital violence.

Develop a Hospital Workplace Violence Risk Reporting System

Davide Ferorelli evaluated the incident reporting system for clinical risk management and found that the system can effectively reduce litigation between doctors and patients (41). At the same time, the scholar also proposed corresponding clinical risk management methods to measure the risk of psychiatric violence (42). Hospital violence also requires clinical risk management. The occurrence of such incidents is not without warning. There must be some omens and signs before the incident. Hospital managers and researchers should develop and improve the risk reporting system of hospital violence by summarizing the causes and precursors of hospital violence in the future. The corresponding risk prevention tools help to timely identify the risk of violent incidents and take targeted preventive measures to avoid such incidents.

Continuing to Reform the Medical and Health System and Increasing Investments in the Health Sector

The occurrence of hospital violence partly reflects the disadvantages of China's medical and health systems. For example, inadequate health system investments result in insufficient training costs for medical personnel. Moreover, it becomes difficult to pay expensive remuneration for their services. This leads to medical malpractice, corruption, poor communication between doctors and patients, and hospital violence (43). Therefore, the government should increase investments in the health sector and improve the quality of medical services. Through systematic reform, the government and hospitals can ease the dispute between doctors and patients and reduce the occurrence of hospital violence (27).

Improving the Legal System Construction Against Hospital Violence

The law is an effective means of regulating violence. Although China has successively issued relevant laws and regulations for dealing with hospital violence (6), the punishment for perpetrators is light, and the effect of deterring criminals from committing crimes is limited. Thus, using the other countries' experience as a basis, China should make special legislations on hospital violence. They must also distinguish the punishment for hospital violence from those for other forms of general violence and impose stricter punishments. This will help China achieve the purpose of warning and regulation.

Strengthening the Publicity and Education of the General Public's Concept of the Health and Legal System

The gradual enhancement of patients' awareness of their rights and improving their understanding of medical services' particularity will exacerbate the conflict between doctors and patients. The state should pay attention to the popularization and education of people's basic health and medical knowledge through media publicity and community education. Through this, patients will have a clearer and reasonable understanding of their diseases and will be able to more easily accept the adverse effects of such diseases (44). At the same time, legal education for the masses should be strengthened to reduce their criminal motives.

Strengthening the Security Force of the Hospital

Security guards are an important force for maintaining law and order in the hospital. However, Chinese hospitals' security are generally weak. Security personnel's characteristics such as old age, poor treatment, and high mobility result in their ineffective response to security threats. They may even choose to escape when violence occurs in the hospital. Therefore, a younger security team and improvements in security personnel's treatment and overall quality are crucial for Chinese hospitals to prevent and control workplace violence. At the same time, using digital information in response to security forces' deficiencies is also an effective measure that the hospital can adopt during instances of hospital violence. Strengthening hospital security capacity is crucial in preventing the occurrence of violence after effectively identifying their characteristics.

Improving the Dispute-Handling System and the Dispute-Handling Ability of Personnel

Personnel's personal ability in dispute handling, the hospital dispute-handling team's abilities, and the national medical dispute-handling system's establishment and improvement are crucial to avoid the occurrence of hospital violence (27). The improvement of the dispute-handling system and personnel's dispute-handling abilities can effectively prevent the occurrence of violent medical injuries caused by the failure of doctor–patient negotiations on controversial issues.

Improving the Hospital Treatment Process and Environment

Patients' awareness of their rights is being gradually strengthened and their requirements for medical experience are increasing with society's development. The hospital treatment environment and the treatment process' complexity directly affect the patients' intuitive feelings toward hospitals. Previous studies have shown that improvements in the hospital environment, such as setting clear department instruction signs, creating a clean and comfortable environment, and implementing a convenient medical treatment process can improve patients' medical experience. These will improve patient satisfaction and reduce the likelihood of disputes (40). Therefore, in the process of hospital management, hospital managers should constantly optimize the hospital's diagnosis and treatment process and create a harmonious and orderly treatment environment. They must likewise avoid affecting patients' medical experience and healthcare personnel's working mood brought about by the complexity and noise of the diagnosis and treatment process, which can result in hospital violence.

Improving the Self-Protection Awareness and Ability of Healthcare Workers

Training can effectively prevent hospital violence occurrence (45). Hospitals should provide various forms of training to healthcare workers. These include training and lectures to improve medical personnel's doctor–patient communication abilities, hospital violence risk identification and response abilities, and medical technology levels. At the same time, emergency drills should be actively carried out to prevent and control hospital violence. This will improve medical personnel's prevention and control awareness. Medical personnel should also actively study hard, participate in trainings, and apply the learned skills to practice. They can effectively protect themselves from violence by identifying the risk of violence according to the characteristics of violent events and perpetrators, taking the initiative to avoid danger, and taking preventive measures.

LIMITATIONS

This study had three limitations. First, Due to the delay in court judgment, some violent medical incidents that have occurred have still not been judged by the court. Thus, they were not included in the scope of the study. Second, the occurrence of serious violent medical trauma may be a result of a joint action of multiple factors. The variables involved in this study were limited. As such, some confounding factors were not considered. Therefore, further studies are required in the future. Third, the selected interviewees included only the hospitals' relevant personnel. In the future, government personnel and university researchers should be included in the research to achieve more comprehensive and systematic prevention and control measures. Lastly, convenience sampling is not suitable for general inference.

CONCLUSIONS

The frequency of serious hospital violence events in China is still high. Hospital violence is mostly caused by patient death, dissatisfaction with treatment, and out-of-hospital disputes. These disputes are closely related to the gender, age, education, occupation, and other characteristics of the perpetrator. All concerned parties should take new measures from the aspects of legislation, security, dispute-handling systems, and capacity building to prevent and control the occurrence of hospital violence. Medical personnel should also improve their protection awareness and risk prevention ability. Furthermore, they must take advanced preventive and control measures according to patients' characteristics to protect themselves from violence.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: If necessary, the data can be obtained by contacting the corresponding author. Requests to access these datasets should be directed to Lihua Fan, lihuafan@126.com.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the School of Public Health of Harbin Medical University (Project Identify Code: HMUIRB20180305). Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

YM participated in study design and conception, data acquisition, data analysis, manuscript drafting, and funding acquisition. LW and YW participated in data acquisition. ZL and YZ participated in the design and conceptualization of the study, acquisition of data, and data interpretation. LF and XN participated in the design and conceptualization of study, acquisition of data, revising of the manuscript, acquisition of funding, and supervision. All authors were involved in the manuscript's revision and approved this final version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.783137/full#supplementary-material

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Burnout and Well-Being Among Medical Professionals in China: A National Cross-Sectional Study

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Objective: To determine the profile of Chinese medical professionals with burnout symptoms at the national level and identify the association between capability well-being and burnout.

Design and Setting: A cross-sectional study in a nonrandom national sample of medical staff from 6 provinces across western, central and eastern China.

Participants: Physicians, medical laboratory scientists, nurses, and general practitioners aged 18 years or above who submitted a completed online questionnaire from June 2019 to January 2020 successfully ($N = 25{,}120$).

Main Outcome Measures: The prevalence of burnout symptoms was assessed by the 22-item Maslach Burnout Inventory-Human Services Survey (MBI-HSS), which consists of three domains: emotional exhaustion (EE), depersonalization (DP), and personal achievement (PA). The overall high burnout was defined as EE score ≥ 27 or DP score ≥ 10. The capability well-being was measured by the Investigating Choice Experiments Capability Measure for Adults (ICECAP-A) and the overall ICECAP-A score was calculated using the UK value set, ranging from a score of 0–1. Multivariable logistic regression analysis was used to identify the association between well-being and the overall high burnout.

Results: Among the 25,120 participants, 60.8% of the participants reported at least one symptom of burnout, whereas 11.2% reported all three symptoms of burnout. In the adjusted model, ICECAP-A score was independently associated with high burnout (AOR = 0.018, 95% CI = 0.015–0.022). Medical staff who were males, with shorter working years, working in tertiary hospitals, and those with the specialties of psychiatry, intensive care, emergency medicine, internal medicine, oncology, and pediatrics were at higher risk of reporting burnout symptoms.

Conclusion: The burnout symptoms were relatively common among Chinese medical staff and they were found to be independently associated with capability well-being in health professionals. Interventions should be enhanced on vulnerable groups to reduce burnout and promote well-being in future studies.

INTRODUCTION

Physician burn-out is a global crisis (1), but Chinese doctors may have suffered more. The ratio of doctors to the general population in China is 1:735, which is substantially lower than that in Western countries (where the ratio ranges from 1:280 to 1:640) (2). Yet the violence against the doctors is much higher (3). The number of medical staff injured during medical disputes rose from 2,604 in 2002 to 5,519 in 2006 and to 17,000 in 2010 (4, 5). According to the 2016 and 2017 surveys by the Chinese Medical Doctor Association (2018), more than 60% of medical workers surveyed experienced doctor–patient conflicts (6). More than 63 percent of all hospitals across the country have had their personnel injured, disabled, or even killed by disgruntled patients and their relatives (7). It is therefore not surprising that Chinese medical staff has suffered from a large variety of physical and mental health problems, including burnout (8).

Burnout was newly included the 11th Revision of International Classification of Diseases (ICD-11) in May 2019 as a multi-dimensional syndrome consisting of emotional exhaustion, depersonalization, and diminished feelings of personal accomplishment (9). Burnout and occupational stress among Chinese medical professionals has attracted international attention nowadays (10). Previous studies (11) showed that the prevalence of burnout symptoms among Chinese doctors ranged from 66.5% to 87.8%. However, few study has been conducted to assess the prevalence of burnout among Chinese medical professionals at the national level (12). Unlike depression or occupational fatigue, people with burnout are exposed to high levels of work-related stress (13, 14). Previous studies (15–18) have shown that among medical staff, burnout has adverse effects on health conditions and overall well-being, which could lead to depressive symptoms and suicidal ideations. Moreover, burnout has been associated with job dissatisfaction, frequent job turnover, and increased medical malpractice or errors (19, 20). Hence, burnout is an underlying barrier to the well-being of medical staff and the quality of healthcare.

Traditionally, well-being is a health-related measurement of quality of life comprising physiological, psychological and behavioral dimensions (21). A recent systematic review (15) synthesized 19 studies and found that job burnout could cause negative impact on well-being among human service workers including healthcare providers. However, health-related well-being may not be able to capture multi-dimensional outcomes

such as interests of carers, family or society (22). Under the circumstances, the Sen's (23) capability approach has been developed to provide more comprehensive measures of well-being, one of which is the Investigating Choice Experiments Capability Measure for Adults (ICECAP-A). ICECAP-A is a general instrument developed in the UK to measure capability well-being (24). It is intended for measuring a person's ability to achieve important 'functioning', which consists of five attributes: stability, attachment, autonomy, achievement and enjoyment (19). So far, to our best knowledge, no studies have been performed to examine the relationship between burnout and capability well-being among medical staff in China or in other countries. The aim of this study was to explore the profile of Chinese medical professionals with burnout syndromes at the national level, and to identify the association between capability well-being and burnout among Chinese medical staff.

METHODS

Study Design and Participants

This is a cross-sectional study at the national level performed by the Peking Union Medical College Hospital (PUMCH) and the Chinese University of Hong Kong (CUHK) from June 2019 to January 2020. The study was conducted across the hospitals in both urban and rural health care systems in China. To improve the sample representativeness, 6 of the 31 provincial-level regions in mainland China were surveyed, namely, Shandong, Shanxi, Shaanxi, Jiangsu, Jiangxi, and Sichuan. These selected provinces represented diverse geographical locations (eastern, central, and western China), socioeconomic status (high, middle, and low gross domestic product per capita), and number of health technical staff per 1,000 persons.

The Institutional Review Board of Peking Union Medical College Hospital approved this study. Physicians, medical laboratory scientists, nurses and general practitioners aged 18 years or above from around 400 hospitals in the six provinces were invited to participate in this project. The questionnaire was uploaded to an online survey platform named Wen Juan Xing. Link to the questionnaire was distributed along with the invitation letter. Although the survey mainly involved a non-random convenience sampling method, the total number of participants accounts for 1.3% of all medical professionals from the six provinces, which makes the sample size considerably large enough. All the participants were anonymized and de-identified. The participants must click the "consent to participate" button at the beginning of the survey. Otherwise, the survey would be stopped immediately, and the participants would be taken away from the questionnaire. The exclusion criteria for the valid

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Abbreviations: ICECAP-A, Investigating Choice Experiments Capability Measure for Adults; MBI-HSS, Maslach Burnout Inventory-Human Services Survey; EE, emotional exhaustion; DP, depersonalization; PA, personal achievement.

TABLE 1 | Demographic characteristics of medical professionals in China.

Characteristics	Total n = 25,120	Eastern n = 8,047	Central n = 7,639	Western n = 9,434
	Number (percent)			
Gender				
Male	6,613 (26.3)	2,081 (25.9)	1,909 (25.0)	2,623 (27.8)
Female	18,507 (73.7)	5,966 (74.1)	5,730 (75.0)	6,811 (72.2)
Age				
18–25	2,406 (9.6)	635 (7.9)	555 (7.3)	1,216 (12.9)
26–35	12,874 (51.3)	4,207 (52.3)	3,803 (49.8)	4,864 (51.6)
36–45	6,369 (25.4)	2,093 (26.0)	2,006 (26.3)	2,270 (24.1)
46–55	2,951 (11.7)	961 (11.9)	1,066 (14.0)	924 (9.8)
56–65	483 (1.9)	142 (1.8)	196 (2.6)	145 (1.5)
66+	37 (0.1)	9 (0.1)	13 (0.2)	15 (0.2)
Birthplace				
Urban area	19,043 (75.8)	6,193 (77.0)	6,360 (83.3)	6,490 (68.8)
Rural area	6,044 (24.1)	1,844 (22.9)	1,269 (16.6)	2,931 (31.1)
Others	33 (0.1)	10 (0.1)	10 (0.1)	13 (0.1)
Monthly income				
<5,000	8,922 (35.5)	1,221 (15.2)	3,506 (45.9)	4,195 (44.5)
5,000–10,000	14,196 (56.5)	5,709 (70.9)	3,867 (50.6)	4,620 (49.0)
10,000–30,000	1,874 (7.5)	1,095 (13.6)	227 (3.0)	552 (5.9)
30,000–50,000	43 (0.2)	10 (0.1)	11 (0.1)	22 (0.2)
>50,000	85 (0.3)	12 (0.1)	28 (0.4)	45 (0.5)
Province				
Shandong	3,005 (12.0)	3,005 (37.3)	0 (0.0)	0 (0.0)
Jiangsu	5,042 (20.1)	5,042 (62.7)	0 (0.0)	0 (0.0)
Jiangxi	2,838 (11.3)	0 (0.0)	2,838 (37.2)	0 (0.0)
Shanxi	4,801 (19.1)	0 (0.0)	4,801 (62.8)	0 (0.0)
Sichuan	1,824 (7.3)	0 (0.0)	0 (0.0)	1,824 (19.3)
Shanxi	7,610 (30.3)	0 (0.0)	0 (0.0)	7,610 (80.7)
Education				
Secondary vocational school	209 (0.8)	32 (0.4)	35 (0.5)	142 (1.5)
Three-year college	3,020 (12.0)	440 (5.5)	774 (10.1)	1,806 (19.1)
Bachelor's degree	15,134 (60.2)	4,629 (57.5)	5,012 (65.6)	5,493 (58.2)
Master's degree	5,898 (23.5)	2,481 (30.8)	1,748 (22.9)	1,669 (17.7)
Doctorate/postdoc	859 (3.4)	465 (5.8)	70 (0.9)	324 (3.4)
Title				
Primary	11,307 (45.0)	3,028 (37.6)	3,297 (43.2)	4,982 (52.8)
Middle	8,563 (34.1)	3,123 (38.8)	2,741 (35.9)	2,699 (28.6)
Vice-senior	3,310 (13.2)	1,205 (15.0)	1,035 (13.5)	1,070 (11.3)
Senior	1,316 (5.2)	571 (7.1)	433 (5.7)	312 (3.3)
None	624 (2.5)	120 (1.5)	133 (1.7)	371 (3.9)
Working years				
≤5	7,627 (30.4)	2,212 (27.5)	1,897 (24.8)	3,518 (37.3)
6–10	7,155 (28.5)	2,422 (30.1)	2,222 (29.1)	2,511 (26.6)
11–15	3,932 (15.7)	1,226 (15.2)	1,385 (18.1)	1,321 (14.0)
16–20	2,113 (8.4)	736 (9.1)	618 (8.1)	759 (8.0)
21–25	1,887 (7.5)	648 (8.1)	612 (8.0)	627 (6.6)
26–30	1,441 (5.7)	490 (6.1)	517 (6.8)	434 (4.6)
30+	965 (3.8)	313 (3.9)	388 (5.1)	264 (2.8)
Hospital class				
Tertiary hospital	22,220 (88.5)	8,039 (99.9)	7,625 (99.8)	6,226 (66.0)

(Continued)

TABLE 1 | Continued

Characteristics	Total $n = 25,120$	Eastern $n = 8,047$	Central $n = 7,639$	Western $n = 9,434$
	Number (percent)			
Secondary hospital	3,081 (12.3)	6 (0.1)	8 (0.1)	3,001 (31.8)
Primary hospital	221 (0.9)	2 (0.0)	6 (0.1)	207 (2.2)
Specialty				
Anesthesiology	588 (2.3)	129 (1.6)	146 (1.9)	313 (3.3)
Dermatology	324 (1.3)	119 (1.5)	111 (1.5)	94 (1.0)
Emergency medicine	797 (3.2)	207 (2.6)	312 (4.1)	278 (2.9)
Infectious diseases	796 (3.2)	161 (2.0)	271 (3.5)	364 (3.9)
Intensive care	928 (3.7)	407 (5.1)	327 (4.3)	194 (2.1)
Internal medicine	6,983 (27.8)	2,781 (34.6)	2,043 (26.7)	2,159 (22.9)
Laboratory medicine	720 (2.9)	53 (0.7)	192 (2.5)	475 (5.0)
Obstetrics and gynecology	1,670 (6.6)	472 (5.9)	406 (5.3)	792 (8.4)
Oncology	578 (2.3)	257 (3.2)	188 (2.5)	133 (1.4)
Ophthalmology	464 (1.8)	116 (1.4)	211 (2.8)	137 (1.5)
Orthopedic surgery, medical cosmetology	89 (0.4)	22 (0.3)	30 (0.4)	37 (0.4)
Otolaryngology	327 (1.3)	118 (1.5)	92 (1.2)	117 (1.2)
Pain medicine	118 (0.5)	26 (0.3)	31 (0.4)	61 (0.6)
Pathology	87 (0.3)	10 (0.1)	40 (0.5)	37 (0.4)
Pediatrics	1,742 (6.9)	534 (6.6)	682 (8.9)	526 (5.6)
Psychiatry	255 (1.0)	53 (0.7)	8 (0.1)	194 (2.1)
Radiology	1,363 (5.4)	261 (3.2)	282 (3.7)	820 (8.7)
Sports medicine, rehabilitation	729 (2.9)	182 (2.3)	187 (2.4)	360 (3.8)
Stomatology	337 (1.3)	86 (1.1)	110 (1.4)	141 (1.5)
Surgery	3,757 (15.0)	1,653 (20.5)	1,186 (15.5)	918 (9.7)
Traditional Chinese medicine	491 (2.0)	64 (0.8)	154 (2.0)	273 (2.9)
Others	1,977 (7.9)	336 (4.2)	630 (8.2)	1,011 (10.7)

responses were as follows: total completion time <420 s (420 s generally represented the values for completing questionnaire at or above the 95th-percentile time of general population), selection of the same options throughout the survey.

Study Measures

The demographic characteristics of Chinese medical staff were investigated in the questionnaire including gender, age, birthplace, monthly income, education, working title, working years, hospital class, and specialty. The participants were also asked to rate on the level of 1–4 (1 = full capability, 4 = no capability) for the measurement of well-being using the ICECAP-A. The overall ICECAP score was calculated using the UK value set, ranging from a score of 0–1 (22). The use of the Chinese version of ICECAP-A has obtained permission from the ICECAP team at the Institute of Applied Health Research at the University of Birmingham.

The 22-item Maslach Burnout Inventory-Human Services Survey (MBI-HSS) was used to measure burnout symptoms in this study (25), which encompasses three domains with corresponding subscales: emotional exhaustion (EE), depersonalization (DP), and personal achievement (PA).

Participants were asked to respond using a seven-point Likert scale ranging from a score of 0–6 (0 = never, 6 = everyday). According to previous literature (26), the high score in each domain was designated as follows: EE score ≥ 27, DP score ≥ 10, and PA score ≤ 33. The overall high burnout was defined as: EE score ≥ 27 or DP score ≥ 10 (27). Cronbach's alpha coefficient was used for the reliability analysis of the MBI-HSS, with a value >0.7 indicating a high level of internal consistency (28).

Statistical Analysis

Frequencies, percentages, means, and standard deviations were analyzed for descriptive data based on regional locations (i.e., eastern, central, and western China). Univariable analysis was performed to evaluate the association between the characteristics of Chinese medical professionals and burnout symptoms. Independent sample t-tests were used for continuous variables to compare differences, and Fisher's exact tests or chi-square testes were used for categorical variables as appropriate. In the multivariable regression analysis, adjusted odds ratios (AOR) were reported with 95% confidence intervals and a $p < 0.05$ was considered statistically significant. The variance inflation factor (VIF) for each independent variable in the multivariable

TABLE 2 | Measures of burnout among medical professionals in China.

MBI-HSS scale	Total	Eastern	Central	Western
EE subscale, range 0–54				
Mean score (SD)	23 (11.6)	23.5 (11.4)	23 (11.8)	22.7 (11.5)
Score 0–26[b] (%)	16,213 (64.5)	5,069 (63.0)	4,935 (64.6)	6,209 (65.8)
Score 27–54[a] (%)	8,907 (35.5)	2,978 (37.0)	2,704 (35.4)	3,225 (34.2)
DP subscale, range 0–30				
Mean score (SD)	7.1 (6.0)	7.5 (6.1)	7.0 (6.0)	6.9 (5.9)
Score 0–9[b] (%)	17,583 (70.0)	5,427 (67.4)	5,392 (70.6)	6,764 (71.7)
Score 10–30[a] (%)	7,537 (30.0)	2,620 (32.6)	2,247 (29.4)	2,670 (28.3)
PA subscale, range 0–48				
Mean score (SD)	34.8 (9.6)	35.6 (9.1)	34.4 (9.9)	34.6 (9.7)
Score 34–48[b] (%)	15,474 (61.6)	5,216 (64.8)	4,509 (59.0)	5,749 (60.9)
Score 0–33[a] (%)	9,646 (38.4)	2,831 (35.2)	3,130 (41.0)	3,685 (39.1)
Overall high burnout[c]				
EE/DP/PA (%)	15,285 (60.8)	4,800 (59.6)	4,768 (62.4)	5,717 (60.6)
EE & DP& PA (%)	2,802 (11.2)	957 (11.9)	872 (11.4)	973 (10.3)
EE/DP (%)	11,110 (44.2)	3,723 (46.3)	3,373 (44.2)	4,014 (42.5)

MBI-HSS, Maslach Burnout Inventory-Human Services Survey; EE, Emotional exhaustion; DP, Depersonalization; PA, Personal accomplishment; SD, Standard deviation.
[a] *High burnout.*
[b] *Low or moderate burnout.*
[c] *Three frequently used definitions were employed to determine overall high burnout.*

regression model was examined to eliminate collinearity. Statistical analysis was performed using SPSS, version 25.0 (Armonk, NY, USA: IBM; 2019) by two independent researchers.

RESULTS

Of the 53,636 eligible health professionals who opened the web link, 28,745 (53.6%) completed the survey. After the exclusion of missing and invalid data, 25,120 (87.4%) participants were ultimately included in the study. Among them, 73.7% were females, 51.3% were aged 26–35 years, and 87.2% reported a bachelor or higher degree. The majority (88.5%) of the participants work in tertiary hospitals and more than half (58.9%) of them have worked <10 years. **Table 1** shows more detailed information on the demographic characteristics of the study sample.

The prevalence rates of burnout symptoms among Chinese medical staff are shown in **Table 2**. Among the 25,120 participants, 35.5% of them experienced high EE, 30.0% experienced high DP, and 38.4% had a low sense of PA. Overall, 60.8% of the participants reported at least one symptom of burnout, whereas 11.2% reported all three symptoms of burnout. The Cronbach's alpha coefficients for EE, DP, and PA subscales were 0.891, 0.812, and 0.866, respectively, indicating a high level of reliability. **Table 3** shows the frequencies and percentages of the participants responding to ICECAP-A. For all attributes, the second-best level was the most commonly selected option, ranging from 43.5% for achievement to 63.4% for enjoyment.

The characteristics of Chinese medical professionals with or without an overall high burnout were compared in **Table 4**. Of the 11,110 (44.2%) participants with an overall high burnout, the average ICECAP-A score (mean ± SD) was 0.7568 ± 0.1622,

TABLE 3 | Responses to the ICECAP-A scale among Chinese medical professionals.

Attributes	Overall	Eastern	Central	Western
	Number (percent)			
Stability				
4[a]	5,270 (21.0)	1,582 (19.7)	1,703 (22.3)	1,985 (21.0)
3	13,842 (55.1)	4,834 (60.1)	4,030 (52.8)	4,978 (52.8)
2	5,306 (21.1)	1,478 (18.4)	1,653 (21.6)	2,175 (23.1)
1	702 (2.8)	153 (1.9)	253 (3.3)	296 (3.1)
Attachment				
4	6,254 (24.9)	2,093 (26.0)	1,952 (25.6)	2,209 (23.4)
3	15,401 (61.3)	5,059 (62.9)	4,547 (59.5)	5,795 (61.4)
2	3,304 (13.2)	857 (10.6)	1,077 (14.1)	1,370 (14.5)
1	161 (0.6)	38 (0.5)	63 (0.8)	60 (0.6)
Autonomy				
4	7,391 (29.4)	2,377 (29.5)	2,242 (29.3)	2,772 (29.4)
3	13,967 (55.6)	4,701 (58.4)	4,141 (54.2)	5,125 (54.3)
2	3,684 (14.7)	947 (11.8)	1,226 (16.0)	1,511 (16.0)
1	78 (0.3)	22 (0.3)	30 (0.4)	26 (0.3)
Achievement				
4	4,111 (16.4)	1,208 (15.0)	1,383 (18.1)	1,520 (16.1)
3	10,917 (43.5)	3,699 (46.0)	3,252 (42.6)	3,966 (42.0)
2	9,856 (39.2)	3,075 (38.2)	2,927 (38.3)	3,854 (40.9)
1	236 (0.9)	65 (0.8)	77 (1.0)	94 (1.0)
Enjoyment				
4	6,446 (25.7)	2,067 (25.7)	1,996 (26.1)	2,383 (25.3)
3	15,931 (63.4)	5,194 (64.5)	4,727 (61.9)	6,010 (63.7)
2	2,564 (10.2)	743 (9.2)	853 (11.2)	968 (10.3)
1	179 (0.7)	43 (0.5)	63 (0.8)	73 (0.8)

[a] *Refers to the capacity score at each attribute level.*

which was lower than those of participants without an overall high burnout (0.8318 ± 0.1154). Significant differences between participants with or without an overall high burnout were found in gender, age, location, education, working title, working years, hospital class, specialty and ICECAP-A score ($p < 0.001$); these variables were further included in the multivariable logistic regression model. However, the variables of age and working years were found to have a value of VIF larger than 10, which indicated the occurrence of collinearity. Therefore, we only included the variable of working years instead of both variables in the multivariable regression model. In the final reported model, all the variables were found to have a value of VIF below 5, which indicated no problem of collinearity.

Factors associated with an overall high burnout were identified in the multivariable logistic regression analysis (**Table 5**). Males were more likely to suffer from high burnout than females (AOR = 0.763, 95% CI = 0.716–0.815 for females vs. males). Working longer than 15 years was significantly associated with lower risk of high burnout (AOR = 0.870, 95% CI = 0.766–0.988 for working years 16–20 vs. ≤5). Medical professionals working in tertiary hospitals were at greater risk of reporting high burnout than those working in primary hospitals (AOR = 2.003, 95% CI = 1.456–2.789 for tertiary hospitals vs. primary hospitals). Comparing to the specialty of anesthesiology, the specialty with

TABLE 4 | Characteristics of Chinese medical professionals associated with high burnout[a].

Characteristics	High burnout $n = 11,110$	Low/moderate burnout $n = 14,010$	p-value[c]
	Number (percent)		
Gender			<0.001
Male	3,177 (28.6)	3,436 (24.5)	
Female	7,933 (71.4)	10,574 (75.5)	
Age			<0.001
18–25	1,062 (9.6)	1,344 (9.6)	
26–35	5,967 (53.7)	6,907 (49.3)	
36–45	2,824 (25.4)	3,545 (25.3)	
46–55	1,081 (9.7)	1,870 (13.3)	
56–65	158 (1.4)	325 (2.3)	
66+	18 (0.2)	19 (0.1)	
Birthplace			0.938
Urban area	8,413 (75.7)	10,630 (75.9)	
Rural area	2,683 (24.1)	3,361 (24.0)	
Others	14 (0.1)	19 (0.1)	
Monthly income			0.089
<5,000	4,022 (36.2)	4,900 (35.0)	
5,000–10,000	6,246 (56.2)	7,950 (56.7)	
10,000–30,000	794 (7.1)	1,080 (7.7)	
30,000–50,000	15 (0.1)	28 (0.2)	
>50,000	33 (0.3)	52 (0.4)	
Location			<0.001
Eastern	3,723 (33.5)	4,324 (30.9)	
Central	3,373 (30.4)	4,266 (30.4)	
Western	4,014 (36.1)	5,420 (38.7)	
Education			<0.001
Secondary vocational school	69 (0.6)	140 (1.0)	
Three-year college	1,262 (11.4)	1,758 (12.5)	
Bachelor's degree	6,555 (59.0)	8,579 (61.2)	
Master's degree	2,801 (25.2)	3,097 (22.1)	
Doctorate/postdoc	423 (3.8)	436 (3.1)	
Title			<0.001
Primary	5,110 (46.0)	6,197 (44.2)	
Middle	3,928 (35.4)	4,635 (33.1)	
Vice-senior	1,343 (12.1)	1,967 (14.0)	
Senior	472 (4.2)	844 (6.0)	
None	257 (2.3)	367 (2.6)	
Working years			<0.001
≤5	3,490 (31.4)	4,137 (29.5)	
6–10	3,358 (30.2)	3,797 (27.1)	
11–15	1,838 (16.5)	2,094 (14.9)	
16–20	902 (8.1)	1,211 (8.6)	
21–25	712 (6.4)	1,175 (8.4)	
26–30	490 (4.4)	951 (6.8)	
30+	320 (2.9)	645 (4.6)	
Hospital class			<0.001
Tertiary hospital	9,757 (87.8)	12,133 (86.6)	
Secondary hospital	1,294 (11.6)	1,721 (12.3)	
Primary hospital	59 (0.5)	156 (1.1)	

(Continued)

TABLE 4 | Continued

Characteristics	High burnout $n = 11,110$	Low/moderate burnout $n = 14,010$	p-value[c]
	Number (percent)		
Specialty			<0.001
Anesthesiology	245 (2.2)	343 (2.4)	
Dermatology	123 (1.1)	201 (1.4)	
Emergency medicine	406 (3.7)	391 (2.8)	
Infectious diseases	310 (2.8)	486 (3.5)	
Intensive care	466 (4.2)	462 (3.3)	
Internal medicine	3,409 (30.7)	3,574 (25.5)	
Laboratory medicine	207 (1.9)	513 (3.7)	
Obstetrics and gynecology	682 (6.1)	988 (7.1)	
Oncology	282 (2.5)	296 (2.1)	
Ophthalmology	177 (1.6)	287 (2.0)	
Orthopedic surgery, medical cosmetology	30 (0.3)	59 (0.4)	
Otolaryngology	141 (1.3)	186 (1.3)	
Pain medicine	45 (0.4)	73 (0.5)	
Pathology	25 (0.2)	62 (0.4)	
Pediatrics	804 (7.2)	938 (6.7)	
Psychiatry	122 (1.1)	133 (0.9)	
Radiology	543 (4.9)	820 (5.9)	
Sports medicine, rehabilitation	272 (2.4)	457 (3.3)	
Stomatology	108 (1.0)	229 (1.6)	
Surgery	1,779 (16.0)	1,978 (14.1)	
Traditional Chinese medicine	182 (1.6)	309 (2.2)	
Others	752 (6.8)	1,225 (8.7)	
ICECAP-A score[b] [mean (SD)]	0.7568 (0.1622)	0.8318 (0.1154)	<0.001

[a]The definition of high burnout was determined by a MBI-HSS EE score ≥27 or a DP score ≥10.
[b]The overall ICECAP-A score was calculated using the UK value set ranging from 0 to 1.
[c]Fisher's exact test or chi-square test was adopted as appropriate.
Bold values indicate statistical significance which is defined as p < 0.05.

the highest risk of burnout was psychiatry (AOR = 1.605, 95% CI = 1.175–2.191), followed by intensive care (AOR = 1.514, 95% CI = 1.217–1.886), emergency medicine (AOR = 1.471, 95% CI = 1.174–1.844), internal medicine (AOR = 1.469, 95% CI = 1.228–1.759), oncology (AOR = 1.441, 95% CI = 1.131–1.837), and pediatrics (AOR = 1.317, 95% CI = 1.080–1.607). In the adjusted multivariable regression model, ICECAP-A score was independently associated with high burnout (AOR = 0.018, 95% CI = 0.015–0.022).

DISCUSSION

Burnout symptoms has been common in health professionals since its recognition in the 1970s (29). Regardless of specialties among physicians and nurses, the rates of burnout symptoms ranged from 25 to 60% in western countries (30–33). Based on the findings in the current study, the prevalence of Chinese medical staff exposed to at least one burnout symptom was 60.8%, which was relatively higher than that reported by

TABLE 5 | Multivariable logistic regression analysis of predictors of high burnout among Chinese medical professionals[a].

Characteristics	AOR	95% CI	p-value[b]
Gender (female: male)	0.763	0.716–0.815	**<0.001**
Location (ref: central)			
Eastern	1.084	1.013–1.160	**0.019**
Western	0.981	0.912–1.055	0.604
Education (ref: secondary vocational school)			
Three-year college	1.230	0.895–1.704	0.207
Bachelor's degree	1.270	0.928–1.751	0.139
Master's degree	1.271	0.921–1.768	0.149
Doctorate/postdoc	1.460	1.027–2.089	**0.037**
Title (ref: primary)			
Middle	1.038	0.961–1.122	0.340
Vice-senior	0.961	0.849–1.088	0.532
Senior	0.881	0.738–1.050	0.158
None	0.832	0.697–0.991	**0.040**
Working years (ref: ≤5)			
6–10	1.019	0.945–1.099	0.624
11–15	1.021	0.925–1.128	0.678
16–20	0.870	0.766–0.988	**0.032**
21–25	0.726	0.630–0.837	**<0.001**
26–30	0.655	0.556–0.771	**<0.001**
>30	0.686	0.567–0.829	**<0.001**
Hospital class (ref: primary hospital)			
Secondary hospital	1.897	1.374–2.650	**<0.001**
Tertiary hospital	2.003	1.456–2.789	**<0.001**
Specialty (ref: anesthesiology)			
Dermatology	0.953	0.711–1.275	0.748
Emergency medicine	1.471	1.174–1.844	**0.001**
Infectious diseases	0.998	0.794–1.253	0.985
Intensive care	1.514	1.217–1.886	**<0.001**
Internal medicine	1.469	1.228–1.759	**<0.001**
Laboratory medicine	0.622	0.489–0.791	**<0.001**
Obstetrics and gynecology	1.130	0.925–1.382	0.232
Oncology	1.441	1.131–1.837	**0.003**
Ophthalmology	1.011	0.779–1.311	0.935
Orthopedic surgery, medical cosmetology	0.810	0.489–1.316	0.402
Otolaryngology	1.153	0.866–1.534	0.330
Pain medicine	0.866	0.562–1.320	0.506
Pathology	0.604	0.357–0.997	0.054
Pediatrics	1.317	1.080–1.607	**0.007**
Psychiatry	1.605	1.175–2.191	**0.003**
Radiology	1.000	0.814–1.229	1.000
Sports medicine, rehabilitation	0.883	0.700–1.114	0.294
Stomatology	0.743	0.553–0.994	**0.046**
Surgery	1.349	1.122–1.625	**0.002**
Traditional Chinese medicine	0.919	0.710–1.189	0.521
Others	1.030	0.846–1.255	0.770
ICECAP-A score	0.018	0.015–0.022	**<0.001**

[a]The variables with p-values < 0·05 in the univariable analysis were further included in the multivariable logistic regression analysis. [b]Bold values indicate statistical significance which is defined as p < 0.05.

western countries. To the best knowledge of us, this is the first large-scale national study assessing burnout symptoms among medical staff across eastern, central and western China, which has increased the representativeness and generalizability of the research findings. The majority of prior studies on the evaluations of burnout focused on a group of health professionals with a specific specialty or occupational setting (34–37). This study has assessed burnout symptoms in health professionals across diverse specialties and occupations, which has contributed to an extended picture of the situation of burnout among medical staff.

In this study, capability well-being was found to be independently associated with the overall high burnout after adjustment for the characteristics of Chinese medical staff. This finding indicated that burnout can not only affect the health-related well-being of medical staff, but also lead to a decline in one's ability to achieve more comprehensive outcomes defined by the ICECAP-A. Although the ICECAP-A is a newly developed instrument for measuring capability well-being in UK, the validity of the Chinese version of ICECAP-A has been proved (38), making it appropriate for measuring the general well-being in China. This study was one of the first attempts to explore the association between capability well-being and burnout, which could benefit social care decision-making for policymakers. Nevertheless, the mechanism on how burnout symptoms can affect capability well-being among medical staff is warranted to be studied in both research and clinical settings.

In this study, males were found to be at higher risk for burnout symptoms than females among Chinese medical staff. However, it appear to be inconsistent worldwide. A multinational cross-sectional study investigating 16 Asian countries/regions showed that gender was not associated with burnout among physicians and nurses (39). Several studies (40, 41) conducted in North America indicated that female physicians were at increased risk of burnout symptoms than males; whereas a systematic review revealed that male students experienced greater emotional exhaustion and depersonalization than females in China (42). A possible interpretation is that men are likely to receive higher societal expectations, promotion stress than women from a culture perspective (43), which may lead to higher job burnout. Work-life integration could be another important impact on gender differences in burnout among medical staff. A national study conducted in the US indicated that female physicians were less satisfied with work-life integration than males (44). Compared with female health professionals in western countries, Chinese female medical staff may obtain more assistance from their parents, including childcare and housekeeping, owing to the distinctions in cultural tradition and family composition. Nonetheless, the satisfaction with work-life integration among Chinese medical staff and its association with burnout need to be further explored. Besides, the COVID-19 pandemic could also impact the level of peritraumatic distress and burnout among medical professionals, which should not be neglected.

Previous studies have shown that heavy workload is associated with increased risk of burnout among physicians and nurses (21), which is consistent with the findings in the current study. In this study, the study revealed the significantly negative correlation between length of employment and prevalence of

burnout among Chinese medical staff. It is indicated that medical staff in their early career stage are more vulnerable to burnout symptoms. This is probably because young medical staff serving as trainees or junior positions are generally more overloaded with work (2, 14). We also found that medical staff who work in tertiary hospitals were more likely to report burnout symptoms than those work in primary hospitals. In China, the effectiveness of primary care gatekeeping is limited (45), thus patients are more willing to visit tertiary hospitals to see a doctor as long as it is accessible and affordable. Under the circumstances, the heavy workload of medical staff in tertiary hospitals contributed to the high rates of burnout. Furthermore, the risk of reporting burnout symptoms varied across different clinical specialties according to the results in this study, which mirrored the unique workload characteristics in different occupational settings. The specialties with the increased work burden such as psychiatry, intensive care, emergency medicine, and internal medicine, were at the higher possibility of reporting burnout symptoms. Interventions at both individual and organizational levels should be strengthened on the medical staff with a heavy workload to reduce burnout (46), especially those working with shorter years, in tertiary hospitals, and with specific specialties.

To our knowledge, this is the first national study in China to explore the relationship between burnout and well-being of medical professionals. It finds that males, working in tertiary hospitals, and practicing psychiatry, intensive care, emergency medicine, internal medicine, oncology, and pediatrics were at a higher risk of reporting burnout symptoms; while working longer could decrease the risk of burnout. Moreover, higher burnout was associated with lower well-being. Despite these strengths, our study has some limitations that should be noted. First, the study sample was recruited by convenience sampling methods, resulting in the selection bias of the participants by the inclusion of more young medical staff and those working in tertiary hospitals and primary care facilities. Nevertheless, this large-scale study was performed at the national level with the study cohort selected from 6 representative provinces across eastern, central and western China. Thus, we believe the study sample in the current study is able to represent the general population of Chinese medical staff. Second, the overall ICECAP-A score was calculated based on the UK value set, which may not reflect the real-world value of the Chinese population. Further studies are needed to develop Chinese value sets for measuring capability well-being. Third, our study is lack of distinctions among different occupational settings, which resulted in difficulty comparing the prevalence of burnout between different occupational groups within the study or with other studies at national and global levels. To make a proper comparison, more efforts are required to focus on the distinctions

of medical staff by occupations for the analysis of burnout in future studies.

In conclusion, the prevalence rates of burnout symptoms were relatively high among Chinese medical staff. Despite the negative effect on health-related well-being, burnout is also found to be independently associated with capability well-being in health professionals. Interventions should be enhanced on the vulnerable groups of medical staff to reduce burnout, including males, those with shorter working years, working in tertiary hospitals, and specialties with heavy workload.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Peking Union Medical College Hospital Ethics Committee approved the study (Ref No.: SK-814). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SZ and DD developed the idea. YX, DD, and SZ designed the study. DD, YX, XL, ZT, ZJ, and PC were responsible for data collection. YX, HZ, and DD performed the statistical analysis and drafted the manuscript. SZ revised it. All authors had full access to all of the data in the study, can take responsibility for the integrity of the data and the accuracy of the data analysis, and read and approved the final manuscript.

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The Dermatological Effects and Occupational Impacts of Personal Protective Equipment on a Large Sample of Healthcare Workers During the COVID-19 Pandemic

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Introduction: Working during the Sars-CoV-2 pandemic healthcare workers (HCWs) had to wear Personal Protective Equipment (PPEs) for extended periods of time, leading to an increase in dermatological reactions. The study evaluates the prevalence of adverse skin reactions to PPEs among Italian healthcare workers during the COVID-19 pandemic, and aims to determine whether prolonged PPEs usage poses a significant occupational health risk, by measuring the loss of work days and the eligibility of workers that requested health surveillance due to dermatological PPEs reactions.

Materials and Methods: An online *ad hoc* questionnaire was administered to a sample of Italian HCWs. Questions verted on sociodemographic characteristics, PPEs usage, and occupational well-being. Descriptive analyses and logistic regressions were performed to explore possible associations between variables.

Results: Two types of PPEs, Gloves and Masks, were tested. The sample included 1,223 interviewed HCWs, 1,184 gave their consent for participation. A total of 90 medical surveillance visits were requested due to PPEs related dermatological issues: in 30 cases were recognized limitations in working duties and in one case the worker was deemed not fit to keep working. Furthermore, 25 workers had a loss of occupational days due to dermatological issues. A statistically significant correlation was observed with being a nurse or midwife (OR = 1.91, IC = 1.38–2.63, $p < 0.001$), and being female (OR = 2.04, IC = 1.49–2.78, $p < 0.001$), which acted as risk factors.

Discussion: The enhanced protection measures put in place during the COVID-19 pandemic, highlight the importance of occupational dermatology. This study could contribute to assess the issue, aiming to develop better prevention strategies in the workplace in order to improve well-being of HCWs and reduce the impact of dermatological adverse reactions to PPEs.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) originated in Wuhan, China in December 2019. Within a short amount of time, hundreds of thousands of cases were diagnosed around the world, causing the World Health Organization to announce it as an infectious disease pandemic on January 30, 2020.

The main form of human-to-human transmission occurs through respiratory droplets expelled by an infected individual; hence, coughing and sneezing render SARS-CoV-2 airborne, putting non-infected individuals at risk of contracting the disease (1–3). Additionally, data have indicated that SARS-CoV-2 transmission can also occur as a result of contact with contaminated inanimate objects, also known as fomite transmission (4, 5).

The most important strategy to undertake the risk of contagion is frequent handwashing, using portable hand sanitizer, practicing respiratory hygiene (i.e., covering their cough), avoiding crowds and extended use of personal protective equipment (PPE), such as masks, gloves, goggles, face shields, and bonnets.

Due to the uncertainty of the infection status of patients or the direct contact with COVID-19 patients (6), healthcare workers (HCWs), are mandated to wear PPE to markedly reduce the infection risk (7–9).

Many healthcare workers, aside from a major risk of contracting the disease, reported added stress from adverse effects of prolonged PPE usage, such as headaches, breathing difficulty and impaired cognition. It also interferes with vision, communication and thermal equilibrium (10–12).

These enhanced protection measures during COVID-19 emergency highlight the importance of occupational dermatology (13). It has been reported that up to 97% of HCWs showed skin lesions (14), including acne, skin breakdown, rashes, contact and pressure urticaria, rosacea, perioral dermatitis, contact dermatitis, or aggravation of pre-existing skin disorders.

The most commonly affected areas were the hands, cheeks, and nasal bridge (10, 15).

Skins problems often have a significant impact on emergency management, as they effect patients' quality of life and are potentially able to reduce the effective workforce (10–12).

Prolonged usage of PPE can exacerbate or cause acne vulgaris (16). The tight seal and humid environment created by masks, particularly N95s, aggravates acne (also known colloquially as maskne) (17, 18). This is likely because pressure on the skin can rupture comedones and block pilosebaceous ducts. Moreover, the humid microclimate within the mask is ideal for bacterial growth and prevents filaggrin (FLG) breakdown, which contributes to skin barrier disruption (18).

Atopic dermatitis (AD) and irritant contact dermatitis (ICD) are common types of eczema that are characterized by pruritus, eczematous lesions, xerosis, and lichenification. AD is a chronic relapsing inflammatory skin condition that often develops at a young age, while ICD is caused by direct contact of the skin with environmental, chemical, or physical agents that disrupt the epidermal barrier (19, 20). AD and ICD can be exacerbated or caused by wearing PPE for long periods of time (15, 21).

Skin reactions to gloves included complaints of dry skin, itch, and rash (22).

Hand eczema (HE) is the most common form of ICD (23). Anionic surfactants, commonly found in hand soaps, disrupt the stratum corneum by damaging proteins and the processing of new lipids, allowing for greater penetration of irritants and Transepidermal Water Loss (TEWL) (24). Likewise, extended exposure to water disrupts the stratum corneum's lipid structure and increases skin permeability (25). Other irritants, such as organic solvents used in hand sanitizers, strip away lipids from the stratum corneum, although they are less damaging compared to harsh detergents (26).

Wearing gloves or having wet hands for >2 h during work hours, or hand washing 10–20 times daily, is generally accepted to be quantitatively sufficient for triggering of irritant contact dermatitis (27–29). Additionally, the timeframe that an activity can be sustained is decreased when wearing masks and PPE (10, 11, 16, 21).

These adverse effects are mainly caused by the hyperhydration effects of PPE, friction, epidermal barrier breakdown, and contact reactions. All of these can aggravate pre-existing skin diseases or cause new ones, many of which can be controlled with proper moisturization. Moisturizers treat damaged skin by repairing the stratum corneum, increasing hydration, and reducing trans epidermal water loss (TEWL) (24). However, the main obstacle remains poor adherence to skin care recommendations (30–33).

It is acknowledged that PPE items are designed for single use. However, the reality during the course of the pandemic is that reuse has been undertaken by many health care workers across the world out of necessity, who were challenged to rationally use the limited supplies by decontaminating and reprocessing them (34). Improper or inadequate decontamination of equipment before reuse is unsafe and can pose serious threats (35).

The study aims to determine the prevalence of adverse skin reactions to PPE among Italian healthcare workers during the

COVID-19 pandemic and characterize them, hence determining whether prolonged PPE use poses a significant occupational health risk; this risk was assessed by measuring the loss of work days and the eligibility of workers that requested health surveillance due to dermatological PPEs reactions. We also intend to identify potential predictors of cutaneous adverse reactions due to the PPE usage, and corrective actions to be applied in order to reduce this occupational risk.

MATERIALS AND METHODS

Sample and Questionnaire

The study is a cross-sectional study; a questionnaire was administered to healthcare workers using an online platform. Participants were recruited by convenience among the workplace circle of the authors and were invited to send the questionnaire to other colleagues, therefore using snowball sample recruitment. The participants were informed about the aim of the study and gave their consent to participate before accessing the survey. A total of 1,184 valid answers were received and thus included in the study.

The questionnaire included 29 questions, divided into four sections.

The first section was made up of seven questions. The first five questions assessed the participant's gender, age, mansion, working sector, and if the healthcare professional assisted Sars-CoV-2 patients; two additional questions investigated if the participant had a history of dermatological illness and, if they had, which one.

The second section investigated the use of gloves during work hours, with seven questions pertaining to: gloves type and usage time, if cutaneous hand reactions were observed and which ones, times hands were washed and times hand gel was used, and use of hand cream.

The third section included questions about the use of face masks, with nine questions investigating: mask type and usage time, reusage of mask and if it was disinfected before reusing it (if it was, which disinfectant was used), if adverse reactions to the mask were observed and which ones, and if face creams (and which type) were used.

The fourth and final section focused on the occupational health aspect, with six questions investigating if the healthcare workers requested medical surveillance, their eligibility, if work days were missed due to adverse reactions to PPEs and how many, if their company had given instructions about the management of adverse reactions to PPEs, and if the creams and/or lotions used had been supplied by their company.

Statistical Analyses

Skewness and kurtosis were used to investigate the distribution of the collected data and the Saphiro-Wilk test was used to investigate normal distribution. The variables that were normally distributed were: gender, working with Sars-CoV-2 patients, Adverse dermatological effects to PPEs, Recycling mask, Washing recycled mask, Adverse dermatological reaction to the hands, Type of hand cream used, Requesting medical surveillance for and adverse dermatological reaction, Type of reaction for which medical surveillance was requested, and Number of lost work days. All other variables were not-normally distributed.

Descriptive statistics were used to assess participants' socio-demographic data, and frequencies and percentages were defined.

Pearson bivariate correlations were performed to check multi-collinearity and to give some preliminary information into relationships between dermatological disease and the use of PPE; p-values were considered significant if they were ≤ 0.05.

In a second stage the significant predictors of the first stage were entered together in multiple logistic regression models. Data were stratified by gender, age, occupational group and sector, time of PPE usage, type and material of PPE. Crude odds ratios (ORs) and adjusted ORs for all the other entered variables, along with 95% confidence intervals, were calculated. To analyse the collected data, we used the STATA 16 statistical package.

RESULTS

The sample included 1,223 interviewed HCWs, 1,184 gave their consent for participation (response rate: 96,8%).

Of them, 257 (21.71%) were males and 927 (78.29%) females. The age range was between 21 and 68 years, with a mean of 43.37 (SD 10.94) years. Concerning occupational groups, the healthcare workers were: 332 (28.04%) physicians, 772 (65.20%) nurses/midwives, 80 (6.76%) other professionals. Regarding the working sector, workers were distributed as follows: 367 (31%) were employed in Hospital Wards, 253 (21.37%) in day hospital, 114 (9.63%) in Intensive Care Research, 88 (7.43%) in Emergency Room, 71 (6%) in Surgery, 41 (3.46%) in Delivery Room and 250 (21.11%) in other sectors. Among all the participants, 292 (24.66%) reported a dermatological illness, grouped in four different pathological issues: 45 (15.421%) had Psoriasis, 54 (18.49%) Eczema, 38 (13.01%) Acne, 48 (126.44%) had Seborrheic Dermatitis and 107 (36.64%) other reactions.

Making a distinction based on personal history, 38 (10.67%) participants with no personal history of dermatological reactions had issues related to PPE, and 254 (30.68%) participants with a personal history of dermatological reactions had an adverse reaction to PPE.

From an Occupational Health standpoint, 90 (7.6%) workers requested a health surveillance visit. Among these participants, two workers were deemed unfit to keep working (one of them requested health surveillance due to PPE-related issues, and one did so for other reasons), 30 were given limitations to their daily working activities, and 55 were deemed fit to work. For three workers who requested health surveillance, the eligibility data was not reported.

Out of the 90 participants who requested a health surveillance visit, 56 did so for PPE-related issues; among these, 49 (87.5%) had a personal history of dermatological reactions, in 25 of them a limitation to working activities was established and one of them was deemed not fit to work (**Table 1**). Having personal history of dermatological problems was associated with requesting a health surveillance visit; the correlation was statistically significant ($p > 0.001$).

TABLE 1 | Univariate analysis of frequencies for *Adverse Dermatological Reaction*, *Medical Surveillance* and *Eligibility*.

		Adverse dermatological effect (*N*, %)		
		No	**Yes**	***p*-value**
Medical surveillance	No	349	779	0.003*
		30.94	69.06	
	Yes	7	49	
		12.50	87.50	
	Total	356	828	
		30.07	69.93	
Eligibility	Limitations	3	27	0.216
		10.00	90.00	
	Suitable	30	25	
		54.55	45.45	
	Not Suitable	4	1	
		80.00	20.00	
	Total	37	53	
		41.11	58.89	

Statistically significant value p ≤ 0.05.

TABLE 2 | Univariate analysis of frequencies for *Previous Dermatological Illness*, *Number of lost days of work* and *Job*.

		Previous dermatological illness (*N*, %)		
		No	**Yes**	***p*-value**
Number of lost work days	<7	11	4	0.031*
		73.33	26.67	
	7–20	1	6	
		14.29	85.71	
	>20	2	1	
		66.67	33.33	
	Total	14	11	
		56.00	44.00	
Job	Other	64	16	0.038*
		80.00	20.00	
	Physician	265	67	
		79.82	20.18	
	Nurse-midwife	563	209	
		72.93	27.07	
	Total	892	292	
		75.34	24.66	

Statistically significant value p ≤ 0.05.

In 25 (2.11%) workers, a loss of working days due to dermatological issues was observed; 15 participants missed work for <7 days, seven participants missed between 7 and 20 days of work, and three participants missed more than 20 days of work due to dermatological illnesses. A previous dermatological illness was present in 6 (85.71%) workers who missed between 7 and 20 working days; the correlation was statistically significant ($p = 0.031$). A personal history of dermatological disease was also significantly ($p = 0.038$) correlated with mansion, as 209 (27%) nurses reported previous dermatological illnesses (**Table 2**).

A logistic regression was performed to test correlation between adverse dermatological reactions and the following variables: occupational group, working environment, age and gender. A statistically significant correlation was observed with being a nurse or midwife (OR = 1.91, IC = 1.38–2.63, $p < 0.001$), and being female (OR = 2.04, IC = 1.49–2.78, $p < 0.001$), which acted as risk factors. As protective factors, a statistically significant correlation was observed with working in day hospital (OR = 0.52, IC = 0.29–0.94, $p = 0.031$), being between 31 and 40 years of age (OR = 0.56, IC = 0.36–0.87, $p = 0.009$), or being over 50 years of age (OR = 0.46, IC = 0.30–0.72, $p = 0.001$).

Two types of PPE were tested: Gloves and Masks.

As far as gloves were concerned, 591 (50%) participants reported dermatological reactions on the hands. These reactions were more frequent in participants between 41 and 50 years of age (29.61%), female (83.42%), working with Sars-CoV-2 patients (63.62%). Most participants (42.64%) had a reaction between 3 and 6 h of wearing gloves, most reactions happened in patients who wore nitrile gloves (57.53%), in participants who washed their hands more than 10 times per day (63.79%), or used hydroalcoholic gel more than 10 times per day (61.93%). People using a hand cream had more dermatological reactions (72.30%) than those who didn't use any (**Table 3**).

A logistic regression was performed to test the correlation between adverse hand reactions and the following variables: working with Sars-CoV-2 patients, type of previous dermatological illness, time wearing gloves, times hands were washed during a working day, use of hand cream, age, and gender (**Table 4**). Our results showed that working in contact with Sars-CoV-2 patients was a risk factor for an adverse dermatological reaction to the hands (OR = 2.06, CI = 1.18–3.60, $p = 0.011$), and the correlation was statistically significant. Wearing gloves between 3 and 6 h was a statistically significant risk factor (OR = 3.02, CI = 1.04–8.79, $p = 0.042$) for adverse hand reactions. Out of the 292 patients with a previous dermatological issue, 203 (69.52%) had adverse hand reactions; concerning the pathology subgroups, a statistically significant correlation with hand adverse reactions showed that having a personal history of Acne (OR = 0.24, CI = 0.08–0.66, $p = 0.006$) or Seborrheic Dermatitis (OR = 0.31, CI = 0.12–0.82, $p = 0.018$) was protective for hand reactions.

We observed adverse reactions to the face mask in 633 (53.46%) participants. This type of adverse reactions were more frequent in workers between 41 and 50 years of age (32.22%), females (87.04%), working with Sars-CoV-2 patients (61.45%), wearing masks for more than 6 h per day (83.73%), using surgical masks (60.98%). Reactions to the face mask were more frequent in participants who recycled the same mask (52.37%), and did not disinfect it for re-usage (82.62%). More adverse reactions were observed in participants using face creams (65.03%), and more specifically moisturizers (65.36%) over soothing creams (**Table 3**).

Another logistic regression was performed to test the correlation between adverse face mask reactions and the following variables: working with Sars-CoV-2 patients, type of

TABLE 3 | Univariate analysis of frequencies for *Adverse dermatological reactions to the hands* and *Adverse dermatological reactions to the mask*.

N = 1,184		Adverse dermatological reactions to the hands (N, %)			Adverse dermatological reactions to the mask (N, %)		
		No	Yes	*p*-value	No	Yes	*p*-value
Age	21–30	82	128	0.003*	84	126	0.002*
		39.05	60.95		40.00	60.00	
	31–40	137	129		124	142	
		51.50	48.50		46.62	53.38	
	41–50	179	175		150	204	
		50.56	49.44		42.37	57.63	
	51+	195	159		193	161	
		55.08	44.92		54.52	45.48	
Gender	Male	159	98	0.000*	175	82	<0.001*
		61.87	38.13		68.09	31.91	
	Female	434	493		376	551	
		46.82	53.18		40.56	59.44	
Working with COVID-19 patients	No	338	215	<0.001*	309	244	<0.001*
		61.12	38.88		55.88	44.12	
	Yes	255	376		242	389	
		40.41	59.59		38.35	61.65	
Previous dermatolo-gical illness	Psoriasis	16	29	0.018*	19	26	0.045*
		35.56	64.44		42.22	57.78	
	Eczema	9	45		21	33	
		16.67	83.33		38.89	61.11	
	Acne	17	21		5	33	
		44.74	55.26		13.16	86.84	
	Seb-derm	19	29		17	31	
		39.58	60.42		35.42	64.58	
	Other	28	79		33	74	
		26.17	73.83		30.84	69.16	
Time wearing gloves	<1 h	113	38	<0.001*			
		74.83	25.17				
	1 < h < 3	157	122				
		56.27	43.73				
	3 < h < 6	210	252				
		45.45	54.55				
	>6	112	179				
		38.49	61.51				
Type of gloves used	Lattex no dust	206	179	0.284			
		53.51	46.49				
	Lattex dust	37	46				
		44.58	55.42				
	Nitrile	331	340				
		49.33	50.67				
	Other	19	25				
		43.18	56.82				
Times hands washed per day	Never	0	1	<0.001*			
		0.00	100.00				
	<5	74	40				
		64.91	35.09				

(Continued)

TABLE 3 | Continued

N = 1,184		Adverse dermatological reactions to the hands (N, %)			Adverse dermatological reactions to the mask (N, %)		
		No	**Yes**	**p-value**	**No**	**Yes**	**p-value**
	5 < t < 10	213	173				
		55.18	44.82				
	>10	306	377				
		44.80	55.20				
Times hand gel was used per day	<5	72	56	0.066			
		56.25	43.75				
	5 < t < 10	192	169				
		53.19	46.81				
	>10	329	366				
		47.34	52.66				
Using Hand Cream	No	272	146	<0.001*			
		65.07	34.93				
	Yes	321	445				
		41.91	58.09				
Time wearing mask	<1 h				12	2	<0.001*
					85.71	14.29	
	1 < h < 3				21	7	
					75.00	25.00	
	3 < h < 6				143	94	
					60.34	39.66	
	>6				373	530	
					41.31	58.69	
Type of mask	Surgical mask				366	386	0.299
					48.67	51.33	
	FFP2 no valve				162	213	
					43.20	56.80	
	FFP2 valve				8	7	
					53.33	46.67	
	FPP3 no valve				7	14	
					33.33	66.67	
	FFP3 valve				3	7	
					30.00	70.00	
	Other type				4	6	
					40.00	60.00	
Recycling mask	No				209	301	0.001*
					40.98	59.02	
	Yes				342	331	
					50.82	49.18	
Washing recycled mask	No				433	523	0.079
					45.29	54.71	
	Yes				118	110	
					51.75	48.25	
Type of gel used on mask	NaClO				32	26	0.822
					55.17	44.83	
	70% alcohol				60	62	
					49.18	50.82	
	Alcohol isopropile				5	5	

(Continued)

TABLE 3 | Continued

N = 1,184		Adverse dermatological reactions to the hands (N, %)			Adverse dermatological reactions to the mask (N, %)		
		No	Yes	p-value	No	Yes	p-value
					50.00	50.00	
	Alcohol gel				10	14	
					41.67	58.33	
	Other				10	8	
					55.56	44.44	
Using face cream	No				326	221	<0.001*
					59.60	40.40	
	Yes				223	411	
					35.17	64.83	
Type of face cream	Soothing				14	142	<0.001*
					8.97	91.03	
	Moisturizers		222		268		
					45.31	54.69	

*Statistically significant value p ≤ 0.05.

previous dermatological illness, time wearing mask, recycling face masks, use of face cream, type of face cream used, age, and gender (**Table 4**). Our results showed a statistically significant correlation between adverse dermatological face reactions and the following variables that acted as risk factors: working with Sars-CoV-2 patients (OR = 2.33, IC = 1.04–5.21, $p = 0.038$), having Acne as a previous dermatological illness (OR = 6.87, IC = 1.13–41.73, $P = 0.036$), using a face cream (OR = 3.99, IC = 1.00–15.89, $p = 0.049$), and being female (OR = 3.63, IC = 1.13–11.69, $p = 0.031$). Using a moisturizer (OR = 0.12, IC = 0.04–0.38, $p < 0.01$) was a statistically significant protective factor for adverse reactions to face masks.

DISCUSSION

Out of the workers who requested health surveillance due to PPE-related reasons, 87.5% had a personal history of dermatological reactions. In 2.11% of healthcare professionals a loss of working days was observed, because a limitation to working activities was established, and one worker was deemed not fit to work. Adverse dermatological reactions to the hands were higher for healthcare professionals who worked in contact with Sars-CoV-2 patients and wore gloves between 3 and 6 h, and lower for workers with a personal history of Acne or Seborrheic Dermatitis. Adverse dermatological reactions to the face were higher for female healthcare professionals, in workers interacting with Sars-CoV-2 patients, in who had Acne, or used a face cream; masks reactions were lower in workers using a moisturizer.

To our knowledge, this is the first study to investigate dermatological reactions caused by PPEs in an occupational health perspective. A personal history of dermatological illness was significantly associated with requesting a health surveillance visit, with missing between 7 and 20 working days and with the profession (being a nurse). Out of the 90 workers who requested

health surveillance for PPE-related dermatological issues, 30 were given limitations to their working activities and one was deemed not fit to work. These results highlight the need to establish a better line of action in preventing PPE-related issues in professionals who already have a dermatological illness, as well as the need to promptly intervene when a dermatological issue ensues to prevent the worsening of cutaneous symptoms and illnesses; this statement is underlined by our finding that a loss of working days due to dermatological issues was observed in 25 workers because the occupational physician deemed the healthcare professional unfit or only partially fit for work.

A review from Spagnolo et al. has highlighted the growing importance of medical surveillance and occupational medicine during the Sars-CoV-2 pandemic (36). As suggested in this review, medical surveillance is essential, and it could be a fundamental instrument in early identification of individual susceptibility to PPEs usage and to prevent the onset of adverse reactions or chronic clinical conditions. Furthermore, medical surveillance could be a useful tool to identify those HCWs who need a targeted training in the use of PPEs, specific for their work tasks and routine.

A study conducted in 2020 by di Altobrando et al. has highlighted a growing problem in dermatological reactions to masks; the researchers proposed a series of precautions to avoid skin reactions, including but not limited to: not wearing fabric masks, not reusing masks, not applying disinfectant gel on the masks' surface, use emollient to prevent skin abrasion, avoid the use of face masks for long periods if pre-existing dermatological conditions are present (37).

Our results are coherent with those of di Altobrando et al., as the preventive measures they proposed are directly in contrast with the risk factors emerged in our study, since adverse dermatological reactions to the mask were significantly higher in healthcare workers with a personal history of Acne or Seborrheic Dermatitis, and lower in those using a moisturizing face cream.

TABLE 4 | Logistic regression analysis for *Adverse dermatological reactions to the hands* and *Adverse dermatological reactions to the mask*.

		Adverse derm reactions to hands		Adverse derm reactions to mask	
		OR	(95% Conf interval)	OR	(95% Conf interval)
Working with COVID-19 patients	No	1	–	1	–
	Yes	2.062	1.18–3.603*	2.336	1.048–5.206*
Previous dermatological illness	Psoriasis	0.401	0.15–1.07	0.909	0.278–2.971
	Eczema	1	–	1	–
	Acne	0.237	0.085–0.664*	6.875	1.132–41.736*
	Seb-derm	0.309	0.117–0.819*	1.847	0.494–6.913
	Other	0.554	0.232–1.325	1.688	0.559–5.096
Time wearing gloves	<1 h	1	–		
	1 < h < 3	1.628	0.54–4.909		
	3 < h < 6	3.027	1.042–8.795*		
	>6	1.823	0.589–5.643		
Times hands washed per day	<5	1	–		
	5 < t < 10	1.622	0.601–4.375		
	>10	2.022	0.776–5.269		
Using hand cream	No	1	–		
	Yes	1.476	0.816–2.672		
Time wearing mask	<3 h			1	–
	>3 h			2.674	0.367–19.494
Recycling mask	No			1	–
	Yes			0.919	0.406–2.079
Using face cream	No			1	–
	Yes			3.994	1.004–15.895*
Type of face cream	Soothing			1	–
	Moisturizers			0.125	0.041–0.386*
Age	21–30	1	–	1	–
	31–40	0.695	0.282–1.716	1.003	0.297–3.388
	41–50	0.874	0.375–2.038	1.005	0.3–3.367
	51+	0.807	0.338–1.926	1.457	0.432–4.916
Gender	Male	1	–	1	–
	Female	0.804	0.391–1.654	3.631	1.127–11.695*

*Statistically significant value $p \leq 0.05$.

We also explored the association between adverse dermatological effect to the mask, and masks reusage or applying disinfectant gel to the mask, but results were not statistically significant.

Daye et al. performed a cross-sectional study on healthcare workers during the COVID-19 pandemic, finding that skin problems were higher in professionals who did not use moisturizers; in their results was also highlighted that the use of PPE increased the severity of a pre-existing dermatological disease and the skin symptoms associated with them, and that skin problems were higher for healthcare workers who used PPEs, in female professionals and nurses (38).

In our study, similar findings emerged: using moisturizers is a protective factor against facial skin reactions to the masks, while these reactions appear to be higher in female healthcare workers and in those who had a pre-existing dermatological condition (i.e.,: Acne). We investigated a possible link between profession and dermatological reactions but our results were not statistically significant.

In our study a consistent result for both gloves and masks was that working in contact with Sars-CoV-2 patients increased the risk of a dermatological reaction. There are studies analyzing the PPE dermatological effect on healthcare professionals during the COVID-19 pandemic (37–39), but prevalence data on this phenomenon is scarce. Guertler et al. conducted a cross-sectional study comparing healthcare professionals working with COVID-19 patients and those who were not, reporting among results that there was no significant difference between these groups (40). In accordance with literature data, our study highlighted that working in contact with Sars-CoV-2 patients was a statistically significant risk factor (37–39); this might be caused by a longer use of PPEs in these workers, as well as by the use of more straining equipment, necessary to ensure the safety of HCWs working in contact with Sars-CoV-2 patients.

Prolonged use of PPEs has been reported to be a risk factor for dermatological reactions, and worsening of skin symptoms is directly correlated to the time PPEs are used

(15, 21, 41). Coherently with these findings, we observed that adverse dermatological reactions to the hands were significantly correlated to wearing gloves between 3 and 6 h per day. The higher rate of dermatological reactions while wearing PPEs between 3 and 6 h might be because HCWs prepare for their shift and maintain their PPEs thorough their workday, and they might not have an appropriate timeframe to safely change their PPEs. An apparent lower risk of dermatological reactions to PPEs in HCWs above the 6 h mark might be due to the fact that these workers have time to change, and the physiologically needed breaks allow them to recover from the harm done by PPEs. Furthermore, workers wearing PPEs for more than 6 h a day might be better trained and informed concerning the proper and comfortable use of PPEs, thus avoiding relevant dermatological reactions. Further research is needed to further evaluate the correlation between PPEs time of usage and dermatological reactions.

The present study had some strengths and limitations. From an occupational health perspective, to our knowledge this was the first study to assess the eligibility of workers and the loss of working days due to dermatological illnesses, therefore contributing to assess the problem of occupational PPEs exposure during the COVID-19 pandemic. Furthermore, our sample was numerous (1,184 participants) and well-distributed concerning age groups, and working vs. not working with COVID-19 patients. On the other hand, gender distribution was not optimal, with females being far more represented in the sample than males; although the sample was numerous, geographical distribution could not be assessed.

CONCLUSIONS

From this study's findings, the need to identify groups with a higher intrinsic risk of developing dermatologic reactions—such as nurses and female workers—during health surveillance visits has emerged, in order to ensure prevention measures are put in place for these workers to avoid the worsening of a pre-existing condition that might lead to morbidity and to the loss of working days. Furthermore, occupational physicians could identify workers subjected to other risk factors highlighted in this study, such as working with Sars-CoV-2 patients, prolonged use of PPEs, and pre-existing dermatological illnesses, in order to better prevent dermatological conditions in healthcare workers with a higher risk. This study can be a starting point for further research into occupational dermatology, to better comprehend which risk factors can be acted upon to prevent dermatologic reactions and loss of working days.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

CP, IP, NS, and PS conceived and design the study and recollected data. IB performed the statistical analysis. MR, MG, CA, and AD drafted the paper. UM and WR supervised the study. All authors contributed to the article and approved the submitted version.

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Influence of Professional Identity on the E-Learning Adaptability Among Chinese Nursing Students During COVID-19

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Background: The traditional face-to-face education methods have been altered to E-learning due to the outbreak, and the E-learning adaptability of nursing students will directly affect the effectiveness of online education. The professional identity of nursing students refers to the positive perception, evaluation, and emotional experience of the nursing profession and identity to be undertaken, which may affect the E-learning adaptability of nursing students during the coronavirus disease 2019 (COVID-19). This study aimed to explore the impact of professional identity on the E-learning adaptability of the Chinese nursing students during COVID-19.

Methods: This study was conducted in three medical schools in Yunnan Province, China from August to October 2020. Data collection consisted of three sections: participants' characteristics, learning adaptability, and professional identity.

Results: A total of 585 nursing students had a moderate level of E-learning adaptability. There was a positive correlation between E-learning adaptability and professional identity ($r = 0.316 \sim 0.505$, $p < 0.001$). In addition, the professional identity was associated with predictors of the E-learning adaptability among nursing students ($p < 0.001$).

Conclusion: There was a moderate level of E-learning adaptability among the Chinese nursing students during the COVID-19 crisis. Enhancing the professional identity is critical in improving the E-learning adaptability among nursing students.

Keywords: computer-assisted instruction, professional identity, adaptability, students, COVID-19, E-learning, nursing

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has spread widely throughout China and the world, which brings lots of challenges to the educational work in institutions of higher learning (1, 2). The traditional educational methods are altered to E-learning because the conventional face-to-face education is considered as an opportunity for the virus to spread. E-learning has been adopted in most colleges and universities to ensure learning from the beginning of the outbreak. In 2020, the Ministry of Education issued a new regulation that colleges and universities should take full advantage of E-learning platforms to ensure teaching progress and quality (3). Since then, E-learning has been widely applied as a vital part of the learning pattern.

E-learning, also known as online education, refers to the use of the Internet, computers, smartphones, and other electronic resources to acquire and disseminate knowledge, such as network education, digital learning, interactive learning, and computer-assisted teaching (4, 5). Compared with the traditional classroom teaching pattern, the network teaching platform breaks the limitation of time and space. However, students need the spirit of independence, initiative, and consciousness in the progress of E-learning. E-learning adaptability directly affects the effectiveness of online education (6). E-learning adaptability is the capacity to adjust behaviors, thoughts, and feelings in response to the variable, uncertain, and unexpected situations and circumstances in the process of online learning. It realizes the changed process of balance between the individual and the learning environment (7). Adaptability is an essential academic and personal development capacity among students (8). The better the E-learning adaptability of students, the better the learning effect (9). Conversely, learning maladjustment may adversely affect their learning efficiency and the occupation prospects for development (10, 11). Nowadays, many universities have recognized the importance of E-learning as a core element of their learning system. E-learning adaptability of students belongs to the middle level of the whole. More than half of students showed low learning autonomy and satisfaction in web-based learning in China (12, 13).

The professional identity of nursing students refers to the positive perception, evaluation, and emotional experience of the nursing profession and identity to be undertaken. It determined the career choice of nursing students and the stability of the nursing team to some extent. The formation of professional identity was a dynamic process for a nurse. It started at the professional education stage and then developed, fluctuated, and accompanied the entire career. The role of nursing students was a crucial period for the formation of professional identity. Nursing students with a stronger professional identity were more likely to remain in their work posts and improve the quality of care in the long run (14–16). However, there is no relevant research on whether the professional identity of nursing students will directly affect their learning adaptability.

So, in this study, we aim to (1) assess the situation of E-learning adaptability and professional identity of Chinese nursing students during the COVID-19; (2) identify the association between E-learning adaptability and professional identity; and (3) determine the influential factors of the E-learning adaptability among the Chinese nursing students.

MATERIALS AND METHODS

Study Design

This study was a cross-sectional study on nursing students enrolled in three medical schools in Yunnan province using the STROBE guideline for cross-sectional studies. All theoretical courses through online learning of this semester during the epidemic prevention and control from March to July 2020. E-learning methods include the live, record, or sometimes both. It involves the online platform of Rain classroom, Tencent Meeting, and Zoom app. It is essential for implementing online

education with computers, virtual reality devices, mobile phones, and personal digital assistants. Institution of higher education has conducted training on the use of the online teaching platform and online collective preparation of instruction to teaching staff. Teachers adjust the curriculum plan in time according to the characteristics of online teaching. The teaching and research section conducts a rational examination and evaluation system for E-learning courses.

Participants

Participants were nursing students enrolled in three medical schools in Yunnan Province. Students who met the following criteria were included in this study: (1) currently studying in the school of nursing; (2) participated in E-learning from March to July 2020; (3) participants had no cognitive impairment or obvious language barriers and provided their informed consent to participate in this study. International students were excluded. Inclusion and exclusion criteria were stated in the content of the invitation to participate link.

Measurement

The questionnaire consisted of three sections: sociodemographic characteristics, learning adaptability, and professional identity.

The sociodemographic characteristics form was designed based on previous studies and the opinion of two nursing specialists, such as age, gender, educational level, residence, household incomes per capita (CNY), duration of classes in a week, preferred teaching method, and network environment.

E-learning adaptability was measured for the undergraduates' learning adaptability questionnaire (ULAQ), and compiled and validated in China by Xu (17). The questionnaire consists of 55 items and two dimensions of learning motivation and learning behavior. Each item was rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (exactly right), such as "1" is poor, "2" is middle and lower, "3" is middle, "4" is middle and upper, and "5" is excellent. Total and two dimensions scores were calculated by taking the average across all items within each dimension. The higher the score, the better the learning adaptability of nursing students. This questionnaire has good reliability and validity. The internal consistency coefficient of total scores and two dimensions were 0.891, 0.789, and 0.864. The correlation coefficient between total scores and two dimensions was 0.783 and 0.893. ULAQ was used to assess the learning adaptability among college students in previous studies (18, 19).

Professional identity was measured using the Professional Identity Questionnaire for Nurse Students (PIQNS), developed and validated by Chinese scholars (20). The questionnaire consists of 17 items, with five dimensions respectively: professional self-image (six items), the benefit of retention and risk of turnover (four items), social comparison and self-reflection (three items), independence of career choice (two items), and social modeling (two items). Each item was rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (exactly right). Total and each dimension scores were calculated by taking the average across all items within each dimension; a higher score indicated a higher level of professional identity. The

Cronbach's alpha and the split-half reliability of PIQNS were 0.827 and 0.842, respectively.

Statistical Collection

As a result of the pandemic outbreak, we conducted a web-based online survey to reduce face-to-face interactions. Therefore, data were collected through a professional online questionnaire platform. After they signed written informed consent, a text message containing the URL of the online survey was sent to all the students. At the start of the online study, we validated our participants by asking them about their major and college. Participant information was electronically encoded for data storage, and the computer of researcher was password-protected to prevent unauthorized access. The system would remind respondents of missing responses before submission, and only full completed questionnaires were allowed to submit. A total of 600 questionnaires were received in this online survey, and 15 invalid questionnaires with incorrect information were excluded. The remaining 585 valid questionnaires were valid, with an effective rate of 97.5%.

Statistical Analysis

All statistical analyses were performed using SPSS Statistics 25.0 (IBM Corp, Armonk, NY, USA). Data were expressed as means $\pm$ SD. We used Kolmogorov–Smirnov to assess the normality of the distribution of continuous variables. Descriptive statistics were used for the participant characteristics of E-learning adaptability and professional identity among nursing students. Independent samples t-tests and one-way ANOVA tests were conducted to further analyze the ULAQ scores by sociodemographic variable. Correlation analysis was used to determine the relationship between total dimensions and each dimension of professional identity and E-learning adaptability. The magnitudes of correlations are classified as follows: ≤ 0.25 very low; $0.26 \leq r \leq 0.49$ low; $0.50 \leq r \leq 0.69$ moderate; $0.70 \leq r \leq 0.89$ high; and $0.90 \leq r < 1$ very high. Multiple linear regression was used to analyze the influential factors of E-learning adaptability. All tests were two-tailed, with a significance level of $p < 0.05$.

RESULTS

Characteristics of Participants

A total of 585 nursing students were included in this study, and the average score for age was 20.17 ± 1.38. Participant characteristics are presented in **Table 1**. Most respondents in this study were women (89.91%) and undergraduate students (52.48%). Approximately 77.09% of respondents live in rural areas, and 63.93% reported a poor network environment. Household incomes per capita (CNY) of respondents mainly were around 1,000–3,000 yuan (57.78%). The duration of classes in a week of most respondents was 15–25 h (38.63%), followed by more than 25 h (33.85%), and <15 h (27.52%). About 70.77% of respondents preferred live as their teaching method in E-learning.

TABLE 1 | Sociodemographic characteristics of the study participants (N = 585).

Variable		N	%
Gender	Male	59	10.09
	Female	526	89.91
Educational level	Undergraduate students	307	52.48
	Junior college students	278	47.52
Residence	Urban	134	22.91
	Rural	451	77.09
Household incomes per capita (CNY)	<1000	145	24.79
	1000–3000	338	57.78
	>3000	102	17.43
Duration of classes in a week	<15 h	161	27.52
	15–25 h	226	38.63
	>25 h	198	33.85
Preferred teaching method	Record	131	22.39
	Live	414	70.77
	Combination	40	6.84
Network environment	Stable	211	36.07
	Poor	374	63.93

Descriptions of E-Learning Adaptability Among Nursing Students

Data shown in **Table 2** clearly illustrated the E-learning adaptability among nursing students. Gender ($p = 0.146$) and household incomes per capita (CNY) ($p = 0.159$) were no statistical significance with E-learning adaptability. ULAQ score was significantly associated with the educational level of respondents ($p < 0.001$), residence ($p < 0.001$), duration of classes in a week ($p < 0.001$), preferred teaching method ($p < 0.001$), and network environment ($p < 0.001$). The highest ULAQ scores were from undergraduate (3.65 ± 0.47), living in urban areas (3.81 ± 0.67), 15–25 h courses per week (3.68 ± 0.41), combination teaching methods (3.76 ± 0.60), and stable network environment (3.58 ± 0.55) among the Chinese nursing students. *Post-hoc* analyses (**Appendix Table 1**) result from the comparison showed that 15–25 h courses per week scored better than <15 h ($p < 0.001$) and more than 25 h ($p < 0.001$), and <15 h scored better than more than 25 h ($p = 0.007$). A combination of both scored better than record ($p = 0.001$) and live ($p = 0.002$). Compared with the record (3.34 ± 0.57), live (3.40 ± 0.46) had higher ULAQ scores, but the difference was not significant ($p = 0.499$).

Correlation Analysis Between E-Learning Adaptability and Professional Identity of Nursing Students

Appendix Table 2 represents the dimensions and total scores of E-learning adaptability and professional identity for nursing students. The average score of E-learning adaptability was 3.41 ± 0.51, including two dimensions of learning motivation (3.34 ± 0.56) and learning behavior (3.42 ± 0.52). The average score of professional identity was 61.60 ± 10.06, it had five dimensions

TABLE 2 | Undergraduates' Learning Adaptability Questionnaire (ULAQ) scores among nursing students with different sociodemographic characteristic (N = 585).

Variable		Mean (SD)	Statistical test	P
Gender	Male	3.50 (0.51)	$t = 1.457$	0.146
	Female	3.40 (0.51)		
Educational level	Undergraduate students	3.65 (0.47)	$t = 13.368$	0.000***
	Junior college students	3.15 (0.42)		
Residence	Urban	3.81 (0.67)	$t = 8.535$	0.000***
	Rural	3.30 (0.38)		
Household incomes per capita (CNY)	<1000	3.35 (0.49)	$F = 1.843$	0.159
	1000–3000	3.44 (0.48)		
	>3000	3.41 (0.61)		
Duration of classes in a week[a]	<15 h	3.35 (0.39)	$F = 55.291$	0.000***
	15–25 h	3.68 (0.41)		
	>25 h	3.18 (0.61)		
Preferred teaching method[b]	Record	3.34 (0.57)	$F = 10.892$	0.000***
	Live	3.40 (0.46)		
	Combination	3.76 (0.60)		
Network environment	Stable	3.58 (0.55)	$t = 5.93$	0.000***
	Poor	3.32 (0.46)		

***Significant at 0.001.
[a]15–25 h>(<15 h) (p < 0.001) and (>25 h) (p < 0.001), (<15 h)>(>25 h) (p = 0.007).
[b]Combination >Record (p = 0.001) and Live (p = 0.002), Live > Record (p = 0.499).
ULAQ, Undergraduates' Learning Adaptability Questionnaire.

according to the ranking of total scores as follow: (1) professional self-image (22.5 ± 4.03), (2) benefits of retention and risk of turnover (13.54 ± 2.88), (3) social comparison and self-reflection (11.28 ± 2.15), (4) independence of career choice (6.39 ± 1.51), and social modeling (7.85 ± 1.60). There was a positive correlation between total dimensions and each dimension of professional identity and E-learning adaptability ($r = 0.316\sim 0.505$, $p < 0.001$), which is shown in **Table 3**.

Factors Influencing the E-Learning Adaptability of Nursing Students

Multiple linear regression analysis is shown in **Table 4**. The E-learning adaptability was a dependent variable. The independent variables included the educational level, residence, duration of classes, preferred teaching method, network environment, and professional identity. These were significant predictive factors on the E-learning adaptability of nursing students ($F = 85.327$, $p < 0.001$).

DISCUSSION

E-Learning Adaptability of Nursing Among the Chinese Nursing Students During COVID-19

With the transformation of teaching methods during the epidemic, the adaptability of online learning of college students

has received extensive attention and research. In this study, the E-learning adaptability of nursing students was at a medium level, based on the total average ULAQ score (3.41 ± 0.51). Similar results were observed with Saudi Arabia (21) and Egypt (22) studies, which indicated that about half of the students showed a positive attitude toward E-learning and had some barriers. The effectiveness of e-learning programs in developing countries scores lower than in developed countries among medical students (23). Developed countries may have built and adapted the technological infrastructure for the transition of face-to-face to digital education. In contrast, developing countries are not fully prepared for the shift. The integration of information and communication technology in teaching and learning is still early in the education systems (24). Arthur-Nyarko (25), DePaul (26), and other researchers also reported that unstable network connections and the lack of computers in homes in rural areas are important factors affecting the progress and quality of online learning. The results are in keeping with our findings that nursing students who live in rural areas and have unreliable network connections have lower ULQA scores. At the same time, undergraduate, 15–25 h courses per week and combination of live and record among nursing students have better E-learning adaptability. There were no significant differences in gender and household incomes per capita. Almaiah (27), Singh (28) reported similar results. However, some suggest that affluent family is an essential factor of E-learning feasibility for nursing students, and women showed a more positive response toward E-learning than men in previous studies (29). Therefore, it is necessary to evaluate further and analyze the influential factors of the E-learning adaptability among nursing students. Based on the analysis results, strategies to improve the E-learning adaptability of students will be formulated.

E-Learning Adaptability and Professional Identity

There was a positive correlation between E-learning adaptability and professional identity, and the higher the professional identity, the higher the E-learning adaptability. In the regression model, professional identity is an essential predictor of E-learning adaptability among the Chinese nursing students during COVID-19. Existing research showed that professional identity and learning burnout were negatively correlated (30). More than 60% of Chinese college students are often unclear about their future career goals and lack active academic participation (31, 32). Students often face difficulties due to the lack of a good learning attitude, such as the lack of self-control and indiscipline when self-isolated at home (33). Therefore, by helping the formation of professional identity in nursing students, learning adaptability will possibly be more developed in them. Professional identity is considered to construct and deconstruct through nursing education continuously (34, 35). It is suggested that colleges and universities pay attention to career guidance of nursing students, improve the online career planning curriculum, and guide nursing students to set up the correct values of career choice in the teaching management process. Additionally, teachers should help students to set

TABLE 3 | The correlation between the E-learning adaptability and professional identity dimensions (r).

Variable	Total scores	Professional self-image	Benefits of retention and risk of turnover	Social comparison and self-reflection	Independence of career choice	Social modeling
Total scores	0.505***	0.453***	0.454***	0.384***	0.425***	0.357***
Learning motivation	0.504***	0.479***	0.468***	0.418***	0.413***	0.402***
Learning behavior	0.445***	0.402***	0.402***	0.342***	0.374***	0.316***

r: Correlation coefficient.
***Significant at 0.001.

TABLE 4 | Multiple linear regression analysis for E-learning adaptability of nursing students ($N = 585$).

Model	Unstandardized coefficients		Standardized coefficients	t	P	95% Confidence interval
	B	Std. Error				
Constant	2.436	0.132		18.510	0.000***	2.178, 2.695
Education level (Ref. = Undergrauate student)						
Junior college students	0.269	0.031	0.264	8.636	0.000***	0.208, 0.331
Residence (Ref. = Urban)						
Rural	−0.253	0.037	−0.209	−6.908	0.000***	−0.325, −0.181
Duration of classes in a week (Ref. = 15–25 h)						
<15 h	−0.054	0.038	−0.047	−1.421	0.156	−0.127, 0.020
>25 h	0.163	0.036	0.151	4.541	0.000***	0.092, 0.233
Preferred teaching method (Ref. = Combination)						
Record	−0.183	0.064	−0.150	−2.851	0.005**	−0.309, −0.057
Live	−0.117	0.059	−0.104	−1.982	0.048*	−0.232, −0.001
Network environment (Ref. = Stable)						
Poor	−0.088	0.032	−0.083	−2.768	0.006**	−0.150, −0.025
Professional identity	0.019	0.002	0.375	11.702	0.000***	0.016, 0.022

$R = 0.736$, $R^2 = 0.542$, Adjusted $R^2 = 0.536$, $F = 85.327$, $p < 0.001$.
*Significant at 0.05, **Significant at 0.01, ***Significant at 0.001.
Ref, Reference.

up the learning goals of professional courses and complete online learning courses in a planned way. On the other hand, it strengthens the cultivation of professional identity among nursing students. Through guiding students to understand the value of nursing work in the learning process, stimulating nursing students demands for academic knowledge, and thus significantly promote the E-learning adaptability of nursing students.

Factors Affecting the E-Learning Adaptability

Previous studies have shown similar findings that the higher the educational level, the higher the E-learning adaptability of nursing students. Lu (36) shows that the higher the educational level, the better the online learning self-efficacy and deep learning level. Undergraduate and junior college nursing students have different self-learning abilities, and different coping styles in solving significant learning problems might be one of the reasons causing the difference in E-learning adaptability. Similarly, Zhao (37) reported that postgraduates have better overall online learning adaptability than undergraduates due to stronger independent innovation thinking and more precise knowledge

needs. Another study found that the learning burnout of junior college students is higher than undergraduate students (35). Therefore, it is necessary to fully evaluate the current situation of the problems and needs encountered by different educational background groups in the progress of online learning and to apply online tests intellectually to teach students according to their aptitude.

We observed that the residence and network environment were essential predictors of E-learning adaptability. Compared with living in the city, limited internet access, such as an unstable network environment and a lack of computers in homes in rural areas, affected the E-learning progress. Students from cities have better availability of Wi-Fi routers and dedicated rooms at home and better proficiency in computer and internet usage than those in towns and villages, which determines the feasibility of e-learning (38). Previous research found that inadequate access to technology, studying materials, and computers can leave students marginalized and anxious, affecting online learning (39). At the same time, students are more satisfied with the teaching method of combination of live and record, which reduces the problem of poor network connection to a certain extent and helps students to after-school review (40). It is recommended that improving

the Information and Communication Technology infrastructure is warranted in the long run. Meanwhile, using and developing the offline curriculum resources is essential in enhancing E-learning adaptability. Colleges and universities should assess the difficulties in E-learning from rural nursing students so that alternate study plans and strategies can be worked out in advance.

It was of great interest to discover that duration of classes can be used as one of the significant predictors in E-learning adaptability. Similar findings to those in a previous study found that most of the students prefer the duration of each class to be capped at a maximum of 45 min, which could be attributed to the maximum attention span, a student can have (41). Previous studies have shown that health issues are more common in those students who have to attend classes for >4 h a day and have long courses. It may result from prolonged exposure to digital gadgets, which is associated with various ailments, such as digital eye strain and cervical spondylosis (42). Therefore, it is crucial that colleges and universities set aside guidelines for online teachings, such as the number of classes per day, length, and break between classes. Time-to-effort optimization and inclusion of practices, such as adopting creative and blended learning will make E-learning more effective.

LIMITATIONS

This study used only quantitative measures rather than a mixed-methods approach. In addition, this study used only self-reported measure tools rather than e-learning proficiency within the concept of successful adaptation, such as learning outcomes. Further exploration adding objective evaluation indicators and using qualitative methods could have acquainted more comprehensive situations to learning about E-learning adaptability among nursing students.

CONCLUSION

Our study identified that the E-learning adaptability of nursing students during the COVID-19 was at a moderate level.

Professional identity played a significant role in the E-learning adaptability of nursing students. Educational level, residence, duration of classes, preferred teaching method, and network environment were significant predictors of the E-learning adaptability of nursing students. The conclusions of this study can provide a reference, which will improve the E-learning adaptability of nursing students and reduce the negative impact.

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 Research Ethics Committee in Kunming Medical University. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

HW and MY contributed to the conception and design of the study. HW undertook the statistical analysis and wrote the first draft of the manuscript. Both authors contributed to manuscript revision, read, and approved the submitted version.

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APPENDIX

APPENDIX TABLE 1 | Multiple comparisons of the one-way ANOVA for E-learning adaptability of nursing students ($N = 585$).

Variable	(I)group	(J)group	Mean difference (I–J)	Std. Error	P
Duration of classes in a week	<15 h	15–25 h	−0.336	0.039	0.000***
		>25 h	0.168	0.055	0.007**
	15–25 h	<15 h	0.336	0.039	0.000***
		>25 h	0.504	0.056	0.000***
	>25 h	<15 h	−0.168	0.055	0.007**
		15–25 h	−0.504	0.056	0.000***
Preferred teaching method	Record	Live	−0.062	0.055	0.499
		Combination	−0.417	0.108	0.001**
	Live	Record	0.062	0.055	0.499
		Combination	−0.355	0.098	0.002**
	Combination	Record	0.417	0.108	0.001**
		Live	0.355	0.098	0.002**

**Significant at 0.01, ***Significant at 0.001. ANOVA, Analysis of Variance.

APPENDIX TABLE 2 | Dimensions and total scores of E-learning adaptability and professional identity ($N = 585$).

Variable	Dimensions	Items	Mean (SD)
Undergraduates' learning adaptability questionnaire (ULAQ)	2	Learning motivation	3.34 (0.56)
		Learning behavior	3.42 (0.52)
		Total scores	3.41 (0.51)
Professional Identity Questionnaire for Nurse Students (PIQNS)	5	Professional self-image	22.55 (4.03)
		Benefits of retention and risk of turnover	13.54 (2.88)
		Social comparison and self-reflection	11.28 (2.15)
		Independence of career choice	6.39 (1.51)
		Social modeling	7.85 (1.60)
		Total scores	61.60 (10.06)

Psychosocial Experiences of Front-Line Nurses Working During the COVID-19 Pandemic in Hubei, China: A Qualitative Study

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Background: A large number of nurses across China joined the anti-coronavirus disease 2019 (COVID-19) front-line in Hubei province, where the local healthcare system faced unprecedented challenges in the early 2020. Few studies have reported the psychological experiences of nurses from other regions who voluntarily participated in the response to the COVID-19 pandemic in Hubei province.

Aim: To describe the psychological experiences of nurses who were involved in the anti-COVID-19 pandemic battle in Hubei province from January to April 2020.

Methods: This was a qualitative descriptive study using purposive and snowball sampling strategies for participant recruitment. Twenty-four nurses were approached and twenty-one of them completed telephone interviews in April 2020. The interviews took an average of 75 min (range 34–140 min). Data were analyzed thematically after verbatim transcription of the interviews.

Results: Our analysis generated three primary themes: (I) Contexts; (II) Psychological responses; and (III) Coping strategies (most participants identified suitable coping strategies including relaxing activities and seeking social support). Participants' psychological responses varied in four phases of the journey through the experience: (i) initiation phase: obligations and concerns/fears; (ii) transition phase: from overwhelmed to increased confidence; (iii) adaptation phase: a sense of achievement and exhaustion; and (iv) completion phase: professional and personal growth.

Conclusion: Nurses had concerns, fears, and faced challenges working on the COVID-19 front-line. However, they were motivated by a strong sense of professional commitment. Most nurses successfully achieved personal and professional growth as they identified a range of coping strategies. Future research is needed to explore the long-term impact of the COVID-19 related working experiences on these nurses.

Keywords: coronavirus disease 19 (COVID-19), front-line, healthcare provider, psychological experiences, qualitative study

INTRODUCTION

Millions of coronavirus disease 2019 (COVID-19) cases have been confirmed since it was declared as a public health emergency of international concern on January 30, 2020, by the WHO. As of 9 January, over 304 million confirmed cases and over 5.4 million deaths have been reported (1). This large-scale public concern exerts unprecedented pressure on healthcare systems and poses physio-psychological challenges to healthcare professionals. As of April 8, 2020, a total of 22,073 confirmed cases of COVID-19 have been reported among healthcare professionals in 52 countries, which aggravated the shortage of healthcare professionals. To alleviate the overwhelmed local healthcare system in Hubei, China, where the outbreak of COVID-19 was first reported, more than 42,600 healthcare professionals (including 28,670 nurses) from across China voluntarily went to Hubei for the fight against COVID-19 by April 7, 2020 (2). Earlier evidence has shown that a great majority of front-line healthcare professionals experienced clinically significant psychological symptoms (3–11). Healthcare professionals who traveled to the other regions in response to COVID-19 pandemic might have a greater risk of developing the aforementioned psychological symptoms due to their extra challenges relating to the entirely new working environment and social isolation (7, 12, 13). An understanding of their psychological experiences is essential to directly support them and to strengthen their capacity to provide a better care in the future healthcare crisis. However, only few studies have specifically focused on this group of healthcare professionals.

Nurses, women, and front-line healthcare professionals, and higher perceptions of risk of infection are the main associated factors for developing psychological symptoms relating to COVID-19 (3, 5, 10, 11, 14). These psychological problems could not only have a long-term effect on their wellbeing, but also decrease their work morality and efficacy, leading to hindering the urgent response to COVID-19 (8). Extant research has shown that healthcare professionals who experienced a more severe degree of psychological symptoms associated with disaster relief activities are more likely to report a job burnout and turnover (15–17). Compared to other healthcare professionals, nurses are more likely to perceive a high risk of infection and develop a post-traumatic stress disorder (PTSD) (10). To date, there are limited studies investigating their psychological experiences of involvement in pandemics, as distinct from other healthcare professionals, although nurses are the largest healthcare professional group and provide care to patients in the closest physical proximity.

Systemic reviews on the psychological impact of COVID-19 pandemics have indicated that front-line healthcare professionals, whose psychological symptoms were not identified and treated appropriately, could have maladaptive responses (e.g., PTSD) (18, 19). With its unpredictability and large infection scale, COVID-19 has the potential to have a deep psychological impact on healthcare professionals. Suicide has already been reported among front-line healthcare professionals providing care for patients with COVID-19 (20, 21). Front-line healthcare professionals can also have positive responses to the psychological impact of COVID-19 (e.g., post-traumatic growth) if they can adapt to the highly challenging events (7, 12). Understanding the psychological responses of the front-line nurses to the COVID-19 pandemic could inform the training, psychological support, and post-pandemic intervention for them. However, extant research has rarely reported the psychological responses of front-line nurses involved in the COVID-19 pandemic.

Therefore, this study aimed to describe the psychological experiences of nurses who were from the external provinces to Hubei and who were involved in the anti-COVID-19 pandemic battle in Hubei between January and April 2020.

METHODS

The study used a qualitative descriptive approach involving individual over-the-phone interviews based on the epidemic prevention and control policy. Qualitative description is widely adopted to gain knowledge from the key informants about poorly understood research questions in healthcare settings (22, 23). We considered this approach suitable for this study because we aimed to seek knowledge on the experiences of nurses involved in the combat against the COVID-19 pandemic.

Sample and Setting

Participants were recruited by purposive and snowball sampling from the existing network of the authors. Eligible participants included nurses who were assigned from the other regions of China to work on the COVID-19 front-line in Hubei, China, between January and April 2020 for no <2 weeks.

Potential participants were approached by the authors *via* WeChat with an explanatory note already provided. Nurses, who were interested in the project, were invited to participate in an in-depth interview. An informed consent was obtained prior to the interview. We purposely selected participants from a balanced background, including gender, the level of education, and work roles and positions, to increase their representativeness.

Data Collection and Analysis

All the interviews were conducted in Mandarin over the phone by three members of the research team in April 2020 and audio-recorded. A semi-structured interview guideline was first developed by the research team, and pilot tested on three nurses. The interview questions were subsequently adjusted based on the feedback from the pilot interviews. All the participants received the core questions 3 days before the interview to allow them to prepare.

The audio recordings of the interviews were transcribed in verbatim in Mandarin by the interviewer, and then proofread for accuracy by other members of the research team. The data were then thematically analyzed using Microsoft Excel in accordance with the Braun and Clarke's (24) six-step approach: (1) being immersed in data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) reporting results. All participant information was de-identified prior to analysis. Data collection and analysis occurred concurrently until reaching saturation.

Two members of the research team, who were proficient in Mandarin, coded the transcripts independently. After the coding emerged, the researcher, who is proficient in Mandarin and English, translated all the codes and some primary extract quotes that illustrated the codes into English. An initial thematic map was developed based on the coding to form themes. Several meetings were held within the research team to discuss and to refine the themes (25).

Ethical Consideration
Ethical approval was obtained from the Ethics Committee of Second Xiangya Hospital of Central South University in China on 25th Feb 2020 (NO.2020007). All participants provided either written or verbal informed consent prior to individual interviews. All interview recordings and transcripts were stored in an encrypted file which could only be accessed by the research team. Confidentiality was maintained throughout the research process.

RESULTS

Participant Demographics
Twenty-four nurses accepted the invitation to participate in the study and three opted out for personal reasons. The remaining twenty-one nurses were interviewed individually (interview average duration 75.1 min; range 34–140 min). Among the 21 participants, 15 voluntarily joined the COVID-19 front-line and six were assigned by hospital authorities. The participants were aged between 25 and 42 years (mean age = 30.7). All the participants had more than 2 years of clinical experience in non-infectious departments (average 8.1 years; range 2.5–22 years), but seven of them had previous experience associated with infectious diseases. The duration they had served on the COVID-19 front-line ranged from 15 to 101 days at the time of the interview, and two participants were still on the COVID-19 front-line when their interviews were conducted (characteristics of participants are in **Table 1**).

Primary Results
Three main themes with four subthemes were obtained: (I) Contexts; (II) Psychological responses; and (III) Coping strategies as follows: (i) self-care: relaxing activities; (ii) peer support: comradeship; and (iii) family support. Participants' psychological responses varied in four phases of the journey through the experience: (i) initiation phase: obligations and concerns/fears; (ii) transition phase: from being overwhelmed to increased confidence; (iii) adaptation phase: a sense of achievement and exhaustion; and (iv) completion phase: professional and personal growth.

Contexts: Concerted Efforts
Healthcare professionals from other regions of China joined the anti-COVID-19 front-line in Hubei province where the local healthcare system faced unprecedented challenges. All the participants perceived that the whole nation was making a concerted effort to combat against the COVID-19 pandemic. For example, the state medical insurance administration in China

TABLE 1 | Characteristics of participants ($n = 21$).

Characteristics	
Ages in years, mean ± SD/median (range)	30.67 ± 4.88/30 (25–42)
Gender	
Female, n (%)	16 (76.2%)
Male, n (%)	5 (23.8%)
Marital status and offspring	
Married with children, n (%)	8 (38.1%)
Married without children, n (%)	5 (23.8%)
Unmarried without children, n (%)	8 (38.1%)
Level of education	
College, n (%)	2 (9.5%)
Undergraduate, n (%)	16 (76.2%)
Master, n (%)	3 (14.3%)
Working experience in years	
Mean ± SD/median (range)	8.07 ± 5.60/7.00 (2.5–22)
Previous experience of infectious disease	
No, n (%)	14 (70%)
Yes, n (%)	7 (30%)
Duty on COVID-19 ward	
Head nurses	2
General nurses	19
Days worked during on COVID-19 ward mean ± SD and median (range)	55.1 (15–101)

imposed a coverage of testing and treatments for COVID-19. The participants stated that the collective spirit of the nation demonstrated our country's capacity and determination to conquer COVID-19 and to protect the people from the infection.

> … *Every province was transporting supplies to Wuhan, like Anhui province sent 300 tons of fresh vegetables to support Wuhan … [Wulinghongguang A company cited] said: "We produce whatever the people need, for example, facial masks, intelligent mobile temperature measurement vehicles, unmanned disinfection vehicles, and unmanned transport vehicles" …. (P15)*

Psychological Responses
The participants' experiences of working on the COVID-19 front-line can be classified into four phases: (i) initiation phase: obligations, concerns, and fears; (ii) transition phase: from being overwhelmed to increasingly confident; (iii) adaptation phase: a sense of achievement combined with exhaustion; and (iv) completion phase: professional and personal growth.

Initiation Phase: Obligations, Concerns, and Fears
Most participants voluntarily participated in the combat against COVID-19 and perceived that it was their moral obligation to join the combat. As nurses, they felt morally obliged to "*heal the wounded and rescue the dying*". As citizens, they felt that they should take on the responsibility of serving their people and their country whenever necessary. For example:

It's (joining anti-COVID19 combat) an instinctive response as a nurse. We have made pledges to heal the wounded and rescue the dying. This is the pledge given by all of us...(P10)

All the participants expressed concerns when they made the decision to join the COVID-19 front-line. Their concerns included lack of knowledge about the disease, risk of infection to self and significant others, and working in an unfamiliar environment, which increased the level of uncertainty among the participants. Feeling nervous and fear were common amongst the participants during this phase. One participant described:

The fear of being infected had always been there. I felt that any of my friends, colleagues or families and myself had a risk of being infected… (P20)

Transition Phase: From Being Overwhelmed to Being Increasingly Confident

In addition to the concerns and fears discussed above, participants felt overwhelmed in the early stage of anti-COVID-19 by unexpected situations. For example, many participants were panicked by the large number of patients waiting for treatment on the first day they started work. A number of participants reported being powerless and unready when they were confronted with the sudden death of their patients and the high levels of distress and fears experienced by their patients. Confirmed cases were isolated in designated wards. They had limited contacts with their families who may also be patients with COVID-19 or even die from it. Provision of psychological support and bereavement services for these patients were also challenging for many of these nurses.

There was an elder patient in our ward. His wife died and his daughter was infected in this epidemic…I don't know how to help him or comfort him… (P6)

Most participants reported that they were gradually becoming more confident with caring for patients with COVID-19 as they had more experiences and received training. The training provided participants with precautionary measures and standard operating procedures that had facilitated their work safety and sense of security. They have confidence in the function of the personal protective equipment and felt secure in it. Some participants also mentioned that their confidence was also increased because the problem with the shortage of personal protective equipment was quickly addressed.

We spent a whole afternoon on learning and practicing the standard procedures of wearing and removing protective suits… The head nurse checked it (protective suit) for us before we entered the ward. I knew I was safe...(P18)

They reported that medical supplies delivered from other regions in China including supportive individuals, industries and home hospitals quickly addressed the shortage of personal protective equipment. This increased their confidence and courage to combat COVID-19.

In the early days, when we were in short supply of protective equipment, many people helped us, including raising funds, to buy protective equipment and endeavored to mail those to us through various approaches...(P12)

Adaptation Phase: Sense of Achievement and Exhaustion

In this phase, most participants found that their efforts paid off as the transmission of coronavirus was gradually contained, which brought them a high level of sense of achievement and job satisfaction. Their efforts also resulted in gratefulness from patients and a harmonious and trusting nurse-patient relationship. Most participants enjoyed the significance and meaningfulness of their efforts and commitment, and some expressed their willingness for future participation.

I felt that the situation was getting better when I saw the number of discharged patients increased every day, which made me feel happy … I feel privileged and proud to join this combat...(P15)

Despite the job satisfaction, three participants, especially those who worked in the intensive care units reported being exhausted by the long-time intensive work. They repeatedly mentioned that the use of personal protective equipment substantially contributed to their workload.

Injection and blood drawing were easy. But it took twice as much time to do these with personal protective equipment… My clothes got often wet after a shift, so I just wanted to lie down when I was back to the hotel room...(P6)

In this circumstance, some participants reported problems with sleeping and irregular menstruation. Many of them wished to win this war with COVID-19 and return to a normal life as soon as possible.

I hadn't had a period for more than 50 days when I was in Wuhan, which was a sign of great stress… (P9)

Completion Phase: Professional and Personal Growth

Most participants reflected that they gained a tremendous professional and personal growth from this combat. For example, many of them acquired new nursing skills. For example, one nurse who had no experience in working in an infection ward or intensive care unit prior to the combat reported that she learned mechanical ventilation.

I accumulated a number of skills and knowledge from this experience, such as how to prevent hospital-acquired infections… how to care for patients with dyspnoea...(P8)

Some participants developed new strategies to provide better quality care for patients. One of the examples was surrogate family, a role played by a responsible nurse of patients for whom the family could not visit them given the high risk of infection. These surrogate families provided multiple support which included replenishment of daily necessities, provision of psychological support, acting as an intermediary

between the patient and the physician, developing individualized rehabilitation plan, and post-discharge follow-up.

> We adopted an approach "surrogate family", so that each patient had a particular relative who looked after his/her daily life as well as treatments...(P6)

Nearly all the participants reviewed the values embedded in nursing practice and reaffirmed the meaning of the nursing profession. They reported that nurses' commitment to the combat against COVID-19 gained a growing public recognition of the nursing profession and further constructed their professional identity and pride. While nurses were considered as heroes, some participants perceived that they only did their job as a nurse.

> Through this anti-epidemic experience, I have a stronger sense of nursing professional identity than I used to. 90% of the first-line healthcare providers are nurses, and it is us who spend the most time with patients...(P16)

Some participants had no experience working in infectious wards or intensive care units and reported that they gained several professional expertise through this combat. They also reported that their communication ability was improved when they collaborated with team members from different specialties or different organizations.

> This is a new team, most of us are from different departments in our hospital and we are also some nurses of [hospital name] … I gradually learn how to facilitate effective communication within the interprofessional team...(P4)

Personal growth was also commonly reported which mainly included strengthened willpower and realization of the importance of health and family. Many of them highlighted that they would hold a more positive attitude toward the future life.

> It is my first time facing so many deaths. I feel that life is so precious...It is really important to enjoy the life and the moment...(P13)

Coping Strategies

Participants actively adopted various coping strategies to relieve stress, including: (i) self-care: relaxing activities; (ii) peer support: comradeship; and (iii) family support. They reported that they successfully adapted to their work environment and did not seek for psychological counseling, although this service was available from a number of agencies *via* hotline assistance.

Self-Care: Relaxing Activities

Relaxing activities were commonly adopted for self-care, such as singing, watching films, reading, doing exercise, and writing a diary. Three participants reported that they learned stress-relieving techniques online. Some participants intentionally avoided receiving information about COVID-19 after work to ensure a high-quality rest.

> I had kept the habit of writing diaries which had helped to sort things out and deal with things objectively… (P10)

Peer Support: Comradeship

Participants predominantly reported that mutual support and encouragement among colleagues made the journey easier, and many regarded their colleagues as comrade-in-arms. They identified that talking with people who shared common experiences could effectively relieve work pressure. In addition, support and suggestions from colleagues who had experienced pandemics could help overcome the feeling of fear.

> We helped each other get dressed in the ward… On the shuttle bus, we often sang together… Some funny colleagues told us jokes… Everyone was trying to create a relaxing atmosphere…(P7)

Family Support

Many participants reported that their family supported their engagement in the anti-COVID-19 pandemic battle even if their families were concerned about their safety. They identified that sharing adequate information about COVID-19 in Wuhan and sharing their work experiences with families was a good approach to relieving family concerns. They reported that family support enabled them to focus on patient care. However, two of them chose to hide the fact that they were involved in the combat from their parents.

> I had video calls with my parents every day and told them about my work and the situations in Wuhan. My parents were assured that I was safe there. For me, talking was a great way of relaxing...(P11)

DISCUSSION

The COVID-19 pandemic has posed tremendous challenges to healthcare providers, especially to front-line nurses. They risked their lives to deal with the unpredictable situation. This qualitative study reported on the psychological experiences of front-line nurses from other regions of China who voluntarily participated in response to the COVID-19 pandemic in Hubei province. The results indicated that concerted efforts of the whole country and a strong sense of professional commitment motivated nurses to participate in the battle on the COVID-19 front-line. Their psychological responses generally experienced four phases from being full of obligation and having concerns and fears at the initiation phase, experiencing a mixture of overwhelming/exhaustion, and increasing confidence/fulfillment at the transition and adaptation phases, to achieving professional and personal growth at the completion phase. We also identified a range of coping strategies adopted by nurses to cope with psychological distress, such as relaxation activities, peer encouragement, and family support.

This study identified contexts that existed throughout all phases. It demonstrated that external factors contributed to the motivation of voluntary participation and positive experience of nurses in the fight against the COVID-19 pandemic. The whole nation united to combat the pandemic that alleviates psychological conflicts issue of the front-line nurses, such as

the conflicts between fear and obligation (26). We found that lack of knowledge and skills, unfamiliar work environments and contents, concerns for family members and friends, powerless feelings, and difficulties in accepting the sudden death of patients were the common sources of concerns and stress among the front-line nurses (27), this is similar with As. As' study demonstrated that there are several sources of distress, ranging from fears of COVID-19 transmission, clinical challenges, and perceived lack of control, to concerns about family and home life (11). But the strong national backup force motivated them to go to Wuhan without hesitation, which is in line with our findings that nurses in this study more commonly had positive experience than negative experience, and this is consistent with Liu et al. (7).

This study identified four dynamic phases of the psychological experience of front-line nurses who voluntarily participated in response to the COVID-19 pandemic in Hubei province from other regions. Of the four phases, the phase of adaptation was not fully revealed in previous studies. The four phases of psychological experience were not always sequential, and some experience may be presented across multiple phases. For example, the sense of responsibility and concerns exist in all the four phases, and the sense of exhaustion occurred in both the adaption and completion phase but the specific features varied. This study also illustrated the gradual decrease of negative psychological experiences and increase of positive psychological experiences of nurses with their time of involvement grew, consistent with a previous study, the psychological experiences of anti-COVID-19 nurses in Hubei evolved perception such as obligations, concerns, fears at the initial stage of anti-COVID-19 pandemic (28). Similarly, a previous study found that anxiety was prevalent among health care staff during the MERS-CoV epidemic (29). Nurses in our study reported that they had concerns about working conditions, such as lack of adequate protective equipment and knowledge. Our findings of the study are supported by other research which declared that front-line healthcare providers have felt negative and complex emotions in the earlier stage of the pandemic (30). As the nurses received more training and support, they gained more experience and confidence. Through the results of this study, it is necessary to establish an effective communication and support mechanism for front-line nurses, such as the allocation of adequate protective devices and materials, and humanistic care for the families of front-line nurses, especially, there are vulnerable groups in their family, such as the elderly, children, and the disabled. group. Our study demonstrates that self-adjustment is useful in coping with stress, and an increasing psychosocial support is an important way to support the patients, which is congruent to a previous study (31).

In order to better support the patients and help them establish confidence in overcoming the disease, a number of front-line nurses play the role of "temporary family member" to their patients. This role required nurses to care for patients as both healthcare professionals and family members, including use of medicines, psychological counseling, health education, rehabilitation guidance, and support of daily living activities. The role of temporary helped nurses strengthen humanistic care, awaken the power of love, empower patients and health

providers' courage to fight against COVID-19. For the majority of nurses, fears and concerns in the initiation phase were gradually replaced with positive perceptions and attitudes in the transition phase. In the adaptation phase, several front-line nurses also feel fatigued and overworked but also gain increased job satisfaction and a sense of achievement.

Our study showed that front-line nurses used various coping strategies to relieve stress. After the outbreak of the epidemic, the medical staff actively fought on the front line, but they are also faced with a heavy workload and psychological burden. Firm comradeship established which dispel the fear of COVID-19; WeChat workgroup communicates in real-time, timely answer doubts, give rapid treatment, relieve the anxiety of healthcare providers, and enhance their confidence in work. Furthermore, based on our results, family support helped nurses to fight against stress and fear. Similarly, it has been indicated that nurses have received psychosocial support from the government, from social environment, and from their families during the COVID-19 process and that they have expressed their emotions and feelings regarding the epidemic by keeping diaries (8). Therefore, a sound social support system for nurses should be urgently called for an establishment. The needs of the front-line nurses should be cared for by the government and by the society, including psychological and living needs and living needs. It follows that social and peer supports are crucial to promote the positive psychological experience of front-line nurses.

As the pandemic occurs abruptly, and the life of the majority of the population has been affected worldwide, the result of our study is the first study that specifically focused on the nurses who were the first wave of the anti-COVID-19 heroes in the rescue of the first epidemic center—Hubei province, so understanding of their psychological responses will facilitate a better psychological preparation of future epidemic rescue team.

However, this study has some limitations. It may not be able to represent the entire population of the front-line nurses in this combat, and, therefore, limit the generalizability of our findings. Additionally, most nurses were interviewed after completing their rescue tasks, whose responses to our questions were likely to be different from those who were still in fight against COVID-19 because of the environment change and recall bias.

The interviewee recruitment methodology of "looking for interview volunteers" might result in selection bias toward the nurses who coped better with the situation. While the interviews had been conducted to the observed data saturation, our findings can well-represent the situation of the involved nurses and explore the psychological experiences and coping strategies of the front-line nurses in more details for the future, and a larger sample research laid a good foundation. In this study, we did not obtain an additional qualitative information from the nurses; in the future, researchers should consider that, in order to have richer descriptions.

CONCLUSION

Nurses had concerns, fears, and had faced challenges working on the COVID-19 front-line. This study generated three primary

themes: (I) Contexts; (II) Psychological responses, and (III) Coping strategies. Participants' psychological responses varied in four phases of the journey through the experience: (i) initiation phase, (ii) transition phase, (iii) adaptation phase, and (iv) completion phase. Nurses were motivated to be engaged in an anti-epidemic work because of their strong sense of obligation, although they had concerns, fears, and had faced challenges working on the COVID-19 front-line. A range of coping strategies was identified to deal with these challenges, most nurses successfully achieved personal and professional growth. Future research is needed to explore the long-term impact of the COVID-19 related working experiences on these 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 author/s.

AUTHOR CONTRIBUTIONS

JW, YZ, JD, QC, JJ, and CH made substantial contributions to conception and design, acquisition of data, analysis, and interpretation of data. JW, YZ, and JD involved in drafting the manuscript or revising it critically for important intellectual content. JW, YZ, QC, JJ, and CH given final approval of the version to be published and should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. JW, JJ, and CH agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

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A Qualitative Study of Health Workers' Experiences During Early Surges in the COVID-19 Pandemic in the U.S.: Implications for Ongoing Occupational Health Challenges

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Background: Health workers (HWs) have faced significant threats to physical and psychological health during the COVID-19 pandemic. The recent surges associated with the spread of the delta variant in the U.S., coupled with political resistance to effective public health mitigation strategies, indicate that the risks experienced early in the pandemic are not likely to abate soon. This study sought to better understand the experiences, thoughts, concerns, and recommendations of HWs during one of the first major surges in the U.S. and to explore how these experiences might inform efforts to mitigate potential ongoing COVID-related negative health and psychological impacts on HWs.

Methods: HWs were recruited using a multi-faceted approach tailored to public health mitigation guidelines. Semi-structured interviews were conducted via video conference with front line HWs, support staff, and opioid use disorder service organization providers between April 1 and July 9, 2020 using the Social-Ecological Model as a framework. Interviews were audio-recorded and professionally transcribed; transcripts were analyzed inductively and deductively using thematic analytic methods, generating major themes and subthemes.

Results: A total of 22 HWs participated in the study; 14 were female; 3 identified as a member of a racial or ethnic minority population. Major themes identified included: (1) Institutions, Infrastructure, and the Pandemic; (2) Working Under Fire; (3) The Political Becomes Personal and (4) Hope. Themes and subthemes explicated the ways in which phenomena at personal, interpersonal, community, organizational, and societal levels affected HWs experiences and suggested potential mechanisms through which negative effects on HW mental health and health may be mitigated.

Conclusions: Previous global infectious disease epidemics have had profound negative effects on HWs' health and mental health. This study suggests the potential for similar

negative impacts that may be exacerbated by the U.S.'s current sociopolitical milieu. Efforts to systematically describe and quantify these effects and to intervene to mitigate them are warranted.

Keywords: health worker, COVID-19, occupational health and safety, qualitative, mitigation

INTRODUCTION

As of September 9, 2021, COVID-19 had sickened more than 222 million people globally and killed more than 4.6 million (1). The U.S. currently has one of the highest number of cases per 100,000 people in the world and despite having only 4% of the world population, has accounted for an estimated 14% of deaths worldwide (2). New York and Massachusetts experienced major surges in COVID-19 cases in the early days of the U.S. pandemic when little was known about the virus's infectivity, its range of clinical manifestations, or effective treatments. The U.S.'s lack of public health infrastructure and the absence of a coordinated federal government response left state governments and health care systems struggling to procure personal protective equipment (PPE), reliable diagnostic tests, and testing supplies. Health systems and health workers (HWs) had to rapidly develop and test new clinical protocols and learn how to function in the face of great uncertainty. These and other challenges placed a substantial strain on health systems, service organizations, and their HWs. Failure to achieve widespread acceptance of effective mitigation strategies such as masking, social distancing, and vaccination, has led to multiple subsequent surges, extending the strain on health systems, service organizations, and HWs.

Studies of previous global infectious disease epidemics showed significant health and mental health consequences for HWs (3–6). A highly publicized suicide of a New York emergency medicine physician on April 26, 2020 was an early warning sign that the COVID-19 pandemic might also have serious consequences for HWs' mental health (7). Although there is currently no systematic approach to calculating the number of excess deaths among HWs related to COVID-19 in the U.S., a report by the National Nurses Union in September 2020 suggested that the excess HW deaths due to COVID-19 was more than 1,700 (8). The Kaiser Health Network, in partnership with The Guardian, has been tracking the number of COVID-19-related HW deaths, estimating ∼3,176 excess deaths by mid-January 2021 (9), a number believed to be a substantial undercount due to the lack of robust tracking systems. Some of the earliest studies of the mental health impacts of the COVID-19 pandemic on HWs took place in countries such as China that experienced high infection rates in January and February, 2021. Relying primarily on survey data, these international studies suggested that HWs were experiencing increased rates of depression, anxiety, post-traumatic stress, and burnout (10–15). U.S.-based studies on the impacts of COVID-19 on HWs have largely consisted of surveys focused on mental health and have also demonstrated increased rates of depression, anxiety, and substance use (16, 17).

Prior studies of HWs during the COVID-19 pandemic have provided important descriptions of the potential negative impacts of the pandemic on HWs' mental health. However, a more nuanced understanding of HWs' experiences during the pandemic, including the potential ways in which institutions and social phenomena may affect their experiences, is needed to be able to decrease the occupational risks experienced by HWs for approaching 2 years. This qualitative study aimed to address this gap in knowledge through interviews with U.S. HWs' across multiple health sectors during the earliest surges in the U.S.

METHODS

Theoretical Framework

Although there were no empiric data on the effects of the COVID-19 pandemic on HWs when this study was undertaken, the SARS epidemics in China and Hong Kong suggested that HWs could be at risk for pandemic-related mental health sequelae (3–6, 18). The existence of the prior experiences provided a rationale for using both inductive and deductive approaches to studying HWs' COVID-19 experiences. The Social-Ecological Model (SEM) served as the theoretical framework for the study (19) and data collection and analysis were structured to allow for new theory to emerge (20). We selected the SEM because it posits that human development and behavior are influenced by nested individual, interpersonal, community, organizational and broader societal levels of influence. The model has been used extensively in public health and health care as an explanatory model and as an intervention framework. Part of the model's applicability for this study lies in its reflection of the nuances of complex systems of human health. The earliest days of the COVID-19 pandemic suggested that geopolitical, national and state governments, health care systems, community and individual factors would shape and be shaped by the pandemic. The SEM's inclusion of interrelated micro-, meso-, and macro-level social constructions makes it an apt theoretical framework for exploring nuances of HW's experiences with the COVID-19 pandemic.

Study Population and Recruitment

HWs participated in semi-structured interviews conducted via Zoom between April 1 and July 9, 2020. HWs were defined broadly as nurses, medical assistants, clerical staff, janitorial and food service staff, social workers, physicians, pharmacists and pharmacy technologists, psychologists, and community-based substance use service providers to be able to capture a broad range of experiences. A multimodal approach to recruitment was used in response to restrictions related to COVID-19 and anticipation that health workers might have limited availability. The first wave of recruitment included a convenience sample of HWs who were known professionally or personally by research team members and who worked in states experiencing

current or recent surges. In the second wave of recruitment, leaders of a community-based coalition of organizations that provide services for people with opioid use disorder (OUD) in Massachusetts partnered with the research team to send an invitation to members on its list serv. One of the 16 people recruited during the first phase ultimately was unable to participate in an interview because they were too busy. Seven were recruited in the second wave; the total number on the list serv was not known. All interviewees were also asked to suggest additional HWs to interview (snowball sampling) (21) and three of the participants were recruited through this method. A letter of invitation that included the purpose of the study, details of what would be asked of participants, and contact information for the investigative team was sent via email with an attached consent form that was reviewed with participants at the start of interview sessions. Zoom interviews were scheduled at a mutually agreed upon time. The study was approved by the University of Massachusetts's Institutional Review Board.

Interviews

A semi-structured interview guide was developed and pilot-tested for clarity and completeness. Question development was guided by the five SEM levels (individual, interpersonal, community, organizational, societal). The interview guide consisted of open-ended questions with probes related to key areas of interest, including the personal effects of social distancing/quarantine, family and community effects, organizational factors related to the participants' experiences, trusted sources of information, opinions regarding government responses, and positive impacts of the pandemic. The interview guide was amended in an iterative process to add probes as new concepts emerged during interviews. Interviews were conducted by SG, who has extensive experience with qualitative research methods (22–28) including studies in which she trained and supervised students and research assistants, as she did for the current study (KW, MF, NP, EC, and KC), and KC. Interviews were conducted via Zoom using audio and video in compliance with social distancing and travel restrictions in Massachusetts at the time. Interviews were conducted until data saturation was reached, defined as no new concepts emerging over three consecutive interviews, and achieved after ~16 interviews. Between 20 and 30 interviews were estimated to be needed to achieve data saturation based on the homogeneity of work setting among participants and the narrow focus of the study. This estimate was based on recommendations in methodological texts and papers as well as publications of similar studies.in journals with high impact factors (29–32). Interviews were audio-recorded and professionally transcribed verbatim and field notes were taken during the interviews.

Analysis

Interview transcripts were analyzed using thematic analysis, applying a validated rapid analytic technique (33). This approach was utilized because it has been identified as an important method for research questions that address rapidly changing health and public health risks, such as those presented by the COVID-19 pandemic. Four members of the investigative team

(KC, MF, EC, NP) reviewed a subset of the transcripts to familiarize themselves with the interview content. SG generated a template of broad themes derived from the interview questions for the first phase of the analysis; an open category was included on the template to allow for inclusion of concepts that may have fallen outside of either the structured portion of the template or the theoretical framework. Using a deductive approach, analysts each read a subset of the transcripts and identified key concepts which were entered on a separate form for each transcript. With supporting quotations. SG independently analyzed one of each of the other analysts' transcripts to assess agreement; differences in key concepts were resolved through discussion with the full team. In Phase 2 of the analysis, SG identified unifying themes across the key concepts identified in Phase 1 and applied an inductive approach to theorize connections between SEM levels. These unifying themes and connections were discussed with the full team and revised based on discussion, resulting in a comprehensive set of major themes and subthemes. A summary of themes was sent to participants for review and comment (member checking). During the analysis, reflexivity was considered and discussed. Considerations included that SG is a HW (primary care pediatrician and internist), a parent of school-aged children, and teaches an undergraduate-level elective on the U.S. opioid epidemic. EC, MF, NP, and KW had SG as a professor in an elective course in the spring semester of 2020, KC was a master's student advisee of SG's, and MD is an undergraduate research assistant working with SG.

RESULTS

Of the 22 HWs interviewed, 14 identified as female; 1 as Black, 2 as South Asian, and 18 as Caucasian/white; 7 were physicians and 6 worked in organizations serving people with opioid use disorder (OUD) (**Table 1**). Concepts pertinent to the study's aims were identified at all SEM levels. Major themes are organized beginning with the outermost context of the SEM (Societal), such as government and state responses,

TABLE 1 | Participant demographic characteristics.

Characteristics (N = 22)	n (%)
Average age (range)	47.6 (21–74)
Self-identified gender	
Female	14
Male	8
Self-identified Race/ethnicity	
Caucasian/White/Western European	18
South Asian/Asian American	2
Black/African American	1
Not reported	1
State	
New England (Massachusetts and Rhode Island)	18
New York	3
Colorado	1

and moving to the innermost (Interpersonal and Personal), such as impact on families, with a final broad theme. The interconnectedness of the SEM levels means that subthemes for each major theme often touch on multiple levels. Major themes included: (1) Institutions, Infrastructure, and the Pandemic (Societal level); (2) Working Under Fire (Organizational, Community, Interpersonal, and Personal levels); (3) The Political Becomes Personal (Interpersonal and Personal levels); and (4) Hope (Societal, Organizational, and Community levels). Major themes and subthemes are described in detail below with supporting quotations. Additional quotations are located in **Table 2**. Participants' roles in the health care system and a unique study identifier are included in parentheses after quotations; additional details were not attributed to quotations to protect participant confidentiality.

Theme 1: Institutions, Infrastructure, and the Pandemic

Many HWs commented on the role of institutions and infrastructure in combatting the pandemic. The phenomena described in this theme were located primarily at the SEM Societal level. Subthemes included: (1) Federal, and State Government Responses: Coordination Confusion; (2) The Syndemic of Misinformation; and (3) Rules of the (Capitalist) Game. Included in these subthemes are perspectives on how international and domestic political and public health institutions shaped the early arc of the pandemic, and how institutions' responses shaped HWs' and others' perceptions of the institutions. Some HWs discussed the role of social media and the press in the pandemic response. Many HWs felt the lack of public health infrastructure impacted HWs' experiences early in the course of the pandemic and reflected on institutional failures in response to the pandemic.

Federal and State Government Responses: Coordination Confusion

A small number of HWs felt that the problems the U.S. was experiencing in its pandemic response were inevitable:

> "I don't know that this could have been avoided… I don't really have a lot of criticism of the government right now." (Nurse practitioner, RJ3)

Most HWs felt that the federal government's response to the pandemic was inadequate and a major contributor to the rapidly worsening state of the pandemic in the U.S.

> "… it seems pretty clear that it's [federal government response] not been coordinated… not been systematic. It's been seemingly random, at times brutal, at times… unjust… lacking compassion…It's frustrating to see… states are having to design their own disaster plans, because the power of the federal government is to align disaster response across states… instead, we've got a hodgepodge." (Hospitalist, SG1)

One HW with knowledge of the federal government's disaster preparedness programs was puzzled as to why prior plans for such a pandemic were not being implemented.

> "It has been very… hard for me to understand… what came of all the [preparedness] programs... and whether or not they [agencies responsible for programs] were allowed to [be involved in decision-making], during what most people would call the Superbowl [of pandemic preparedness]. We've been talking about it for decades… We have a disinterested health care system. You have a totally underfunded public health system… the knowledge around the pandemic… exists in the military and the National Security Council. It does not exist in health departments." (ED physician/administrator, SG2)

Some HWs noted and worried about the loss of trust in the federal government, including agencies such as the Centers for Disease Control and Prevention (CDC).

> "… the erosion of faith in federal leadership and the ability to believe what the CDC was saying…, to believe that there would be an organized response… it is unconscionable and it's impossible for me to get my head around the damage that it has done forever." (ED physician, SG3)

In comparison, although some HWs also felt their state governments could have instituted lockdowns sooner, most felt that their governors and state governments had stepped into the leadership void to provide clear, science-based, public health messaging and leadership.

The Syndemic of Misinformation

> "… we've got this, like, false information pandemic." (ED physician/researcher, SG6)

Some HWs felt that it was difficult to obtain reliable up-to-date information about the pandemic due to the rapidly evolving state of knowledge about COVID-19. Others felt the volume of rapidly disseminated misinformation was problematic.

> "We sort of have this infodemic…the big examples...are…ACE inhibitors and Ibuprofen… and the hemoglobin hijacking theory… All these things start and then they get amplified by social media." (ED physician/researcher, SG6)

HWs described some of the reasons they did not trust certain sources of information.

> "When you have some big personalities… telling people that this is the way to do things and if you're not… you're wrong and you are killing people… when you start… speaking in absolutes… I start to… lose… respect for you as an authority… I worry that their concern is about public image and not so much getting the right answer." (ED physician, SG8)

Social media was generally seen as unreliable because of the lack of its lack of scientific rigor.

> "I use Twitter professionally... and I actually shut it off about two or three weeks into COVID because I was...going to bed [and] I'm looking at Twitter and reading about … this person died and that person died... it was good for me to absorb...what was going on. But

TABLE 2 | Selected supplementary illustrative quotations.

Themes and Subthemes	Illustrative Quotations
1. Institutions, infrastructure, and the pandemic	
Federal and state government responses: coordination confusion	I think the federal government's response has been very concerning. We started with a government that didn't believe in science and I don't think we should be surprised that this government's biggest challenge is science-based… it's painful to watch the federal government not understand science, not listen to scientists, and then [try] to address what's going on. (ED physician/researcher, SG7)
	I was absolutely shocked when I found out that the CDC and the WHO were not on the same page with wearing masks. … They were giving basically opposite... recommendations. And... I was shocked. I mean they're both organizations that I have extremely high regard for, and I couldn't believe that they were giving differing viewpoints on mask wearing for COVID. (OUD treatment services manager, KC1)
The syndemic of misinformation	I think one of the major missteps is giving medical advice if you're not in an actual position [to]. So, for example the hydroxychloroquine azithromycin, or as Trump called it, H and A on Twitter. Recommending that based off of six patients who got the combination in a non-controlled study… these things come up on a daily basis where… government officials are giving advice that is beyond what they should be giving… (ED physician, SG6)
Rules of the Game	The government is not going to make [COVID-19] tests, right?... So whether you use the Defense Production Act or not, whether or not you say the right things and create the incentive structures [matters]…a strategic level will make the private sector do what the private sector does... form follows finance. (ED physician/administrator, SG2)
2. Working under fire	
The myth of the health worker hero	Some people are saying that none of this is true, they're making it more of a big thing than it really is… but… we do have a very bad virus out there that's very contagious… every day a lot of people are dying. (Physical therapist, MF3)
	… the people [HWs] are putting their lives on the line. And I think society and our federal government colludes with [belief that HW should be expected to take on all risks]… We [HWs] don't make a decision when we enter medicine to throw our lives at risk. We make a decision to… take care of our patients and do our best. We don't sign an oath to torture ourselves for other people 'cause it… doesn't work… that is a total delusion and it's a misconception. And I think we're learning that through this. It doesn't work. (Psychiatrist/researcher, SG9)
Changes in clinical practice	So it's been really cool seeing how… we can if we need to change by the hour, or minute by minute or day by day…we could do it…I never felt like we were losing control of the ship. (ED physician, SG8)
Organizational leadership	… it almost feels like there's more of an expectation [from supervisor] to get all of your work done and more… I'm being asked to do... random projects, collect data for random reasons. (OUD treatment services manager, KC1)
Work-related worry, fear, and loss	…at my place [nursing home], they [supervisors] are against testing people [residents in the nursing home] it's like they don't want to be branded as the COVID home that has patients with COVID… [If a nursing home worker tests positive] as long as we are asymptomatic… we can go to work… yup, they won't make us quarantine." (Physical therapist, MF3)
Vulnerable populations	I think the biggest thing with all of this is not even in my little home here, but it's all these people losing their jobs and not putting food on the table. I mean that's the stuff that really scares me. (Nurse practitioner RJ3)
	… [COVID-19] exacerbated … homelessness… I think some people who are … unstably housed or … couch-surfing, … people are … [saying to them], "no, … you can't stay in my house anymore because I'm worried about … [getting COVID-19]. (OUD treatment coordinator, KC3)
	I do a lot of work connecting with the jails and working with people … getting out.... there were more people getting out, and that … made people very vulnerable, … especially if you're having to leave jail, and you're going in the street. I mean, are you better off [out of jail during pandemic]]? I don't know. (OUD treatment program director, KC4)
Foregone care	… [in] EDs all over the country, the volume is way down except for COVID. And there's this sort of constant conversation, that's like, 'Where are the heart attacks?' Like people are just hanging out at home with their heart attacks… we all have stories of people who are in severe pain and wait days and days and days and then finally come in and they are so far along in their disease process that it makes it much, much harder to treat them or save them… (ED physician/researcher, SG7)
Loss of personal connection to patients	… addiction is a disease of isolation, and people need face-to-face. Zoom is fine, and it serves its purpose, but it's not the same as sitting a few feet away from someone who's listening to you intently and understanding where you're coming from. (OUD treatment coordinator, KC7)
	I know that being a patient and not being able to see your nurse or doctor's face under all of that equipment is also emotionally scarring. (Pharmacy technician, EC3)
3. The political becomes personal	
Health workers as a threat to the public's health	… it occurred to me that if people who were socially isolated right now who are not working in health care wanted to all get together, they could really do that… if you've been legit isolated for five weeks, go have a party with people who have been legit isolated… but I can't come to your party. (ED physician/researcher, SG7)
An emotional toll	… most of the people that I work with have been having lots of anxiety... at night… we all feel like we are coming down with it… we'll feel like we have to clear our throats… like you're going to cough. You feel the same sense of anxiety like you are coming down with it. (Medical records staff, MF5)
	…it's like a roller coaster… there will be times when you just feel normal, and then there's other times when you're worried about the end of the world… and then there's other times where you're just despondent because you don't know what to do next. (ED physician/researcher, SG7)
Family: disruptions and silver linings	... I think the good thing about it being home with them [children] has been that...I can understand what's happening in their lives at school in a very different way than I ever have before… I knew what was happening but being at home seeing that pattern has been extraordinarily different because… I just get him [son] more. (Psychiatrist/researcher, SG9)

now I just shut Twitter off... because I'm like, 'This is not helpful to me'... it was too anecdotal." (Psychiatrist/researcher, SG9)

Many physicians relied on peer-reviewed journals and their medical societies for up-to-date accurate information. However, several also expressed concern that the quality of the studies published and the lack of understanding about "preprints" (papers reporting results of studies that have not been peer reviewed) were problematic.

"It's been an interesting time in research because part of the [misinformation] problem are these preprint servers... they're not peer reviewed... I see many go straight through to other journals without significant changes even though there should be... it's a reminder that research is very much flawed..."(ED physician/researcher, SG6)

Rules of the (Capitalist) Game

One HW contrasted health care and public health systems' financial models and cultures, in the context of trying to understand the federal government's response.

"Public health just doesn't really have a business model. It has a budget. It comes to them from tax dollars,...or grant... and health care does not think like that... within public offices, especially at the federal level, the ... the understanding of how corporate health care is, is shockingly absent. Public sector folks come from public health departments. They're like do-gooders... and I say 'Have you ever been inside a hospital... ever... had to cut budgets because you wanted to maximize margins to recruit a high-powered neurosurgeon?' and they're like, 'What are you talking about?'" (ED physician/administrator, SG2)

Some HWs felt that the U.S.'s capitalist political economy was not structured to mount an effective response.

"... because there was no coordinated federal response, we were bidding against other hospitals, bidding up the price of PPE... in this super dysfunctional way... there are times when capitalism really doesn't work and this is one of them." (Hospitalist, SG1)

"One thing that bothered me was that we had this big meeting... where he had all the different CEOs of different companies come on and talk about what they were going to do. It felt like such a capitalist take." (Pharmacy technician, EC3)

Another HW felt, similarly, that the U.S. response was what one would expect based on institutional structures.

"Don't hate the player, hate the game – I see most of us, all of us, as just responding to the rules of engagement and the incentives that are outlined for us, right?... You can bellyache about how the rules of the game are not what you wish they were or you can try to rewrite the rules of the game." (ED physician/administrator, SG2)

Theme 2: Working Under Fire

HWs discussed changes in their work since the surges began and the work-related challenges that they faced. Subthemes included: (1) The Myth of the Health Worker Hero; (2) Changes in Clinical

Practice; (3) Organizational Leadership; and (4) Work Related Worries, Fears, and Loss. This major theme described HWs experiences that illustrated the toll the pandemic, government response, and citizens' behaviors was taking.

The Myth of the Health Worker Hero

A few physicians expressed frustration with society's framing of HWs as "heroes" and the unfair expectations they felt society had of HWs:

"I'm gonna say that this [public applauding of HWs] has been seen as a positive... I think it's a really big negative. This whole... hero worship thing. I think it's nice that people are appreciating their nurses and their doctors and their health care providers... but I also think that this is sort of the problem... we just expect people [HWs] to fix things. We want a hero to come with their superpowers and just make it all better... we were telling people to stay home if you're sick... just wash your hands... and we got to a point, nobody wanted to listen and we have this whole, consequence because of it and now, we want our [HW] heroes to come in and clean up our mess. It just doesn't work that way. It just doesn't." (ED physician, SG8)

"I'm thinking about this one tweet. Early on, a nurse said she was taking a break from her job because she had an underlying health condition... People were attacking her, being like, oh you signed up for this. Yes, she signed up to care for people but under the caveat that she'd be provided the proper PPE and she wouldn't have to risk her own life." (Pharmacy technician, EC3)

Some HWs also were puzzled, frustrated, or upset by factions of the public claiming the pandemic was not "real" and that people were not taking the pandemic seriously.

"To see others not treating it [COVID] as a threat is disrespectful to not only... my family [who are HWs], but other workers and essential workers." (Pharmacy technician EC3)

Changes in Clinical Practice

"It's completely disrupted our normal way of practicing medicine." (ED physician, NP1)

When HWs talked about their experiences at work, much of the discussion centered on positive aspects of their experience and solidarity among coworkers. There were recommendations for continuing some of the changes in clinical practice and hope that they would result in long-lasting improvements.

"[I] think that our teamwork in the ED is always fantastic... techs, nurses and EMS... but right now... we have a super appreciation because you're in a PPE room... and you have to do everything... to kind of spare people [co-workers] having to come in... I think that culture of collaboration, which we typically have been good at... is even enhanced and I would like to see that go forward." (ED physician/researcher, SG6)

Some also discussed support from the community.

"… I know that a lot of local universities as well as hotels have been offering their spaces for health care workers that don't want to stay at their homes… to prevent transmission." (Pharmacy tech, EC3)

Some HWs welcomed the increased use of telemedicine and the flexibility it provided,

"…[telemedicine] takes away…all these other barriers… people have huge transportation issues and can't get to their appointments or they don't feel like rolling out of bed and leaving their house to take… a half-hour bus ride to come here to see their therapist. They can actually have a conversation with their therapist while they're lying in bed. I mean people who are depressed, who are agoraphobic, who have anxiety leaving the home, … [telemedicine] takes away all of that." (OUD treatment services manager, KC1)

while others felt telemedicine presented new challenges and potential inequities in care delivery.

Organizational Leadership
Several HWs discussed how the response of leadership in their hospitals or organizations affected their experience with the pandemic surge. Some comments were positive,

"The director is a very passionate but very direct person, a very practical person. Her supervision style has completely changed through this to be much more in tune with how the employees are doing mentally, much more in tune with our self-care, telling us it's okay to say no." (OUD treatment coordinator, KC7)

and some were negative.

"They [workplace supervisors] are like, '… you're not gonna wear N95 masks. You don't need to wear it.' Really? Okay. Tell that to the nurse who didn't wear an N95 mask and ended up with COVID." (Hospital-based social worker, MF2)

"… they [administrators] were… mandating things that weren't feasible and forcing employees to … not do something because it wasn't really possible … [or] be insubordinate in order to actually do their job. … people who work in administration don't want to defer to people who do the actual work." (OUD treatment coordinator, KC3)

Work-Related Worries, Fear, and Loss
HWs shared a broad range of work-related concerns in relation to the pandemic. Categories within this subtheme included health disparities and vulnerable populations, foregone health care, loss of personal connection with patients, loss of trust in the health care system, financial concerns, and provider burnout.

Worry about the pandemic's impact on people in vulnerable populations and the associated emerging racial/ethnic and socioeconomic disparities in who was contracting and dying from COVID-19 was among the most commonly discussed concerns.

"… you got a white collar worker who can still work at home…it's still stressful… but nobody knows what other people are dealing with… I feel like it's going to be very easy to really not know how

much other people are struggling…I think it has the potential to really worsen inequality in the country, but… sort of quietly and invisibly worsen it." (ED physician/researcher, SG7)

"I… think it's really challenging for our homeless population… I spoke to someone [known to ED staff and homeless] at the beginning of everything, and he [said], 'That's okay [that public buildings with restrooms were closed], I'm just not going to eat so that I don't have to use the bathroom.'" (ED physician/researcher, SG7)

Many HWs also worried about patients forgoing health care due to fear of contracting COVID-19 if they went to a health care facility.

"I see that a lot of people aren't coming to the hospital for preventive things. There's been a spike in people experiencing strokes and heart attacks because people aren't getting the treatment they need… there is that fear of going to the emergency room… people are going to go months, if not years, without getting their proper dental checkups or primary care checkups or eye checkups – that's going to create years and years of damage for people. That's going to create more strain later on." (Pharmacy technician, EC3)

Some HWs spoke about the diminished opportunity for personal connection when interacting with patients while gowned, masked and gloved.

"… one more drastic difference in my day-to-day life is that my ability to connect with patients when I am wearing a ridiculous amount of gear and they cannot see my face and I cannot see their face is terrible." (ED physician/researcher, SG7)

Some HWs also expressed concern about loss of trust in health care systems due to pandemic-related rumors and misinformation.

"…it did feel…sad… that there were people saying that if you had coronavirus, that we would not do CPR [at hospital x]… EMS had heard this and stopped bringing patients to our hospital for a short period of time… I wonder what's gonna happen with people and their trust in the medical community. Are they gonna feel like the hospital is super dangerous and then never ever come back?…the effects of this are gonna linger…"(ED physician, SG8)

Concern for the financial stability of health care systems made some HWs worry about job security.

"The hospital isn't doing well [financially]. It wasn't doing well before this…I think there's going to be a lot of people being laid off…" (Medical records staff, MF5)

Finally, some HWs also worried about the long-term mental health effects working in the pandemic conditions would have on HWs, including the possibility of having to decide on allocation of scarce resources such as ventilators.

"… moral distress… we talk about this in the emergency room, with situations where you know what should be done and you can't do it… if you're in a place where there's not enough ventilators and

you want to put someone [on a ventilator but can't unless you take someone else off]...I think that that sort of thing is going to affect health care workers all over the country. (ED physician, SG8)

Theme 3: The Political Becomes Personal

HWs described both positive and negative impacts of the pandemic on their personal lives, noting often that personal effects were closely related to work effects. Subthemes for this major theme included: (1) Health Workers as Unintended Threats to the Public's Health; (2) An Emotional Toll; (3) Family: Disruptions and Silver Linings. These subthemes were largely related to Personal and Interpersonal SEM levels. Several physicians prefaced their discussion of how the pandemic was affecting them with comments about awareness of their socioeconomic privilege.

Health Workers as Unintended Threats to the Public's Health

Although the services HWs provided were often crucial to fighting the pandemic, some worried that their high risk of contracting COVID-19 made them a risk to patients and public health. This concern was compounded by the lack of reliable, rapid testing in the U.S. early in the pandemic. This may have contributed to the moral hazard experienced by health workers, whose work is intended to improve health and wellness and cause no harm.

"I'm concerned with being able to get tested because I guess the fear is, jeez, what if I have the virus but I'm asymptomatic and I give it to someone else?" (Chiropractor, EB2)

An Emotional Toll

Many HWs described ways in which their experiences as a HW during the pandemic were negatively affecting their physical and emotional health and the impact of their work on the mental health of their children.

"… my [own] sobriety has probably never been shakier than it has been during this time.… I … drove by a package store for 45 minutes. Back and forth having conversations in my head, 'Who will know? What does it matter?' Luckily, I was up to the task, and it was just … a waste of gas and time, but I can definitely understand people with less momentum [with recovery] struggling even harder, because I wasn't reaching out and asking for help. I haven't been going to in-person meetings, so I don't get to see these people and let them know how I'm doing either." (OUD treatment coordinator, KC7)

" [my] 10 year old [has] told me many nights she just has a hard time turning her brain off because she's worried about people… an adjustment is having these big conversations with her, grownup conversations… people are dying." (Nurse practitioner, RJ3)

Family: Disruptions and Silver Linings

The personal impacts that HWs described were often closely related to their family situation. For example, all public schools and many private schools in New York and Massachusetts had abruptly transitioned to on-line remote learning in mid-March

and most daycares closed at this time, meaning HWs who were also parents were faced with needing to care for young children and supervise older children doing remote schooling while working.

In addition to worrying about putting the public at risk because of HWs' high risk of exposure to COVID-19, HWs also worried more about the risk they put their families at than the risk to themselves.

"I know the risk associated with being an emergency physician but I signed up for those risks… that's what I do, that's part of my job. My family didn't… it's an emotional toll for all of us with a concern that we may bring this home to our family members." (ED physician, NP1)

Some HWs also found that lockdown had positive aspects for their family.

"…it's like if you have a closet and... you're thinking of throwing things out of your closet 'cause you wanna simplify things. But...if you have something that you bought and… that stuff is really nice and you used to wear it. You're like, you don't wanna get rid of it'cause you bought it and it's hard to let it go. But when you come into an empty closet, you could just buy what you wanna buy. You fill it with what… you're gonna wear and what you wanna have. So now it's like someone just came in and… cleaned out the closet. And now I can… add stuff back as I want 'cause I'm not… trying to empty out a really full closet." (Psychiatrist/researcher, SG9)

Others found it difficult to get work done while juggling home responsibilities and that increased work demands reduced the time they spent with their families.

"I've always been kind of a workaholic but… week two of March through …the first week of April, I worked at least 18 hours a day… minimum… I'm actually spending the least amount of time with my kids… [than I have ever spent] in their whole lives..." (ED physician/researcher, SG6)

Some HWs found themselves questioning the importance of some of the non-clinical aspects of their work and the ways in which they had previously structured their days, with some hoping to preserve some of the slow down once lockdowns and social distancing requirements ended.

"…probably for at least a month I was very scatterbrained and I was just like… first of all, who cares about [focus of HW's research] right now, you know?... Before this [interview] I had two meetings, one with primary care and one with surgeons about [research].... I was like 'I do not give a shit'… it's not relevant right now…maybe it will be relevant again." (ED physician/researcher, SG7)

Theme 4: Hope

In addition to silver linings discussed by HWs, some also described hopes that the pandemic could result in broader positive societal changes. The concepts related to this theme centered on Societal, Organizational and Community SEM levels.

"I feel like if this country can use the pandemic to… [institute] paid sick leave, to pass policies that should have existed and should have been in place long ago… that could be a lovely silver lining…that we say, 'Oh, we actually need to take care of everyone with these things rather than every man for themselves.'" (ED physician/researcher, SG7)

Some HWs hoped that the chaotic and fragmented response by the government and the health care system might advance discussions about addressing problems, big and small, in the health care system.

"I am hopeful that the health care system will… in light of the PPE issue… think more about waste…like the amount of stuff we throw out that could be reusable." (ED physician/researcher, SG7)

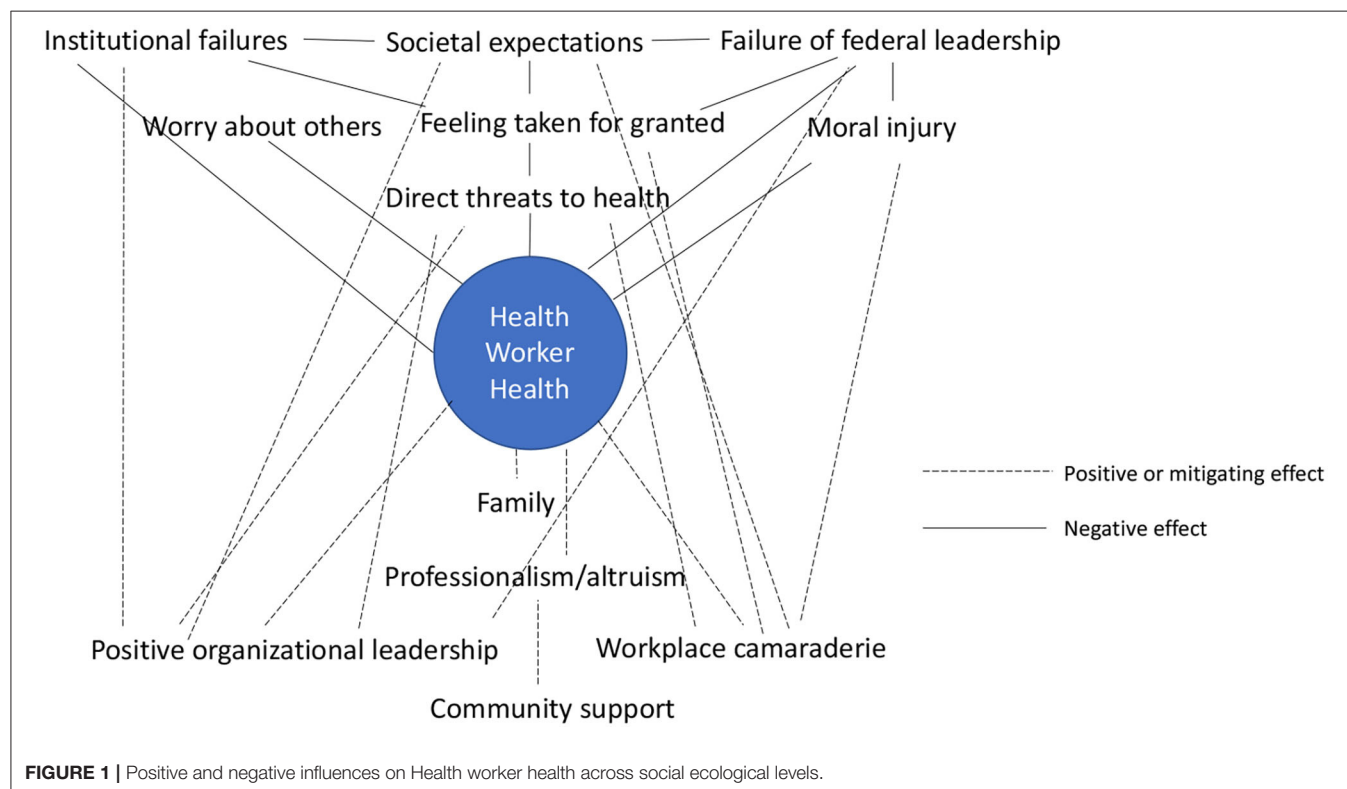## Interpretations in Relation to the Social Ecological Model

"Man is an animal suspended in webs of significance he himself has spun."– Clifford Geertz (34)

The major themes and subthemes identified can be interpreted as a web of interactions involving the SEM levels (**Figure 1**). In the U.S., historical social, cultural, and political phenomena have generated a strongly individualistic society with a largely unregulated capitalist political economy (35). The health care and public health systems that developed within these socio-political boundaries are largely siloed and divorced from each other (36). As one HW noted, these two systems in general,

and unregulated capitalism in particular, are poorly designed for addressing pandemic challenges. The absence of effective federal leadership may have made it all the more challenging to overcome the limitations of the U.S.'s sociopolitical system design, or as one HW framed it, the "Rules of the Game". Despite the obstacles these "Rules" can present, the thoughts and experiences HWs participating in this study described suggested how actions taking place at organizational, personal, and interpersonal levels may mitigate the effects of failures at societal and structural levels.

DISCUSSION

The COVID-19 pandemic's rapidly changing landscape has presented political, public health, medical, community, and individual challenges. Understanding the acute and long-term occupational health effects on HWs will likely require a diverse set of research methodologies. This study was one of the first to take an in-depth qualitative exploration of HWs experiences, feelings, and perceptions during the first surges of COVID-19 infections in the U.S. While much has been learned about the clinical and epidemiological aspects of the COVID-19 virus since data for this study were collected, narrative data such as reported in this study provide the context needed to address the social complexities of the pandemic (37). The U.S. continues to lack a coordinated federal response and public health mitigation strategies such as mask-wearing and vaccination have become deeply politicized, meaning that HWs' heavy workloads, isolation, anxiety, grief, and death are likely to continue for some time. As the virus spreads unabated across the nation and overwhelms health care systems, the narratives shared

FIGURE 1 | Positive and negative influences on Health worker health across social ecological levels.

by the HWs who participated in this study offer insights into the potential short- and long-term impacts the pandemic may have on HWs' physical and mental health as well as potential approaches to mitigating risk. The themes identified in this study illuminate ways in which institutional and infrastructural failures have likely played a role in the U.S.'s pandemic experience but also showed sources of community, interpersonal and personal resilience, resourcefulness, and hope.

HWs in the U.S. have long had some of the highest rates of job-related stress, burnout, and suicide (38, 39). Prior infectious disease epidemics, such as SARS and Ebola, demonstrated the disparate mortality, physical, and mental health effects such epidemics can have on HWs (40). The COVID-19 pandemic is affecting HWs across the globe on a scale not seen for more than a century. In the U.S., poor public health preparedness, lack of a coordinated national response, and failure of the federal government to act swiftly using the best scientific data available may have put HWs at even greater risk for physical and mental health sequelae than they might have otherwise experienced. A study led by the National Nurses Study and the Kaiser Foundation published in a special report by the National Academies of Science, Engineering, and Medicine described how the nation's lack of a uniform system to collect, collate and report illnesses and deaths of HWs related to COVID-19 impairs the ability to accurately monitor and develop interventions to mitigate HWs' risks (41). The report calls for a national system to track not only deaths directly due to work-related COVID-19 infection but collateral deaths, such as suicides due to the fatigue, stress, and burnout, and mental health morbidity. The report notes that accuracy of reporting improved significantly for nursing homes after the Centers for Medicaid and Medicare Services (CMS) implemented a new reporting policy in May of 2020 that included penalties for failure to comply, demonstrating that accurate collection of these data is possible. The results of the current study suggest that development of a robust system to rapidly track the effects of the pandemic and identification of best practices to mitigate the pandemic effects on HWs should be a national priority. These suggestions and other interventions suggested by this study, are consistent with the World Health Organization's *Maintaining essential health services: operational guidance for the COVID-19 context*, which outlines 10 operational strategies for maintaining essential health services, which involves protection of health workers' physical and mental health (42).

The themes identified in this study raise questions about the role of HWs in society and HWs' ethical responsibilities. While some HWs felt that the work-related risks they were experiencing were part of "what they signed up for," others questioned whether their responsibility extended to putting their lives and their families' at risk. This questioning may have been magnified by the perceived lack of support for HWs evidenced by the federal government undermining public health messages about mitigation, failure to help procure adequate PPE, and large portions of the population electing not to wear masks, practice social distancing, or, once vaccines became available, to be vaccinated. Although nurses and other staff have unionized in some regions of the country, a large portion of health workers in the U.S are not part of a labor union.

Working conditions during COVID have renewed interest in health worker organization (43, 44). Physicians historically have not been thought of as workers requiring labor protection, but as employment arrangements have shifted so that more physicians are employed by hospital systems than working in private practice, the pandemic experience may raise questions as to whether there may be a role for more extensive labor organization in the future across all HW roles.

Even in the face of major stressors, themes of HW professionalism, caring, and hope emerged. A narrative review of resilience strategies to manage psychological distress among health care workers during the COVID-19 pandemic published in June 2020 suggested several approaches that tie to the current study's themes (45). For example, organizational justice and organizational strategies, including staff feedback sessions and demonstrating support for workers, link to the Organizational Leadership subtheme in the current study. It remains unclear what the widespread disregard for HWs' and their families' health and mental health may mean for sustaining an adequate workforce in some health professions or how to make clear the toll the behaviors that suggest lack of regard has had.

Limitations

The results of this study should be considered in the context of its limitations. First, one of the goals of the study was to interview HWs in the midst of the first surges in the country. Because the duration of surges in Massachusetts and New York could not be predicted at the time and it was not certain other surges would follow, we relied on a convenience plus snowball sampling approach to recruit participants. This allowed us to recruit HWs quickly and include HWs with a diversity of roles in health care. This also meant that the HWs who were interviewed by someone they knew may have been more or less willing to share controversial or critical thoughts but the criticisms and difficult topics discussed by HWs suggest familiarity may have facilitated openness. The majority of HWs interviewed were white; interviews with Black, Latinx and otherwise socially marginalized HWs as well as HWs in the lowest paying HW jobs may have generated additional themes or alternative views of the themes identified. Interviewers were affiliated with a university in a state with a tradition of liberal politics. Although political affiliation data were not collected, the political divisions in the country may have meant that different perspectives may be obtained in states that experienced surges later in the course of the pandemic with differing majority political views. Some questions in the interview guide were tailored to the earliest days of COVID-19 spread and may have less relevance at the current stage of the pandemic. Although the interviews for this study were conducted in the beginning of the pandemic, the mental health and physical consequences affecting HWs are likely to continue and potentially worsen as infection and death rates continue to climb.

CONCLUSIONS

This study of U.S. HWs experiences in the early days of the COVID-19 pandemic generated important narrative insights

into the unique physical and psychological risks to HWs and similarities to risks identified in prior serious respiratory viral infection epidemics such as SARS-CoV. Although little of the response to the pandemic to date has involved a coordinated effort at the federal or other level, it is of urgent importance that the health and well-being of HWs be protected. The potential need for change at multiple levels of the SEM that were suggested by this study that could be tested in a large representative sample of health workers. For example, at the Societal level, combining the national databases tracking health worker infection rates, morbidity and mortality, coordinating efforts to implement evidence-based protective interventions in health care settings while also trying to understand address the forces that have reduced concern for the collective good and addressing the problematic capacity for emergency response are high level needs. At the Organizational level, management training and guidelines for rapid assembly and performance of an incident command center may help support the coordination needed to protect health workers. Finally, making mental health care support and options for family support more readily accessible and affordable could potentially offer better support at the individual level.

DATA AVAILABILITY STATEMENT

Raw data will be made available on reasonable request with any data that may risk loss of confidentiality redacted.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Massachusetts, Amherst. The Ethics Committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

ACKNOWLEDGMENTS

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The Relationship Between the NSP and the Individual and Work Organizational Variables: A Cross-Sectional Study

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Objectives: To investigate the characteristics of neck–shoulder pain (NSP) and explore the potentional relationship between the NSP and the individual and work organizational variables.

Methods: A cross-sectional study was performed in the tertiary general hospitals in Hunan Province, China between May 2019 and July 2019. A total of 2,030 healthcare workers were enrolled randomly in this study based on a three-stage stratified sampling method. The Neck Disability Index (NDI) was used to measure disability in subjects with neck pain. A self-administered questionnaire was used to assess the characteristics of individual and work organizational variables. The Mann–Whitney U test and the Kruskal–Wallis H test were applied to analyze the prevalence of pain intensity among groups. Multivariate linear regression analysis was performed to explore the potentional relationship between NSP and individual and work organizational variables using the NDI score as the dependent variable.

Results: 2,008 of 2,030 healthcare workers filled out the survey questionnaires online. In the past 12 months, 1,489 participants (74.2%) complained of pain in the cervical–shoulder region. NDI score increased by 0.10 for each year of age, with healthcare workers working in Obstetrics and Gynecology, and the Operating Room less likely to have NSP than those working in other departments. In contrast, female healthcare workers with a history of pregnancy were more likely to have NSP. In terms of organizational factors, workers who received concern from their supervisor about their health, who had the choice to change their shift status to off duty when they were not feeling well, or who were informed about WMSDs were less likely to have NSP.

Conclusion: The prevalence of NSP within the previous year was high in this population. Individual factors including history of neck–shoulder diseases, age, and history of pregnancy and organizational factors including being adequately informed regarding WMSDs, concern from supervisors about workers' health, and the ability of workers to change their shift status to off duty when they were not feeling well were shown to induce significant effects to NSP.

Keywords: neck-shoulder pain, healthcare workers, occupational health, work-related musculoskeletal disorders, neck disability index

INTRODUCTION

Neck–shoulder pain (NSP) is defined as an subjective feeling of unpleasant from shoulder and neck region. Patients with NSP often complain about regional pain, numbness and other discomfort, with or without pain referred into head, torso, and upper limb regions (1). The growing prevalence of work-related musculoskeletal disorders (WMSDs) among healthcare workers has been called "the tip of an iceberg," with a prevalence of 31.2 (2) to 88.0% (3), just secondary to lower back pain. NSP can be categorized by the degree of disability as mild, moderate, severe, very severe, and complete (4).

Negative impacts related to NSP have been grossly underappreciated. According to the Study of Global Burden of Disease, NSP is the fourth leading cause of disability, ranking behind back pain, depression (5), and arthralgias. Surgeons who experience neck pain have also been reported to be more likely to experience shoulder pain. Even in cases in which the pain is mild, repeated instances of pain can lead to repetitive strain injury, affecting the length of the surgeon's career (6).

Studies have shown that biological and physical factors such as age and lifestyle are associated with NSP (7), for example, it was reported that prevalence of neck pain reported at least once monthly in early adolescence was 38%, and genetic and environmental factors seem to play the most important roles in liability to neck pain (8). A survey conducted in Canada reported that more over than 80% of helicopter pilots and 85% of the crew-members had experienced neck pain caused by helicopter flights (9). But, to date, there has been limited research on the risk from organizational factors in healthcare settings. While education was not effective at preventing NSP (10), exercise was found to be effective (11). However, there was no evidence that it is beneficial to eliminate ergonomic or risk factors related to occupational neck–shoulder pain (ONSP). Over 60% of surgeon participating in one study experienced discomfort while performing vaginal procedures, with the most commonly affected body parts being the back, shoulders, and neck (12). High physical workload in surgeons was significantly associated with the risk of WMSDs in the trunk, longer duration procedures, and more severe fatigue (13). In a pre-experiment of the study on the relationship between working posture and WMSDs in registered nurses population, we found that the ratio of A3 and A4 were 15 and 21%, respectively in 45,825 valid images according to The Ovako Working posture Assessment System (OWAS)(14), which was similar to previous study (15). In the simulation of several routine task, the highest ratio of A3 and A4 (21 and 31%, respectively) appeared in the procedure of manual assisted to turn over patients' body and pat on the back. These findings indicate that persistent risk factors in the workplace may be associated with persistent pain and a poor prognosis for WMSDs.

Understanding the prevalence of and the relationship of individual and organizational factors with NSP would contribute to the development of intervention strategies that increase healthcare workers' understanding of how to prevent NSP and improve the workplace environment in medical institutions. Therefore, the aims of the current study were to investigate the characteristics of NSP and to identify the individual and organizational factors associated with it.

MATERIALS AND METHODS

## Ethical Approval and Consent to Participate

The Institutional Review Board of behavioral and nursing research at the School of Nursing at Central South University approved the study protocol (#2017033). Prior to collecting the data, written informed consent was obtained from each participant. The study was conducted in accordance with the Declaration of the World Medical Association and the Helsinki Declaration on the testing of human subjects.

Trial Design and Tools

This cross-sectional study was performed in the tertiary general hospitals in Hunan Province, China between May 2019 and July 2019. Participants were recruited randomly based on a three-stage stratified sampling method: a flowchart of the sampling method is shown in **Figure 1**.

The Neck Disability Index (NDI), a self-administered questionnaire with 10 items, was used to measure disability in subjects with neck pain. The 10 items in this questionnaire measure pain intensity, personal care, lifting, reading, headache, concentration, work, driving, sleeping, and recreation. Each item is scored from 0 to 5 (for a maximum score of 50), and the higher the score, the greater the disability. The formula for the index of impaired neck function (INF) is: INF (%) = [total score from 10 items / (number of items completed $\times$ 5)] $\times$ 100. The criteria for the different INF ratings are 0–20%, 21–40%, 41–60%, 61–80%, and 81–100%, which, respectively represent mild, moderate, severe, very severe, and completely INF. Cronbach's α ranging from 0.74 to 0.93 have been reported for the NDI (16–18).

A further self-administered questionnaire was used to assess the characteristics of individual and work organizational variables. Based on human factors engineering theory, the survey questionnaire was compiled and then modified using two rounds of the Delphi method, in which 20 experts in the fields of occupational musculoskeletal injury, spinal rehabilitation, or human engineering evaluated its content and applicability. The authoritative coefficients of the two rounds of expert consultation were 0.92 and 0.93, respectively. The final version of the questionnaire had a Cronbach's α of 0.930, with each dimension having a Cronbach's α of between 0.680 and 0.924. The final questionnaire was composed of three part. Part one was basic information section including 12 items. Part two was the main body consisting of six dimensions: individual factors, facilities and equipment factors, workload factors, workspace and environment factors, and social psychological factors, which was comprised of 87 closed-ended questions. Part three was the morbidity of NSP including 10 items. In this study, we imposed the further requirement that the uncomfortable condition was recognized as NSP only when it continued for more than 1 week. We focused on the characteristics of NSP and the potentional relationship between the NSP and the individual and work organizational variables in this study.
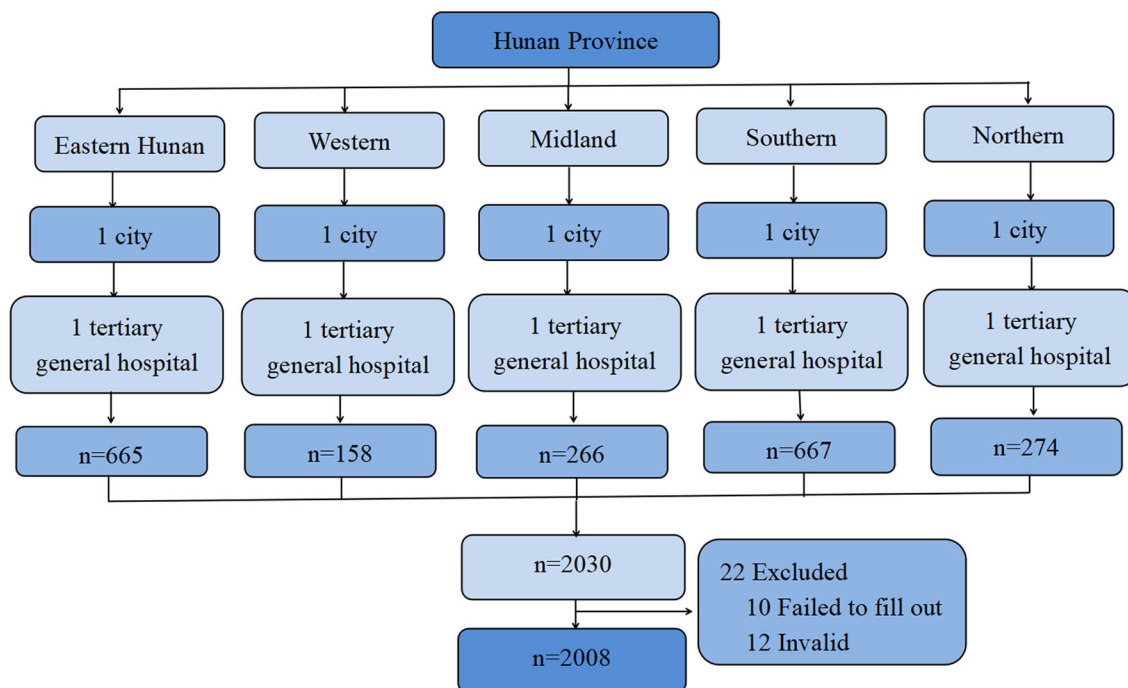
FIGURE 1 | Flowchart of the multi-stage stratified sampling with random principle.

Participants

A total of 2,030 healthcare workers were enrolled in this study. The inclusion criteria were: (1) full-time registered physicians or registered nurses of 18–60 years of age; (2) employed as a clinician or nurse, with at least 1 year of clinical experience; (3) not received any medical therapy in the past 2 weeks; (4) taking part in this study voluntarily and cooperates well with investigators.

Subjects with any one of the following criteria were excluded: (1) diagnosed with cervical spondylotic myelopathy; (2) diagnosed with other severe diseases, such as diabetes mellitus, cardiovascular and cerebrovascular diseases, or tumors; (3) history of neck trauma, neck fracture, or neck surgery; (4) pregnant or breastfeeding women;(5)fibromyalgia syndromes.

Data Collection

We distributed the questionnaire to administrative staff in the nursing department of selected hospitals via the "Questionnaire Star" online survey platform. The administrative staff then distributed the questionnaires to a special WeChat working group, which included staff from the following units: General Internal, General Surgical, Obstetrics and Gynecology, Pediatrics, Operating Room, and Intensive Care. Nurses completed the questionnaire by clicking on the survey link or the quick response (QR) code of the online questionnaires, which were forwarded by the administrative staff of their nursing department. Every participant was asked to read and consent to the agreement of informed consent before replying to the survey. The collection of questionnaire data was completed anonymously, without acquiring any personal details from the participants and on a

voluntary basis. To increase the response rate, an honorarium of nearly $2 USD was paid to each respondent who completed the questionnaire.

Statistical Analysis

SPSS Statistics version 23 (IBM Corp.) was used to perform all statistical analyses. Data were summarized as frequencies and percentages, or as means and standard deviations, as applicable. The Mann–Whitney U test and the Kruskal–Wallis H test were applied to analyze the prevalence of pain intensity among the groups. We performed multivariate linear regression analysis to explore risk factors, with the NDI score as the dependent variable, and the potential individual and organizational factors related to NSP as the independent variables. The odds ratio (OR) and 95% confidence interval (CI) were estimated from the multivariate regression analysis. To reduce confounding bias, we performed a backward linear regression analysis (α entry = 0.10, α removal = 0.15). A two-tailed $P < 0.05$ was considered statistically significant for all tests.

RESULTS

Population Characteristics

In total, 2,008 of 2,030 healthcare workers filled out the survey questionnaires online with no missing data, giving an overall response rate of 99.41%. An overview of the participants is provided in **Table 1**. In this data set, 537 participants (26.74%) were clinicians, and the rest (73.26%) were clinical nurses. The number of participants from each group varied by region, with

TABLE 1 | Demographic characteristics and prevalence of neck-shoulder pain in 2,008 participants.

Items	INF rating					P-value
	Mild Participants (%)	Moderate Participants (%)	Severe Participants (%)	Very severe Participants (%)	Total (%) Participants (%)	
City						
Eastern	433 (65.11)	203 (30.53)	26 (3.91)	3 (0.45)	665 (100)	0.08
Southern	101 (69.18)	37 (25.34)	8 (5.48)	0 (0.00)	146 (100)	
Northern	158 (60.54)	93 (35.63)	10 (3.83)	0 (0.00)	261 (100)	
Central	402 (60.27)	228 (34.18)	35 (5.25)	2 (0.30)	667 (100)	
Western	185 (68.77)	67 (24.91)	15 (5.58)	2 (0.74)	269 (100)	
Clinical department						
General internal unit	443 (65.44)	199 (29.39)	34 (5.02)	1 (0.15)	677 (100)	0.05
General surgical unit	325 (61.90)	163 (31.05)	32 (6.10)	5 (0.95)	525 (100)	
Obstetrics and gynecology	113 (70.63)	44 (27.50)	3 (1.88)	0 (0.00)	160 (100)	
Pediatric unit	126 (63.64)	66 (33.33)	5 (2.53)	1 (0.51)	198 (100)	
Operating room	139 (64.95)	67 (31.31)	8 (3.74)	0 (0.00)	214 (100)	
Intensive care unit	133 (56.84)	89 (38.03)	12 (5.13)	0 (0.00)	234 (100)	
Occupation						
Clinician	329 (61.27)	177 (32.96)	29 (5.40)	2 (0.37)	537 (100)	0.15
Clinical nurse	950 (64.58)	451 (30.66)	65 (4.42)	5 (0.34)	1,471 (100)	
Health technique title						
Nurse	294 (79.25)	69 (18.60)	8 (2.16)	0 (0.00)	371 (100)	0.00
Nurse Practitioner	422 (63.65)	210 (31.67)	28 (4.22)	3 (0.45)	663 (100)	
Nurse-in-charge	193 (52.59)	145 (39.51)	27 (7.36)	2 (0.54)	367 (100)	
Associate Professor of Nursing	38 (59.38)	24 (37.50)	2 (3.13)	0 (0.00)	64 (100)	
Professor of Nursing	3 (50.00)	3 (50.00)	0 (0.00)	0 (0.00)	6 (100)	
Doctor	150 (70.75)	48 (22.64)	13 (6.13)	1 (0.47)	212 (100)	
Doctor-in-charge	118 (51.98)	97 (42.73)	11 (4.85)	1 (0.44)	227 (100)	
Associate Professor of Medicine	52 (58.43)	32 (35.96)	5 (5.62)	0 (0.00)	89 (100)	
Professor of Medicine	9 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	9 (100)	
Marital status						
Unmarried	403 (73.94)	128 (23.49)	14 (2.57)	0 (0.00)	545 (100)	0.00
Married	855 (59.79)	493 (34.48)	75 (5.24)	7 (0.49)	1,430 (100)	
Live apart	3 (60.00)	0 (0.00)	2 (40.00)	0 (0.00)	5 (100)	
Divorced	18 (64.29)	7 (25.00)	3 (10.71)	0 (0.00)	28 (100)	
History of pregnancy						
No	511 (73.21)	169 (24.21)	17 (2.44)	1 (0.14)	698 (100)	0.00
Yes	768 (58.63)	459 (35.04)	77 (5.88)	6 (0.46)	1,310 (100)	
Education						
Junior college degree	292 (66.67)	129 (29.45)	17 (3.88)	0 (0.00)	438 (100)	0.19
Undergraduate degree	898 (62.40)	468 (32.52)	67 (4.66)	6 (0.42)	1,439 (100)	
Graduate degree	89 (67.94)	31 (23.66)	10 (7.63)	1 (0.76)	131 (100)	
Income (¥/year)						
<3,000	120 (76.92)	25 (16.03)	11 (7.05)	0 (0.00)	156 (100)	0.01
3,000–5,000	497 (62.99)	253 (32.07)	36 (4.56)	3 (0.38)	789 (100)	
5,000–8,000	484 (60.80)	270 (33.92)	38 (4.77)	4 (0.50)	796 (100)	
8,000–10,000	139 (67.48)	59 (28.64)	8 (3.88)	0 (0.00)	206 (100)	
>10,000	39 (63.93)	21 (34.43)	1 (1.64)	0 (0.00)	61 (100)	
Gender						
Male	157 (58.00)	93 (34.83)	16 (5.99)	1 (0.37)	267 (100)	0.06
Female	1,122 (64.45)	535 (30.73)	78 (4.48)	6 (0.34)	1,741 (100)	

(Continued)

TABLE 1 | Continued

Items		INF rating				P-value
	Mild	Moderate	Severe	Very severe	Total (%)	
	Participants (%)	Participants (%)	Participants (%)	Participants (%)	Participants (%)	
Age (years)						
<25	243 (82.37)	46 (15.59)	6 (2.03)	0 (0.00)	295 (100)	0.00
25–35	724 (63.34)	355 (31.06)	60 (5.25)	4 (0.35)	1,143 (100)	
35–45	236 (52.68)	187 (41.74)	23 (5.13)	2 (0.45)	448 (100)	
45–55	70 (64.22)	33 (30.28)	5 (4.59)	1 (0.92)	109 (100)	
>55	6 (46.15)	7 (53.85)	0 (0.00)	0 (0.00)	13 (100)	
Height (cm)						
<155	68 (64.15)	35 (33.02)	3 (2.83)	0 (0.00)	106 (100)	0.01
155–160	419 (65.88)	185 (29.09)	30 (4.72)	2 (0.31)	636 (100)	
160–165	458 (61.98)	239 (32.34)	40 (5.41)	2 (0.27)	739 (100)	
165–170	214 (69.71)	83 (27.04)	8 (2.61)	2 (0.65)	307 (100)	
170–175	74 (55.64)	56 (42.11)	3 (2.26)	0 (0.00)	133 (100)	
>175	46 (52.87)	30 (34.48)	10 (11.49)	1 (1.15)	87 (100)	
Weight (kg)						
<45	64 (72.73)	21 (23.86)	3 (3.41)	0	88 (100)	0.03
45–55	517 (65.11)	243 (30.60)	32 (4.03)	2 (0.25)	794 (100)	
55–65	477 (63.77)	222 (29.68)	45 (6.02)	4 (0.53)	748 (100)	
65–75	183 (60.20)	114 (37.50)	6 (1.97)	1 (0.33)	304 (100)	
>75	38 (51.35)	28 (37.84)	8 (10.81)	0 (0.00)	74 (100)	
Body mass index						
18.5– <25	1,128 (64.53)	534 (30.55)	79 (4.52)	7 (0.40)	1,748 (100)	0.14
25– <30	145 (58.23)	89 (35.74)	15 (6.02)	0 (0.00)	249 (100)	
30– <40	6 (54.55)	5 (45.45)	0 (0.00)	0 (0.00)	11 (100)	

INF, impaired neck function.

this variability being due to the difference in sizes of the selected hospitals. In terms of the prevalence of pain intensity, there was no significant regional difference among the five groups (Eastern, Southern, Northern, Central, and Western) (*P* for trend = 0.075).

## Prevalence of NSP in Healthcare Workers

The distribution of the anatomical sites of NSP in this study are shown in **Figure 2A**. In the 12 months prior to the questionnaire, only 6.5% participants reported no NSP, while 1,489 participants (74.2%) complained of pain in the cervical–shoulder region. This percentage was far higher than those in the cervical–occipital, cervical–napex, cervical–thoracic, and cervical–back regions (**Figure 2B**). In this data set, only 291 participants (14.49%) reported their NSP to their hospital. There were 143 cases (7.12%) in which participants were forced to change their shift due to the NSP.

With respect to the prevalence of pain intensity in this study, no participants were categorized as having complete INF, while the numbers of participants with mild, moderate, severe, and very severe INF, respectively were 1,279 (63.70%), 628 (31.27%), 94 (4.68%), and 7 (0.35%). Of the 10 items on the NDI, the "driving" item scored the highest (1.30 ± 1.20), with "headache" (1.28 ± 1.02) coming second (**Figure 3**).

Individual Factors Affecting the Severity of NSP in Healthcare Workers

A non-parametric test revealed a significant difference in the prevalence of pain intensity among the different age groups (*P* for trend = 0.00), while linear regression analysis further revealed that the NDI score increased by 0.10 with each additional year of age (OR = 0.10; 95% CI: 0.03 to 0.16; *P* = 0.00). Furthermore, healthcare workers from the Obstetrics and Gynecology (OR = −1.64; 95% CI: −2.76 −0.52; *P* = 0.01) or Operating Room (OR = −1.51; 95% CI: −2.61 − −0.40; *P* = 0.01) units were less likely to experience NSP than those from other departments. In terms of their history of pregnancy, 354 of 1,122 women (31.55%) had not experienced pregnancy, but those who had were more likely to experience NSP (OR = 1.03; 95% CI: −0.20 − 2.27; *P* = 0.00). Participants with a history of neck–shoulder diseases were more likely to have NSP than those without this history (OR = 1.31; 95% CI: 0.22–2.38; *P* = 0.02). In terms of personal daily living habits, habitually awkward postures (OR = 0.92; 95% CI: 0.34–1.49; *P* = 0.00) and sleeping with a relatively high pillow (OR = 0.89; 95% CI: 0.08–1.71; *P* = 0.03) were risk factors for a higher NDI score.

Interestingly, reading or watching the TV or computer in a reclining posture were protective factors resulting in a lower prevalence of NSP in healthcare workers (OR = −0.84; 95%
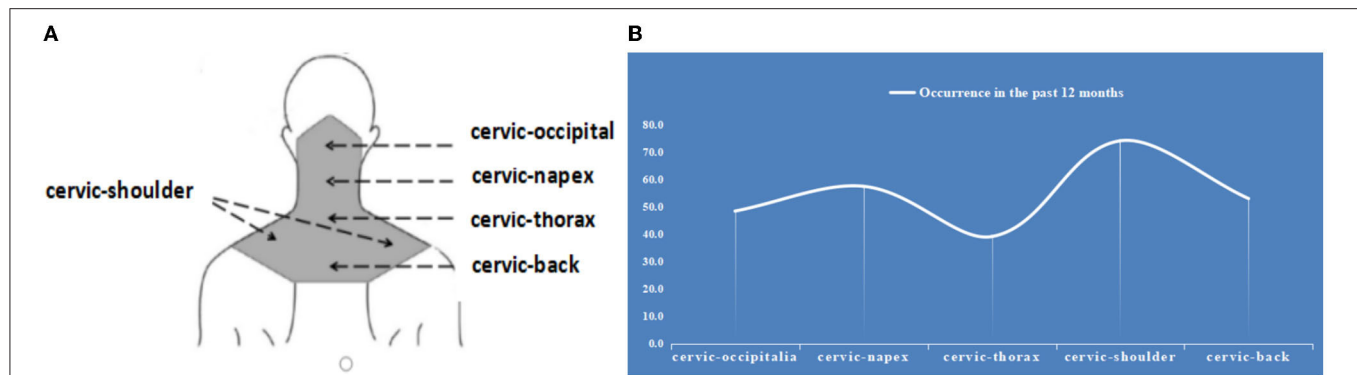
FIGURE 2 | Prevalence of chronic neck shoulder pain in 2,008 participants in the past 12 months. **(A)** Diagram of neck region. **(B)** Prevalence of shoulder and neck pain in 2008 participants in the past 12 months.
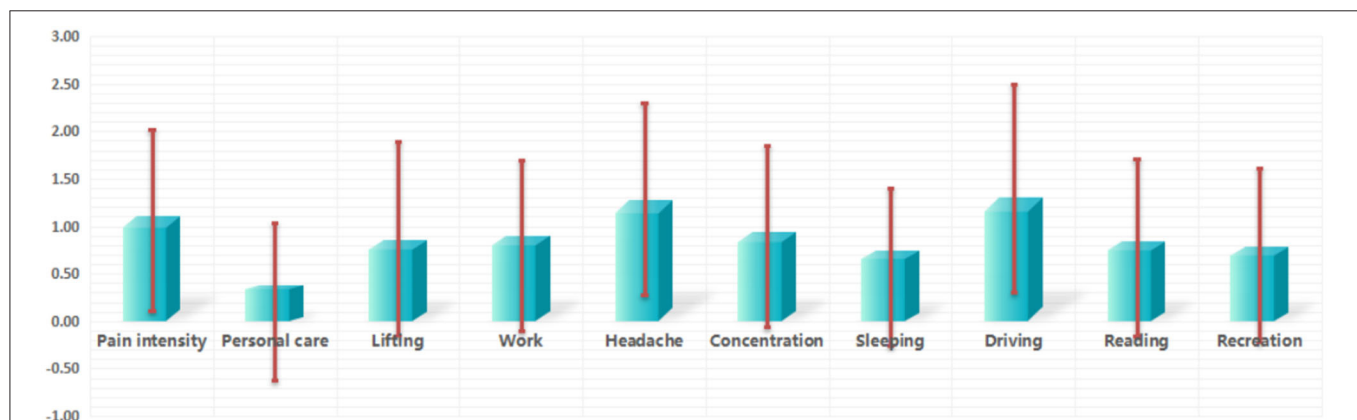
FIGURE 3 | Item-total score of the NDI.

CI: −1.36– −0.32; $P = 0.00$). Additionally, participants who felt a greater sense of tiredness after housework were more likely to experience NSP (OR = 1.43; 95% CI: 0.99–1.86; $P = 0.00$) (**Table 2**).

Organizational Factors Affecting the Severity of NSP in Healthcare Workers

Ten items were included in the questionnaire assessing organizational factors, four of which entered the final regression model. Healthcare workers had a higher risk of NSP if their professional department did not deal with their WMSD concerns well (OR = 0.55; 95% CI: 0.89–1.86; $P = 0.00$). Additionally, the ability to change their shift status to off duty when they were not feeling well (OR = −0.89; 95% CI: −1.32– −0.45; $P =$ 0.00), concern from their supervisor about their health (OR = −0.51; 95% CI: −0.94– −0.08; $P =$ 0.02), and receiving training regarding WMSDs (OR = −0.70; 95% CI: −1.11– −0.28; $P =$ 0.00) were also protective factors (**Table 2**).

DISCUSSION

This cross-sectional study of NSP in healthcare workers revealed the following: (1) the prevalence of NSP within the previous

year was high in this population, with pain in the cervical–shoulder region being the most common; (2) the individual factors associated with NSP were a history of neck–shoulder diseases, age, and a history of pregnancy; (3) the organizational factors linked with NSP were that the healthcare worker had acquired adequate training regarding WMSDs, had received concern from their supervisor about their health, had the ability to change their shift status to off duty when they were not feeling well, and could deal with WMSD complaints via their professional department and *via* experts; (4) the extent to which participants felt tired after housework and a habit of sleeping with a high pillow were predictors of NSP, while reading or watching the TV or computer in a reclining posture reduced the likelihood of NSP; (5) participants working in the ICU were more likely to experience NSP compared with those from other units, including the Obstetrics and Gynecology or Operating Room units.

We demonstrated that the prevalence of NSP within the previous year was high in healthcare workers in China and that pain in the cervical–shoulder region was more common than that in the cervical–occipital, cervical–napex, cervical–thoracic, and cervical–back regions. Previous studies have reported 1-year prevalence estimates of neck pain in office workers ranging from 42–69% (19–21). However, we observed a prevalence of up to 90% in our study, which was far higher than that in office

TABLE 2 | Factors related to neck-shoulder pain in healthcare workers: linear regression analysis.

Variables	Unstandardized coefficient		Standarized coefficient	t	P	95% CI
	β	Std. error	Beta			
Age (years)	0.10	0.03	0.11	3.00	0.00	0.03–0.16
Body height (cm)	0.06	0.04	0.06	1.79	0.07	−0.01–0.13
History of pregnancy	1.03	0.63	0.06	1.64	0.00	−0.20–2.27
Obstetrics and gynecology	−1.64	0.57	−0.10	−2.87	0.01	−2.76– −0.52
Pediatric unit	−0.96	0.57	−0.06	−1.70	0.09	−2.08–0.15
Operating room	−1.51	0.56	−0.10	−2.68	0.01	−2.61– −0.40
Occupation	0.72	0.49	0.06	1.46	0.14	-0.24–1.68
History of neck–shoulder diseases	1.31	0.55	0.08	2.37	0.02	0.22–2.38
Habitually awkward postures during daily life	0.92	0.29	0.12	3.11	0.00	0.34–1.49
Habit of using a high pillow during sleep	0.89	0.42	0.07	2.14	0.03	0.08–1.71
Degree of tiredness felt after housework	1.43	0.22	0.22	6.44	0.00	0.99–1.86
Acquired training regarding WMSDs	−0.70	0.21	−0.12	−3.29	0.00	−1.11– −0.28
Received concern from supervisor about health	−0.51	0.22	−0.09	−2.33	0.02	−0.94– −0.08
Ability to change shift status to off duty when they are not feeling well	−0.89	0.22	−0.15	−4.03	0.00	−1.32– −0.45

R-square = 0.182; F = 10.501, P = 0.00.

worker population samples and the general population with an annual prevalence rate exceeding 30% (22). It is also worth noting that approximately three-quarters of participants experienced pain in the cervical-shoulder region, followed by pain in the cervical-napex and cervical-back regions. Healthcare workers usually spend less time sitting compared with workers in other occupations, but perform a wide range of healthcare activities and procedures, involving repetitive movements, forceful procedures, highly demanding work, work in a static posture, and exposure to vibration. Some ergonomists have described the working conditions of healthcare workers as being equal to those of certain industrial workers (23). Therefore, a deeper exploration of the risk factors linked to NSP in healthcare workers is warranted, suggesting that randomized controlled study should be perfomed and data on some characteristics of the work performed could be collected in the future.

In terms of the individual factors associated with NSP, we confirmed that age has a significant impact on NSP, in line with previous publications (24). Functional and structural changes in the musculature surrounding the spine and the intervertebral disc with increasing age are theorized to lead to a significant impact on passive spine stiffness and discomfort responses (24). With respect to the association between a history of neck–shoulder diseases and NSP, the local muscles of individuals with such diseases may fatigue more easily during work than those of others, which was similar to previous studies. Of note, we found that women with a history of pregnancy were more likely to experience NSP than those with no such history. The age of participants in the current study was concentrated in the range between 25 and 45 years, with approximately one-third of women having never been pregnant. The prevalence of neck pain has been reported to be associated with gender, with females having a higher prevalence than males (25). Pregnancy-induced biomechanical, hormonal, and vascular changes are likely to give rise to a wide variety of musculoskeletal problems (26–28).

Spinal pain has been reported as the most frequent disorder during pregnancy. Positive associations have been found between low back pain and pelvic pain and pregnancy due to altered pelvic joint mechanics and/or altered muscular function (29, 30). However, whether hormonal and vascular changes induced by pregnancy can lead to long-term musculoskeletal problems in individuals is unknown. Therefore, future research should be directed to identifying pathways for pregnancy influence on NSP and in exploring the mechanism whether neuropathic or mechanical.

Interestingly, in terms of the organizational factors linked to NSP, we found that participants working in the ICU were more likely to experience NSP than those working in other units, including the Obstetrics and Gynecology or Operating Room units. It might because of what healthcare workers in the ICU have to provide more bedside nursing procedures involving a static awkward posture, such as oral care, sputum suction and the procedure of manual assisted to turn over patients' body and pat on the back. This hypothesis was confirmed in our subsequent simulation experiment. Most of the subjects in this experiment complained of extreme shoulder and neck discomfort, with RPE scores up to 9. Hence, we recommend that nursing managers review our nursing procedures and optimize them to minimize the frequency and duration of awkward postures. In this study, participants responded that they would have less risk of NSP if they received more concern from their supervisor, had the ability to change their shift status to off duty when they were not feeling well, and could undertake more training regarding WMSDs. This means it's needed for healthcare seetings to develop a series of action programme to help their employees and make ensure their health. Therefore, our results indicate that the importance of organizational factors in the development of NSP might have been underestimated.

In addition, our results revealed that feeling more tired after housework and the habit of having a high pillow during sleep

were potential predictors of NSP in healthcare workers. In contrast, participants who read or watched the TV or computer in a reclining posture were less likely to experience NSP, suggesting that this posture offers the opportunity to release the muscles in their shoulders and neck.

Limitations

There are several clinical and research implications that follow from our study. Factors including a history of neck–shoulder diseases, age, acquiring training about WMSDs, and receiving concern from supervisors were significantly associated with NSP. For clinicians and policy makers, our study draws attention to healthcare workers with NSP, as we revealed several common factors and potential predictors of such pain. However, to our knowledge, no prior studies have reported a link between a history of pregnancy and NSP, and additional prospective studies will be necessary to further clarify this matter. Of course, our study also had several limitations. We included 2,008 participants from one province in China, which may have led to a sampling bias due to the regional nature of the study. Second, we collected data from an online questionnaire using self-reported measures, not objective parameters for the assessment of disability and pain, and this might lead to the result with more subjective. Third, due to the cross-sectional nature of the study, the main limitation was the absence of a control group, which may lead to the exact causal relationship cannot be established. Finally, observational method was not used in this study, this lead to the lack of data on some characteristics of the work performed.

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 Institutional Review Board of behavioral and nursing research at the School of Nursing at Central South University approved the study protocol (#2017033). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SY and HW contributed in conception, study design, coordination of data collection, and acquisition in data. SY, YL, and LZ were responsible for interpretation of data, drafting, and writing and finishing the manuscript. All authors read and approved the final manuscript.

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Cultivating Psychological Resilience of Israeli Medical Directors of COVID-19 Divisions: The Dynamic Spheres of Salutogenics

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Purpose: There are a few qualitative studies on the psychological resilience of COVID-19 medical directors upon outbreaks of pandemics. Psychological resilience is essential to providing quality care through the pandemic.

Materials and Methods: We conducted narrative interviews with 14 out of 21 medical directors of COVID-19 divisions in Israeli public hospitals upon the outbreak of the pandemic and through its first wave. We adopted the Salutogenic paradigm to identify personal and organizational resources that both deterred and promoted resilience of front-line medical directors. Thematic analysis was performed based on the Sense of coherence construct, an anchor of Salutogenics.

Results: Low comprehensibility was compensated by ethical boundaries and managerial experience. A few organizational and personal resources promoted manageability. The hospital management both deterred and promoted resilience. In contrast to Salutogenics theory, meaningfulness was driven by the occupational calling rather than by comprehensibility and manageability. Gaps in personal resources inhibited resilience.

Conclusions: Our study adds to the scant qualitative research performed upon the outbreak of the pandemic and extends the Salutogenic paradigm suggesting that the three axes of sense of coherence are multi-layered, intertwined, and evolving. We introduce the dynamic spheres model that we adopted from Physics to illustrate the findings. We propose interventions to build resilience in front-line medical directors.

Keywords: COVID-19, front-line clinicians, lived experience, medical directors, psychological resilience, salutogenics, thematic analysis, well being

INTRODUCTION

Since the COVID-19 outbreak, clinicians have been reporting heightened stress, depression, anxiety, hopelessness, helplessness, and fear (1, 2). The fear due to the unfamiliar disease and to making clinical decisions without a protocol, has been associated with psychological distress, poor physical health, and risky health behaviors decreasing immunity (2, 3). Clinicians felt obligated to work around the clock, struggling to balance their own physical and mental needs with those of

their team members (4). More responsibilities, a busy work schedule, and emotional exhaustion jeopardize clinicians' health (5). In addition, clinicians experienced ethical conflicts between their responsibility to care for the ill and their right to protect themselves from a deadly virus (6). Clinicians were distressed about discontinued supplies of limited equipment (7).

Moreover, clinicians experience discomfort during endless shifts during which they wore goggles, N95 masks, and full body protective suits, that exacerbated their exhaustion and limited their hearing, causing communication barriers with team members and patients (8, 9). Furthermore, clinicians could no longer rely on facial expressions in communication and had to learn to interpret eye expressions as the sole non-verbal form of communication (10). Since clinicians may potentially spread COVID-19 and feared of infecting family members, they stayed away from their families (11). When they didn't distance from their families, they experienced stigma in their own home communities, causing them frustration and anger (8). Fifty six percent of clinicians treating COVID-19 patients, presented symptoms of posttraumatic stress disorder 58.6% reported an anxiety disorder, and 46% reported depression (12).

Resilience is a process of adapting, and withstanding adversity (13, 14). Resilience refers to a "rebound ability," alleviating the adverse effects of stress (15). Psychological resilience is negatively associated with depression, anxiety, irritability, and burnout (2, 12). Resilience results in better coping, better health, higher well being, and higher productivity (16). Resilience capacity exists in all people but varies between individuals, depending on personality, interpersonal and social background (17). Resilience may be strengthened by using personal and organizational resources that reduce the impact of traumatic events, preventing a post-traumatic stress disorder (14). While clinicians treating COVID-19 patients play a critical role in global and national health, they constitute the group with the lowest psychological resilience and their psychological resilience is not prioritized (12). Poor resilience leads to negative emotions that further compromise the mental well being of clinicians and inhibit the integration of self-regulation, goal setting, and effective decision-making, essential to effective responses while providing patient care (2, 12). Psychological resilience is essential for frontline-clinicians but the conceptualization of resilience of clinicians is premature and scattered (18).

Although qualitative research has much to contribute to the understanding of the unique and complex experiences of medical directors, qualitative studies addressing experiences of front-line medical directors of COVID-19 divisions upon the outbreak and during the crisis, are scant and retrospective (2, 19, 20). Quantitative studies identified personal resources that promote psychological resilience among front-line clinicians in COVID-19: Less worry about being infected, higher life satisfaction, optimism, social support, avoiding information overload, and a sense of control over adversity (12). It is challenging to conduct rigorous qualitative research with clinicians already struggling with patient care during a crisis outbreak and provide actionable insights from qualitative studies in a timely manner (21, 22). However, a better understanding of personal and organizational resources that cultivate resilience of front-line clinicians during

a health crisis may direct efforts to build psychological resilience during the next waves of the pandemic and in future crises more effectively (23). This qualitative study responds to previous calls exploring the cultivation of psychological resilience of frontline-clinicians at both the individual and the organizational level during a pandemic (2, 11, 24). We explored the lived experiences of front-line medical directors upon the outbreak of the COVID-19 in March 2020 through June 2020, in Israel, aiming at gaining insights on how medical directors responded to the pandemic, at identifying factors that cultivate resilience, and at suggesting interventions to mitigate the negative impact of COVID-19 and cultivate psychological resilience.

The Theoretical Framework of Salutogenics

The current study adopted the salutogenic paradigm which explains successful coping with stressors and adjustment and functioning in adults who face adversity (25). Salutogenics views health as a continuum ranging from "total absence of health" to "total health" (26). Movement along this continuum is initiated when people are confronted with stressors that disturb their homeostasis in their internal or external environment (26). Those who successfully manage stressors are on the health side of the continuum avoiding traumatic experience, while those who are unable to manage the stressors move toward the "dis-ease" side resulting in poor resilience, psychological disorders, and post-trauma. Salutogenics posits that the world is complex and uncertain, and stressors are challenges that may lead to health and growth among those who function effectively in adversity (27). A central concept in salutogenics that facilitates effective coping with adversity is 'Sense of Coherence' (SoC) (27).

Individuals with SoC adapt and become resilient in the face of life's obstacles; they have a positive and productive attitude enabling them to understand and meet complex challenges (28). They are consistently and enduringly confident that the stimuli deriving from their internal and external environment are structured, predictable and explicable; that they are able to meet demands with the resources available to them; and that these demands are worthy of engagement. SoC is the trust that the challenge is understood (comprehensibility), and the belief that the available resources suffice for coping (manageability). The strength of the SoC is determined by one's choice to adapt to adversities even when available resources are insufficient (14).

The three axes of SoC are: (a) Comprehensibility, (b) Manageability, and (c) Meaningfulness (26). *Comprehensibility* is one's cognitive ability to find logic in multi-adversity situations and view them as orderly, coherent, clear, and structured. *Manageability* is one's ability to cope and resolve problems using skills and resources that facilitate control of the situation. Comprehensibility and manageability create meaningfulness, i.e., one's ability to find emotional meaning in challenges and feel that actions have a subjective, positive meaning that makes sense in life (26). These three axes orient people toward the resources available to them in multi-adversity. People with a stronger SoC are better able and more highly motivated to cope if they understand the stressors (i.e., comprehensibility),

select an appropriate strategy and marshal resources to deal with the stressors (i.e., manageability), and have a stronger feeling that engaging with the stressors is a meaningful process (i.e., meaningfulness) (29).

While the salutogenic paradigm is starting to impact theory and research in healthcare, it is understudied (27). Thus far, studies on salutogenics in health have mainly focused on public health and patients in the community while they are sparse regarding clinicians in general, and particularly clinicians in a health crisis (14). Since years of salutogenic research demonstrate that SoC is a powerful explanatory factor of health outcomes, coping, and resilience, salutogenics may be applied for the benefit of clinicians as well (30). We seek to provide new theoretical insights regarding resources underlying the coping of clinicians during COVID-19 and shed light on potential interventions to build and maintain SoC. This study aims to identify personal and organizational resources that facilitated psychological resilience upon the COVID-19 outbreak among medical Directors. The Research Questions Are: (a) What Were the Experiences of Front-Line Medical directors? (b) What were the organizational and personal resources that facilitated their adaptation and functioning as they managed the COVID-19 divisions during the pandemic? (c) What was the role of the resources in the three axes of SoC? (d) What recommendations may be derived for interventions to build resilience?

MATERIALS AND METHODS

Ethics

The board of ethics in the academic institute with which the second author is affiliated granted ethical approval for this study. All participants signed a digital informed-consent form regarding participation and publication before beginning the interview.

Sample

Participants were senior physicians specializing in infectious diseases, emergency medicine, and intensive care who were assigned as medical directors of the COVID-19 divisions at 21 Israeli public general hospitals from March 2020 to June 2020. Fourteen (12 males and 2 females, ages 46 to 55) out of 21 division directors participated.

Procedure

We faced acknowledged challenges of data collection in qualitative research during a health crisis and were unable to conduct face-to-face interviews (31). Our responsibility as qualitative researchers, however, was to study the lived experiences of front-line clinicians upon the outbreak of the crisis rather than retrospectively. We adopted a digital, internet-based method (ZOOM videoconferencing platform) for data collection as a recourse for conducting our research (32). Since virtual interaction may alter relationships, we applied participatory research by conducting trial interviews with three directors from private hospitals, to test whether ZOOM can serve as a social form of interaction (33). Based on their reports we concluded that using ZOOM does not compromise effective

communication with interviewees, although paying heed to body language through the ZOOM is challenging.

Following ethical approval, we collected names of COVID-19 division directors, obtained their phone numbers, and sent them messages asking if they are willing to participate in a study on the experiences of directors of COVID-19 divisions. Fourteen out of 21 directors agreed to participate. We were either unable to track the phone number of others or received no response to our messages. Upon receiving their consent, we held a short phone conversation with each participant to introduce ourselves, explain the study goals and methodology, and ask them to minimize the disturbances during the interviews. We assured them that their participation would be anonymous and confidential, and that we would conceal any information possibly identifying them or their hospital (34). Considering the time constraints of interviewees, we scheduled interviews per their requests. We informed interviewees that they could stop the interview at any point they choose, and interviewees acknowledged their understanding that parts of their interview will be published (34). A link to the interview was sent a week in advance. No personal data was entered into the invitation. To assure confidentiality, we canceled the Zoom recording function and recorded the interviews using an external recorder. Only invited participants could enter the ZOOM meeting using a password. We used the video to facilitate natural interaction during the interview. A wide bandwidth, adequate lighting, and the quality of the participants' video cameras enabled smooth interviews. Non-verbal facial responses were evident (19).

We held 14 45-min narrative interviews. We worded the one general open-ended question to encourage participants to share a deep, unstructured narrative (35): "Please tell me about your experience as a COVID-19 division director since the first COVID-19 patient arrived until the time of the interview." Most interviewees responded with silence and commented that it is a complex question. However, once they started sharing their experience, there was no need to elicit further details nor to amplify their answers; the barriers fell, and additional questions were not necessary (35, 36). During the interviews, there were moments of silence, perhaps enabling the interviewees to process their thoughts and feelings. We made no attempt to comment, ask questions, or judge what participants said. After audio-recording interviews were transcribed. Following data analysis, we translated the findings from Hebrew to English.

Data Analysis

We performed thematic analysis, a qualitative method that fits well with our epistemologies, our theoretical anchor, and our research questions for identifying, analyzing, organizing, describing, and reporting the themes within the data (37). Thematic analysis is effective for exploring the perspectives of the interviewees, for highlighting similarities among them, and for generating unanticipated insights (38). We familiarized ourselves with the data, generated initial code description using coding by the three SoC axes of comprehensibility, manageability, and meaningfulness, allowing us to simplify and focus on the Salutogenic characteristics of the data (26, 39). We searched for themes in each axis and reviewed the themes. Data analysis was

an iterative, reflective process that developed over time, involving constant moving back and forward between phases and weekly meetings between the researchers.

We generated themes and categories that conveyed the interviewees' meaning and identified links between the themes; produced a list of main themes which captured the interviewees' main concerns; and presented evidence in words from the interview. In line with theory-based analysis, the dynamic sphered model emerged from the data itself and captures them (**Figure 4**). Elements derived from patterns such as recurring meanings and feelings were marked as themes (37). By bringing together elements of experiences, which are often meaningless when viewed alone, we made sense for the specific context of this study. Themes and behavior patterns emerged from the data through six analytical steps: (1) We independently read and re-read the interviews and listed patterns of experiences through direct quotes. (2) We then identified all data that related to the patterns already classified. (3) We sorted all data according to the corresponding patterns. (4) We combined and categorized related patterns into sub-themes to obtain a comprehensive view of the emerging patterns. (5) We pieced together themes in a meaningful way to form a comprehensive picture representing participants' interpretation of their coping experience (37). (6) By referring to the literature, we obtained information that allowed us to make inferences from the interviews regarding resilience.

Quality Criteria

To ensure that our findings are relevant and actionable we collected data in real time rather than retrospectively. We generated data in a short window of time with a fast recruitment and extensive data collection (40). We were transparent and disclosed the study purpose and rights of the participant. We asked how they feel, to create feelings of connectedness (33). We attempted to make participants feel comfortable as they shared their narrative. The interviews revealed unanticipated themes, facilitating an in-depth understanding of the reality of medical directors from their perspective in a very extreme health crisis at its initial outbreak. The unstructured narrative interviews relied on the interviewee's subjective, spontaneous responses to the question enabling us to understand their perceptions without imposing any prior categorization which might narrow our field of inquiry (35).

We analyzed data using provisional coding guided by the dimensions of Salutogenics as categories and explored data to identify themes (37). To assure reliability, we analyzed all interviews, identified themes and subthemes in the data independently. This study was not initially based on Salutogenic theory, but during the data analysis stage we realized that the theory of Salutogenics may be related to the emergent themes and adopted this theoretical framework. Therefore, SoC wasn't measured directly by specific questions but rather examined according to the three axes of SoC that emerged from the interviews: comprehensibility, manageability, and meaningfulness. Since SoC was not measured, findings do not reflect a change in SoC. Findings reflect the evolvement in the way that directors of COVID-19 divisions perceived themselves, the challenges and the resources that deterred and

FIGURE 1 | The dynamic sphere of resilience on the comprehensibility axis.
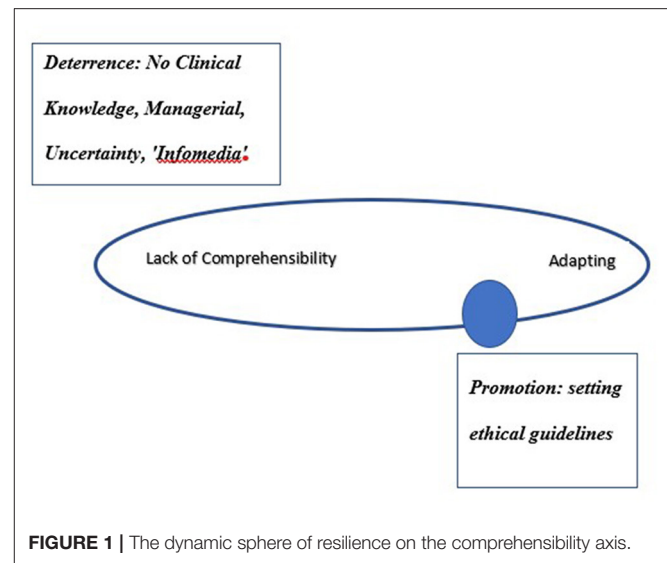
promoted resilience. Findings reflect processes and outcomes as in previous studies that analyzed the three axes of SoC in different contexts (41–43).

Qualitative research encompasses the perspective of the researchers rather than objective reality. As the human instruments making judgments about coding, theming, decontextualizing, and recontextualizing the data, we ensured the coding creates trustworthiness through credibility, transferability, dependability, and confirmability (44). We recorded the study logistics, our methodological decisions, our personal values, our reflections, and insights after each interview (44). We believe coping is modifiable and that stressing resources that enable coping may improve resilience in the face of adversity.

RESULTS

The themes we identified revolve around the three axes of SoC. We present factors deterring SoC and factors promoting SoC in congruence to its three axes (26). In parentheses we present the percentage of interviewees who shared the presented theme. In bold we present what interviewees highlighted.

The First Axis of SoC: Comprehensibility

Findings present the level of a dynamic feeling (or lack of feeling) of confidence that the stimuli deriving from one's internal and external environment are structured, predictable, and explicable. All interviewees referred to the high uncertainty, lack of familiarity, lack of knowledge about COVID-19, its attributes, what lies ahead, and giving treatment without a protocol. Directors referred to two points in time: the initial encounters with COVID-19 patients during the first 3 weeks and encounters with COVID-19 patients thereafter. They all described an evolving dynamic experience. **Figure 1** presents the sphere of resilience on the comprehensibility axis starting from lack of comprehensibility to adapting.

Resilience Deterrence
Lack of Clinical Knowledge (100%)
Interviewees described their experience of helplessness, frustration, and speculation about the exceptional situation they found themselves facing:

*"The virus itself was new to medical systems, at the beginning, **we knew nothing about this disease**. How it attacks the body, how it passes from patient to patient, how it can be defeated. **Not to know a disease in 2020 is an unusual medical situation**." (2, Female); "I am a senior expert, and I realize that **I have never** seen anything behaving the way this virus is behaving. (10, Female)."*

Interviewees were troubled by the fact that in contrast to their core professional value, they were treating patients without a protocol, eliciting a sense of guilt and helplessness in the first 3 weeks:

"It was very stressful. We knew we did not know much about the disease and we were going to treat patients with no protocol. Everything was changing from day to day." (4, Male); "For the first 3 weeks we did not see where the disease was going, and how to treat it. (8, Male); "It is disturbing that our actions are not necessarily the right ones for the patients." (Female, 10).

Managerial Uncertainty (100%)
Interviewees faced new challenges and expressed their frustration and fear:

"I did not know how to act with people who do not want to work in the COVID division." (10, Female); "We did not know how to communicate with patients and with their families". (6, Male); "It took a few days for each of us to process the experience of entering the ward. I was terribly scared" (13, Male)

A Flood of Information (100%)
The overwhelming flood of information was perceived as necessary but terribly frustrating:

*"I call it 'Infodemia': a huge outpouring of information about the virus that was very confusing and full of contradictions. The information reflected the nature of the virus: confusing, deceptive, and constantly changing. **Virality of information transfer**" (2, Male); "Information from Europe kept coming with horrifying scenarios" (14, Male).*

Resilience Promotion
Setting Ethical Boundaries: (30%)
Half of the interviewees described the process of setting clear ethical boundaries as an important facilitator of coping:

*"At first, we gave patients different compassionate drugs but at one point we decided that we are not doing compassionate therapies and not doing science fiction anymore. We decided we would do nothing more without evidence and it made us recognize our limitations, **it was very, very helpful** (1, Male); "Many families asked, "Why don't you give plasma?" or "Why do you do it this way?" I decided to explain to families that what they heard is not applicable, that it may be good for YouTube but will not help their loved one. It*

FIGURE 2 | The dynamic sphere of resilience on the manageability axis.
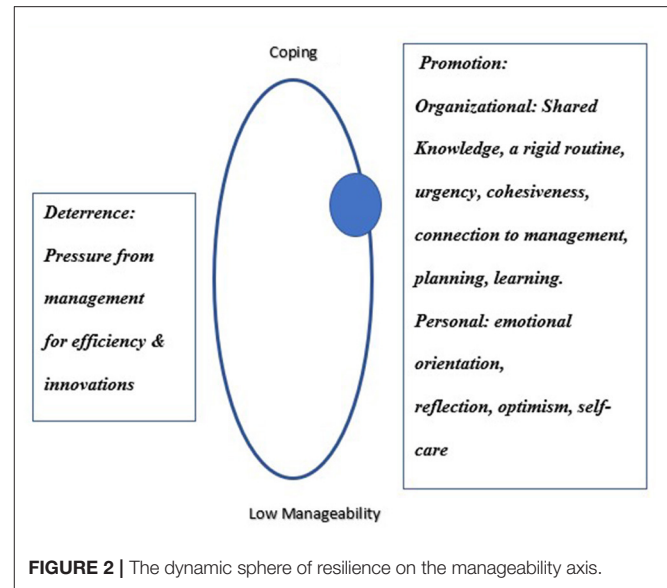
worked; we do not get carried away because of the panic around us." (4, Male).

The Second Axis of SoC: Manageability
Findings present the personal and organizational resources in clinicians' internal and external environment and their role as deterring or promoting manageability in meeting the demands posed by the COVID-19 outbreak. **Figure 2** presents the sphere of resilience on the manageability axis, moving from poor manageability to coping.

Resilience Deterrence
Pressure From Management to Be More Efficient and to Apply Innovations (40%)
I asked my management "Do you really want someone to resuscitate two patients with one ECMO?", I was not willing, I said, "Find someone else". I went through a process of understanding what I am and am not willing to do, despite the pressure and tension …" (8, Male); *"So many inventors and entrepreneurs came here to test their machines or 3D printer masks or filters for the machines…some clinicians tried innovations…As if in any other situation, they would roll in, go up the stairs, skip 3–4 years of experimentation, and **skip a Helsinki approval** before approaching a patient. At one point I did not allow it anymore."* (12, Male).

Resilience Promotion
Manageability entailed organizational processes (sharing, assigning interns, cohesiveness, teamwork, sticking to routine, and connection to management); professionalism (accountability and learning); and inner resources (emotional orientation, self-care, reflection, and optimism).

I. Organizational Resources
Knowledge Sharing (100%)
Interviewees reported that resources of time and attention were invested in sharing knowledge as an ongoing process during the crisis:

> *"Everyday doctors all over the world learned something new and shared it"* (6, Male)**;** *"We held daily meetings. The decisions were joint, and the response was complete and swift. It provided a sense of security."* (9, Male); *"It was clear that what was happening to me may not happen to others so we must each share our experience amongst us and with the world."* (11, Male).

Sticking to a New Routine (100%)
Interviewees sustained the routines of morning visits, professional discussions, and learning during the crisis:

> *"I produced regular morning sessions at 8 A.M. It is no different than what we do on a daily basis but it's at a different scale, level of strain, and numbers."* (13, Male); *"We have a very rigid pattern of morning visits, then relaying information to the senior doctor in charge, then joint discussions about patient needs."* (12, Male).

A Sense of Urgency and Team Cohesiveness (100%)
Interviewees described the importance of the organic team and the cohesiveness that was created although the teams were no longer organic:

> *"Working with your organic staff is very central in such situations. If you build the team the right way, you produce a system that works right. I had to protect clinicians who are at a greater risk."* (10, Male); *"It seems to me that we won the COVID-19 due to treating COVID-19 as a draft notice. Everyone is drafted, everyone helps"* (4, Male).

Interviewees described the individual contributions of each team member, the sense of urgency, and the removal of boundaries between medicine and nursing:

> *"There is a fighting spirit, everyone is present and connected, the situation went from zero to a hundred very quickly."* (3, Male). *"When we are together, we have unlimited power* (2, Female); *"The sense of pioneering and the contribution of each member shapes the division's character. The classic hierarchy of medicine in which we grew up is flattened, the clinical impressions of the nurses don't fall short of those of the doctors."* (14, Male).

Planning and Allocating Residents (80%)
Interviewees allocated tasks according to the strengths of their personnel:

> *"Proper management requires the understanding that in the end, the human capital is the heart of the matter"* (8, Male); *"We understand the need to use lots of technologies, so our interns who are good at technology help us with that."* (5, Male).

Connecting to Management (50%)
Interviewees stressed their communication with top management as a fast route to getting required equipment:

> *"We talk with management constantly as the reference point for everything in this story."* (9, Male); *"The direct connection to management resulted in getting everything I wanted whenever I wanted it, enabling me to manage macro, not just micro."* (7, Male); *"I have the means; bureaucratic issues do not exist. Everything is geared toward optimal patient care."* (8, Male).

Learning (20%)
Interviewees related to the importance of including learning and briefing in work processes in those turbulent times:

> *"Every morning we present the studies that are relevant to our patients. We publish, we teach. We constantly consider what we do well and need to improve; we learn very quickly"* (7, Male).

II. Personal Resources
Interviewees related to personal resources that enabled their adaptation: Emotional orientation; reflective skills; preventing the neglect of self-care, and optimism in the face of horrific scenarios.

Emotional Orientation (20%)
Interviewees expressed their fear and elaborated on how it affects their functioning:

> *"I worried about how I could meet all the demands of providing care and keep the staff from getting infected. That fear was very noticeable at first."* (4, Male); *"The main fear is that you do not know if on the next day you will encounter a catastrophe, if you will be flooded with patients, if the pictures of Italy and New York will be in your backyard"* (11, Male).

Reflection Abilities (20%)
Three interviewees were able to distance themselves from the situation, reflect on it, and gain insights:

> *"In an emergency you work with people who are not in their comfort zone. You, too, are not in your comfort zone. We are continuously out of our element. It adds complexity, but for me it's partly why I specialize in intensive care......[Quiet]"* (8, Male); *"We learn to step forward out of the fog of uncertainty. We rely on intuition, on gut feeling, and we acknowledge that we do not have all the data. We must feel comfortable with uncertainty."* (2, Female).

Optimism (20%)
Optimism served as a beacon of light as interviewees expected positive changes to take place:

> *"People said that my TV interview was a broadcast of cautious optimism. After a week and a half everyone here thought it is the end of the world. Suddenly someone said, guys, if we encounter what happened in Italy, we will do everything to take care of everyone, but we must remember that at some point, this virus will subside."* (7, Male).

Self-Care (15%)
Interviewees shared the need for self-care to maintain good functioning:

FIGURE 3 | The dynamic sphere of resilience on the meaningfulness axis.
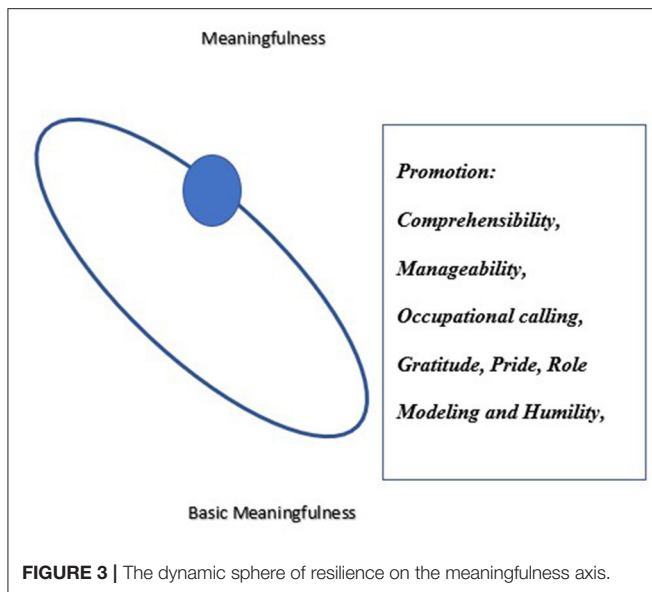
"I sat with my team and saw their crestfallen faces. Then I looked at myself in the mirror and thought "I am the cause of this. Stop, take care of yourself, and then come back to the team with new energy." (3, Male); *"Before the pandemic, I did a lot of work on myself. Now I take a break and I go out riding on my bike for a bit. If the pandemic had happened 2 years ago, I do not think I would have behaved the way I do. Not in terms of courage but in terms of caring for myself."* (13, Male).

The Third Axis of SoC: Meaningfulness

Findings present the emotional axis interviewees perceived as contributing to their individual and collective growth. Meaningfulness was three-fold: as a citizen (national mission), as an expert physician (an occupational mission and professional growth), and as a manager and leader (role modeling, gratitude toward the teams, and humility). **Figure 3** presents the sphere of resilience on the meaningfulness axis moving from occupational calling to gratitude, pride, role modeling, and humility.

I. Fundamental Meaningfulness as a Citizen (100%)

As citizens, interviewees viewed their work in the division as a national mission. They reported feeling "conscripted" from the start of the pandemic:

"Eventually we realized we were doing something extremely important. When we saw the triumph as patients recovered, we felt close to them, it was very touching." (6, Male).

II. Fundamental Meaningfulness as a Physician (100%)

Interviewees shared that their assignment as managers of the COVID-19 division is a once-in-a-lifetime opportunity, and they reported on their professional growth**:**

"It is challenging, very interesting period, really unforgettable. It's heartwarming. There has never been such value to my work as there is now. I always feel the power of a kind of sacred work. Everyone is expecting us to reach a minimum of deaths and a minimum of side effects. Today I can proudly say that we could really stand up to this difficult task." (9, Male); *"It is a very different and very special experience, I love the challenge, I like to be at the forefront of the action. I pushed myself hard into this place. This is the essence of being an intensive care physician."* (14, Male)

III. Meaningfulness as a Manager and a Leader (100%)
Gratitude and Pride (40%)

Interviewees shared that the sense of meaningfulness as managers includes gratitude toward team members and remembering that as leaders, they must be role models:

"I'm very proud that the clinicians, including some interns returning from rotations, showed maturity, great commitment to the task. I am really proud of the team. We worked a lot of hours, no days off on Fridays, Saturdays, no Passover, no Independence Day…" (11, Male); *It is disturbing that our a "Thanks to my wonderful team members, who once again proved their abilities, we met this challenge."* (Male, 14).

Role Modeling (70%)

Directors shared that they were aware of their influence on clinicians in the division and their deliberate efforts to serve as role models:

"My leadership definitely affects how people work. When the leader is charismatic, it makes a difference. I am not attesting to myself, God forbid, but I am giving this as an example of what contributes" (7, Male); *"With my team, the essence of my role is fatherly. Even when I have my fears, I have to show a lot of courage."* (12, Male); *"As division manager, I had to lead the way* (9, Male).

A Lesson in Humility (20%)

Three interviewees related to the pandemic as a reminder of how fragile we all are and of our inability to control our world:

"Who is a wise person? A humble person. One who is willing to hear from every person and even from the least important of all, one who lowers himself and listens to others. It is the knowledge that not all powers are concentrated in my hands and there are things that are more important than me" (3, Male); *"The virus brought humility; as senior experts, it made us hear all the voices because only together could we find the right way to treat the disease."* (2, Female).

Data conveyed SoC as evolving around themes that promote each of the three axes, revealing a salutogenic model that affected collective SoC as well. **Figure 4** presents the data-based *Dynamic Spheres Model of Resilience* illustrating the complex intertwining of the three multi-layered axes creating psychological resilience. This innovative model presents the axes as dynamically revolving around the resources that both deter and promote resilience. The model is derived from physics and is based on the classic atom shape with a nucleus in its center and spheres around it, all in
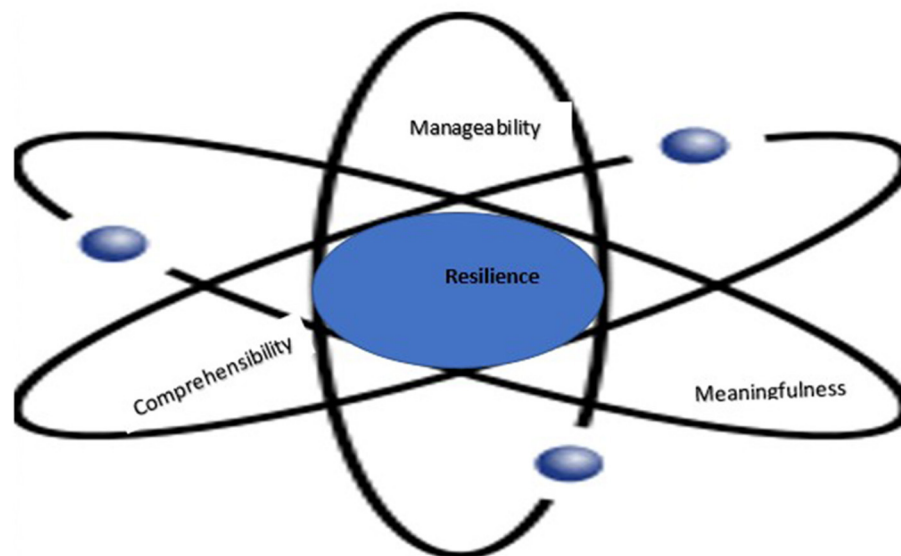
FIGURE 4 | The dynamic spheres of resilience model.

constant motion. On each of the spheres the "nucleus" moves between their poles: from poor resilience to resilience. The model presents a different trajectory for each axis.

CONCLUSIONS

This narrative study is the first to fill the gap in the state of the art, exploring the lived experiences of directors of COVID-19 divisions applying salutogenics to identify resources that promoted their psychological resilience. Participants reflected upon the resources they developed, the actions they took, the lessons they learned, and the reasons they keep going. They shared their personal and managerial voice reflection on their coping as they faced a novel complex situation. Antonovsky [26] maintained that the SoC is a unidimensional construct, with a global orientation. Other scholars argued that it is tri-dimensional, establishing the three interrelated but separate axes of SoC [14, 27] This study extends the Salutogenic theory demonstrating that in a pandemic, resilience of front-line directors in each of the SoC axes is not only tri-dimensional but also multi-layered, evolving, dynamically operating among the layers of each axis, entailing resources that both deter and promote SoC. Also, the three axes are intertwined enabling adaptability that evolved over a short time, from lack of comprehensibility, to using personal and organizational resources to manage the situation, through meaningfulness.

Comprehensibility

Participants lacked an understanding of the disease, were flooded with contradicting information about it, and were confused yet needed to provide care without protocols. The lack of comprehensibility was a deterring factor for resilience, decreasing self-efficacy and creating helplessness and fear. Within

3 weeks, medical directors compensated for their lack of clinical comprehensibility through their managerial and clinical experience. The multi-layers of comprehensibility as physicians, as managers, as supervisors, and as leaders, may compete amongst them as they all require mental resources and energy. A daily prioritization among competing layers created clarity and facilitated effective functioning. It also may have balanced the tension between the multi-layers, facilitating manageability of the chaos. Only half of the participants reported setting clear ethical boundaries as a game changer that facilitated the development of self-efficacy, conveying their recognition of their past accomplishments. Findings suggest that conflicting layers of comprehensibility existed simultaneously. Despite the new challenging circumstances, participants reported that it was their experience rather than comprehensibility of the disease that facilitated manageability. Comprehensibility has been thus far viewed as one-dimensional, but findings contradict the theory, suggesting that comprehensibility may not be limited to the scope of clinical understanding but rather encompass multi-layers.

From Comprehensibility to Manageability

Participants relied on their managerial experience to map challenges and to decide how to best manage the complex situations they encountered. They took responsibility for clinicians who belong to their organic teams but are at high risk for infection. Despite the shortage in clinicians, participants decided to reassign them to units that were safer for them. Participants were challenged by how to respond to clinicians who were afraid of getting infected and refused to work in the COVID-19 division. Another challenge was how to contain the responses of fellow team members, who perceived participants as potential disease carriers and related to them with suspicion and alienation. Participants consciously served as

role models, engaging in endless clinical work, and expressing acceptance and caring for clinicians in their division. An in-depth examination of the themes revealed that organizational resources both promoted and decreased resilience. Hospital managements deterred resilience when they expected clinicians to use scarce equipment more efficiently and to use untested innovations, creating moral conflicts and distressing participants. Such lack of perceived support jeopardizes self-efficacy and problem solving of clinicians during the pandemic (45).

Hospital managements promoted resilience when they recruited and directed resources to the COVID-19 divisions. Participants' expertise in saving lives under intense pressure in intensive care and emergency medicine facilitated manageability across work processes, despite the lack of clinical comprehensibility. Directors created rigid daily routines (e.g., morning visits, meetings, seminars) and engaged in shaping procedures that they manage during routine times, perhaps providing a sense of security and supporting their assessment that they are providing high quality care. Participants systematically analyzed what they would need "down the road" and prepared for it rather than focused only on the "here and now." Participants made sure that their managements understand what must change to put limited resources in place so the division would be ready for the difficulties ahead. Participants orchestrated processes of information sharing, team cohesiveness, and decision making. Personal resources of emotional orientation, reflection, and optimism, self-awareness, awareness of others and empathy, were important in strengthening SoC, but only a few participants harnessed them. The multi-layers of manageability strengthen the individual SoC of the participants. Data analysis regarding the functioning of the COVID-19 divisions, despite the multi-adversity, suggests that the individual SoC of the participants may facilitated a collective SoC of the division.

From Comprehensibility and Manageability to Meaningfulness

While meaningfulness was theorized as driven by comprehensibility and manageability, for clinical directors it was driven by the occupational calling and was tri-layered. The fundamental layers of meaningfulness as citizens and as physicians contradict the salutogenic theory, as they do not emerge from comprehensibility and manageability. Meaningfulness for clinicians in a pandemic may be atypical to meaningfulness according to salutogenics and may emerge from the chosen occupational calling of saving lives. Contradicting salutogenics, comprehensibility and manageability may strengthen the fundamental meaningfulness among clinicians rather than create it. Participants were able to view the COVID-19 as a once-in-a-lifetime endeavor; they felt passionate and viewed the crisis as facilitating their professional growth. Their self-esteem and self-efficacy promoted meaningfulness and strengthened psychological resilience (46). Meaningfulness as managers and leaders, the third layer, encompasses the gratitude toward the teams and the expression of pride and humility, enhancing participants' own well being and that of

team members (47). The capacity to cope infused a sense of triumph, despite all odds, in the face of a virus that keeps striking around the globe.

To sum, this study extends existent knowledge, suggesting that SoC is a multi-layer concept among front-line directors in a pandemic: (a). Comprehensibility is multi-layered. The experience of participants as directors, leaders, and mentors, compensated to a great extent for poor clinical comprehensibility. (b). Manageability, emerging from multi-layered comprehensibility, is also multi-layered entailing managerial experience in shaping organizational and personal resources. (c). Meaningfulness is tri-layered, growing from the fundamental meaningfulness as citizens and as physicians committed to saving lives to meaningfulness as directors and leaders in a crisis, emerging from comprehensibility and manageability. Resources that promoted psychological resilience were personal (ethical boundaries, reflection), organizational (infrastructure support, a sense of connection), and existential (sense of meaning and purpose). Interventions to promote resilience should target both the individual and organizational level (48). Additional personal resources we identified were reflective abilities, self-awareness, empathy, and social skills. These skills are elements of emotional intelligence, directly related to resilience (49, 50). This study contributes to actionable development of resources and capacities that are required for building resilience of clinicians in health crises (23).

Practice Implications

This study illuminates the need to prioritize psychological resilience among front-line directors in hospitals during crises (51, 52). Given that SoC plays a vital role in the psychological resilience of individuals, we call upon hospital managements to strengthen the SoC of front-line clinical directors, particularly when comprehensibility is low. To promote resilience, managements are called upon to identify gaps in resources that harness resilience and strengthen them through mentorship. To encourage an optimistic attitude and self-efficacy in coping, clinicians need to share their coping behaviors with others (14). An organizational discourse of peer support in chaotic times may establish a network of clinicians with whom to share experiences. Identifying, selecting, and using available organizational resources while adapting to adversity will facilitate more effective responses of clinicians (53). Management is called upon to assign a designated mental health professional to improve the buffering of stress (54, 55). Managements to structure ongoing discussions on significant ethical concerns that may arise during a crisis to develop ethical awareness, support real-time ethical reflections, safeguard clinicians, and enhance their well being. Compromising the psychological resilience of clinicians may constrain personal and professional growth. The psychological resilience of medical directors through a crisis is a prerequisite for their ability to keep caring for clinicians and patients, and to mentor others who depend on their leadership.

Limitations and Directions for Future Studies

The cultural attributes of interviewees may have influenced the resources and patterns. There may also be failures in picking up on non-verbal cues not visible via the ZOOM interview. Future studies may replicate this study in other countries to explore the perspectives of front-line medical managers on deterring and promoting factors for psychological resilience in health crises.

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 Board of Ethics, Hadassah Academic College, Israel. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

GG: conceptualization, data curation, literature review, data analysis, and writing the first draft. DP: pilot study and review od draft. LN-S: data curation, data analysis, and review of draft. All authors contributed to the article and approved the submitted version.

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Prevalence of burnout and associated factors among health professionals working in public health facilities of Dire Dawa city administration, Eastern Ethiopia

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Background: Burnout is a common condition among health workers, characterized by emotional tiredness, depersonalization, and a sense of low personal accomplishment. Ethiopia has major health workforce management challenges, including shortages, poor motivation, retention, and performance, and research evidence is limited for health professionals' burnout status, particularly in Eastern Ethiopia. Therefore, this study is aimed at determining the prevalence of burnout and associated factors among health professionals working at governmental health facilities in Eastern Ethiopia.

Method: An institutional-based cross-sectional study was conducted among health professionals using structured self-administered validated questionnaires using the Maslach Burnout Inventory scale. Data were entered into Epi-Data version 3.1 and exported to SPSS version 22 for analysis. Multivariable logistic regression was used to determine the association between burnout and its predictors.

Results: A total of 508 health professionals were approached, out of which 501 participated (a response rate of 98.4%). The magnitude of burnout was 54.1 with a 95% confidence interval of 49.9−58.0%. Working in a hospital (AOR = 3.55, 95%CI: 2.00, 6.33), age $>/=$ 40 (AOR = 3.98, 95%CI:1.60, 9.89) and 30−39 years (AOR = 1.90, 95%CI:1.08, 3.34), being female(AOR = 2.41, 95%CI: 1.37, 4.25), being widowed (AOR = 3.39, 95%CI: 1.13, 10.18), having intention of leaving work (AOR = 2.28, 95%CI: 1.35, 3.87), using at least one substance (AOR = 2.24, 95%CI: 1.36, 3.69), having a 6−11 years of experience (AOR = 2.17, 95%CI: 1.15, 4.06), having no job supervision (AOR = 4.65, 95%CI: 2.07, 10.43), monthly payment <10,000 *Ethiopian Birr* (AOR = 5.69, 95%CI: 2.30, 14.07) and between 10,000 to 15,000 *Ethiopian Birr* (AOR = 2.74, 95%CI: 1.22, 6.15), working in Pediatric Unit (AOR = 3.28, 95%CI: 1.24, 8.70), and profession type (Midwifery, Public health officer, Medical Laboratory professionals) were factors significantly associated with burnout.

Conclusion: Burnout affected more than half of the health professionals working in governmental health facilities in Dire Dawa. Health facility type, age, sex, marital status, intention to leave work, substance use, work experience, job supervision, monthly payment, profession type, and working unit were significantly associated predictors of burnout.

Introduction

Burnout is a condition that is thought to be caused by unmanaged long-term working stress (1). Depersonalization, or sentiments of negativism or cynicism about one's employment; emotional exhaustion, or emotions of energy depletion or exhaustion; and decreased professional performance are the three dimensions of burnout (1). Burnout causes people to perform poorly at work, endangering both their patients and themselves (2).

Burnout is becoming more common among healthcare providers, who have been classified as a high-risk category (3). Employee happiness, mental and physical health, absenteeism rates, work productivity, and staff turnover are all negatively impacted by burnout syndrome. It can also have an impact on family duties and functions. Its consequences extend to threatening the health care system, including care quality, patient safety, and healthcare expenses (4, 5).

Because most studies on this topic are conducted in high-income nations, it is unclear how many people working in the health profession are burnt out globally (2). Furthermore, in low-and middle-income nations, the aggregate burden of burnout and its impact on healthcare providers remains unknown. Studies in different settings of the globe show that burnout in health professionals is precipitated by the health system, individual behavior, and health care seeker numbers (6–8).

In Sub-Saharan Africa, the health system suffers from a scarcity of healthcare professionals and overburdening of the available health professionals because of the increasing health-seeking behaviors in society, and physicians from Sub-Saharan Africa are migrating to the global workforce (9–11). Sub-Saharan African medical graduates made up around 6%

of all overseas medical graduates entered the US workforce in 2015. Furthermore, more than 30% of physicians trained locally have gone to high-income nations in half of Sub-Saharan Africa's countries (9, 12).

In the last decade, Ethiopia has seen significant growth in primary health care services, including a large scale-up of health staff development and deployment. The number of health professionals in the population increased from 0.84 per 1,000 in 2010 to 1.5 per 1,000 in 2016. Ethiopia aims to meet the World Health Organization's (WHO) 2025 standard for Sub-Saharan Africa, which is a ratio of 2.3 health professionals per 1,000 people (13).

Plenty of interventions have been implemented to lower the occurrence of burnout among healthcare professionals around the globe (14, 15). The Ethiopian Federal Ministry of Health also introduced increments in incentives, rotation among frontline health professionals, and increased the number of health professional graduates to satisfy the growing demand of the health system, but the country has major health workforce management challenges, including shortages, poor motivation, retention, and performance (16).

Despite these increments in burnout among health professionals, only a few studies have been conducted in Ethiopia. Most of these studies were conducted in hospitals, and on single health professionals (6, 17). Further research into the factors of burnout among health professionals in various contexts is critical to halting the rising tide of burnout among health professionals. Therefore, the purpose of this study was to determine the magnitude of burnout and the factors that contribute to it among health professionals employed by the city of Dire Dawa.

Methods and materials

Study area, period, and design

A cross-sectional institutional study was undertaken in the Dire Dawa city administration's public health facilities from April 1 to April 30, 2020. Dire Dawa city is located in Ethiopia's eastern region, some 525 kilometers east of Addis Ababa, the country's capital. A total of 341,834 people live in the city

administration. The city of Dire Dawa has 15 health centers, one general hospital, one referral hospital, and 768 health workers, according to the health office of the local administration (18).

Study participants

The source population included all health professionals who worked in the Dire Dawa City administration public health institutions. The study population consisted of all health professionals who were available at work during the study period and were included in the sample. This study comprised health practitioners who hadworked for more than 6 months in Dire Dawa City administration public health institutions prior to data collection. During the data collection period, however, health professionals who were extremely ill or unable to reply were omitted from the study.

Sample size determination

The study's minimum sample size was calculated by using both single population proportion formulas and a power approach based on results obtained from a similar study conducted in public hospitals in Amhara Regional State, Ethiopia (19). After that, by comparing the sample sizes obtained from those two formulas, the maximum sample size of 508 was chosen as the final sample size.

Sampling procedure

In the city administration of Dire Dawa, there are two government hospitals and fifteen health centers. Each health facility's sample size was determined by proportionally allocating the calculated sample size depending on the number of health professionals on staff. The needed number of health professionals in each health facility was then picked using a simple random sample technique using the provided sampling frame (lists of health professionals with serial numbers) from each health institution's human resource department.

Data collection tools and procedures

Self-administered questionnaires adapted from previously conducted studies were used to collect data (20–24). The questionnaire was prepared in English and has questions regarding socio-demographic status, personal factors, work-related factors, and burnout. The English version of Maslach's Burnout Inventory-Human Services Survey (MBI-HSS), adapted from previously conducted studies, was used to collect data on burnout among healthcare professional. The

tool is comprised of 22 items regrouped into 3 subscales: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). Each item was answered on a 7-point Likert scale (0: "never", 1: "a few times a year or less", 2: "once a month or less", 3: "a few times a month", 4: "once a week", 5: "a few times a week", and 6: "every day"). The MBI-HSS is a reliable and valid instrument to assess burnout 25, 30, 31 A previous study has indicated that even when used in another language (Spanish), the instrument produced high sensitivity and specificity, 92.2 and 92.1%, respectively (22–25). The data collection was conducted by thirteen trained diploma nurses and two supervisors recruited from health facilities that were not included in the study.

Operational definition

The measure used to assess burnout among health workers includes 22 questions organized into three burnout domains: 5 questions about depersonalization, 8 questions about personal accomplishment, and 9 questions regarding emotional exhaustion. Each question has a response ranging from 0 = ("never") to 6 = ("daily") based on a 7-point Likert scale. Scores in each of the three subscales of burnout were divided into high, average, and low categories based on the cut-offs used in previous studies (22–25). Burnout refers to the value placed on the standard by the depersonalization, emotional exhaustion, and personal accomplishment subscales. So, if participants scored high in EE and DP but low in PA, they were considered burnt out.

Emotional exhaustion (EE) is defined as emotions of overextension as a consequence of one's job, with a score of 27 or more indicating high EE. Depersonalization (DP) is defined as emotional apathy and dehumanization of those who receive one's services, care, treatment, or instruction, with a score of 13 or more indicating high DP. Personal accomplishment (PA) is defined as sentiments of work stagnation, inefficiency, and underperformance, with a score of $\leq$31 indicating low PA (20–24).

Data quality control

The principal investigator conducted 2 days of training for data collectors and supervisors about the data collection technique and tool. A pre-test was conducted on 5% of health workers in the *Bike primary hospital*, which is one of the non-selected health institutions in Dire Dawa city, and the necessary changes were implemented accordingly. The data were examined for completeness, accuracy, and consistency by supervisors.

Data analysis procedures

The data were compiled, cleaned, and coded before being entered into Epi Data version 3.1 and exported to SPSS version 22 for analysis. The mean, median, and percentage were used to summarize the data. Tables and figures were used to present descriptive data. Using a bivariable logistic regression, crude odds ratios with 95% confidence intervals were calculated to analyze the relationship between each independent variable and the outcome variable. Variables having a P-value of <0.25 in the bivariable logistic regression were included in the multivariable logistic regression analysis. A Hosmer-Lemeshow goodness-to-fit model was tested for model fitness. Finally, adjusted odds ratios with 95% confidence intervals were calculated to assess the strength of the association, and variables with a p-value of <0.05 were considered statistically significant factors.

Ethical approval and participant consent

The Institutional Health Research Ethical Review Committee (IHRERC) at Haramaya University gave ethical approval. The city administration of Dire Dawa approved the conduct of this study and sent a formal letter of support to the respective health facilities in the City. Informed, voluntary, written and signed consent was taken from each study participant after explaining the aim and potential benefit of the study and confidentiality. This research was carried out in line with the Helsinki Declaration.

Results

Socio-demographic characteristics of the study participants

A total of 501 healthcare workers took part in this study, with a response rate of 98.4%. Two hundred fifty-one (50.1%) of the respondents were male, and the respondents' average age was 32 years old, with a standard deviation of 6.4 years. One hundred eighty-four (36.7%) of the participants were Muslim in religion, and 222 (44.3%) of the participants were married. In terms of educational level, 291 (58.1%) of professionals were bachelor's degree holders and 238 (47.5%) were nurses in the profession. Two hundred four (40.7%) of the participants had 6–11 years of experience, and 271 (46.6%) of the participants had ≤10,000 *Ethiopian Birr* (ETB) monthly salary. Three hundred twenty-eight (65.5%) of the participants were urban residents (Table 1).

TABLE 1 The sociodemographic characteristics of healthcare professionals working at public health facilities in Dire Dawa City, Eastern Ethiopia, 2020 (n = 501).

Variables	Categories	Number	Percentage
Age	≤29 years	173	34.5
	30–39 years	267	53.3
	≥40 years	61	12.2
Sex	Male	251	50.1
	Female	250	49.9
Religion	Muslim	184	36.7
	Orthodox	172	34.3
	Protestant	145	28.9
Marital status	Married	222	44.3
	Single	200	39.9
	Divorced/Separated	54	10.8
	Widowed	25	5.0
Educational status	Diploma/Level 4	192	38.3
	Degree	291	58.1
	Masters	18	3.6
Profession type	Nurse	238	47.5
	Midwife	50	10.0
	Laboratory	55	11.0
	Pharmacy	53	10.6
	Public Health (HO)	38	7.6
	Others[*a]	67	13.4
Work Experience	≤5 years	123	24.6
	6–11 years	204	40.7
	>11 years	174	34.7
Residence area	Urban	328	65.5
	Rural	173	34.5

Others[*a] = Specialist., medical doctor, IESO, anesthesia and Physiotherapy.

Work-related factors

Four hundred forty-nine (89.6%) of participants had supervision in their current job, and 281 (56.1%) had ≤72 average working hours per week. Two hundred ninety-eight (59.5%) of the participants were not substance users. The majority of the participants, 290 (57.9%), worked at health centers, while 81 (16.2%) worked in the adult OPD. One hundred thirty-eight (27.5%) of the participants are currently working as—managers or have a position, and 166 (33.1%) had the intention of leaving their work (Table 2).

Prevalence of burnout among health professionals

The prevalence of burnout was found to be 54.1% among health professionals working in Dire Dawa city administration public health facilities, with a 95% CI of 49.9–58.0%. Regarding

TABLE 2 Work-related factors of health professionals working at public health facilities in Dire Dawa City, Eastern Ethiopia, 2020 (n = 501).

Variables	Categories	Frequency	Percent
Having job supervision	Yes	449	89.6
	No	52	10.4
Average working hours per week	≤72 h	281	56.1
	≥72 h	220	43.9
Substance use	No	298	59.5
	Yes	203	40.5
Health facility type	Health center	290	57.9
	Hospital	211	42.1
Current working Unit or service delivery unit	Adult OPD	81	16.2
	Under 5 OPD	47	9.4
	Emergency care unit	55	11.0
	Medical unit	51	10.2
	Pediatric unit	36	7.2
	Surgical unit	22	4.4
	Gyn/Obs. unit	47	9.4
	Others[*b]	162	32.3
Monthly income (wage and incentive) (in)	<10,000 Ethiopian Birr	197	39.3
	10,000–15,000 ETB	229	45.7
	>15,000 Ethiopian Birr	75	15.0
Facility type	Health Center	290	57.9
	Hospital	211	42.1
Have Position or manager	Yes	138	27.5
	No	363	72.5
Intention of leaving the job	Yes	166	33.1
	No	335	66.9

Others[*b] = MCH, ophthalmic, dental clinic, psychiatry unit, ART and TB clinic, and ICU.

components of burnout, 324 (64.7%) of the participants had high emotional exhaustion, 458 (91.4%) of the participants had high depersonalization, and 442 (88.2%) of the participants had low personal accomplishment (Figure 1).

Factors associated with high burnout of health professionals

To determine the predictors of burnout among health professionals, bivariable and multivariable binary logistic regression models were used. In the bivariable analysis, average monthly income (payment), type of profession, intention of leaving a job, having job supervision, average working hours per week, facility type, sex, current marital status, residence area, substance use, total work experience, and current working unit had a significant association with health professional's burnout at p-value<0.05 whereas age, education, residence, working area, and having a job position were not significant at p-value<0.05 but included in the multivariable analysis, based on reviewing previous studies (6, 21, 25, 29, 32).

In multivariable analysis, health professionals working in hospitals had a 3.55 times greater chance of burnout than those working in health centers (AOR = 3.55, 95% CI: 2.00, 6.33). Participants over the age of 30 were more likely to have burnout, with >/= 40 years the most likely (AOR = 3.98, 95% CI: 1.60, 9.89) than ages 30–39 (AOR = 1.90, 95% CI: 1.08, 3.34). When compared to male health professionals, female health professionals had 2.41 times more chances of burnout (AOR = 2.41, 95% CI: 1.37, 4.25). Widowed health professionals had a 3.39 times greater risk of burnout (AOR = 3.39, 95% CI: 1.13, 10.18) compared to married health professionals.

Burnout was twice as common among health professionals who planned to leave their employment (AOR = 2.28, 95% CI: 1.35, 3.87) and those who used at least one substance (AOR = 2.24, 95% CI: 1.36, 3.69) as it was among their counterparts. Health professionals who had 6–11 years of work experience had a 2.17 times greater risk of burnout compared to health professionals who had 5 years of experience or less (AOR = 2.17, 95% CI: 1.15, 4.06). Health professionals who did not get job supervision had a 4.65 times higher risk of burnout than those who did (AOR = 4.65, 95% CI: 2.07, 10.43).
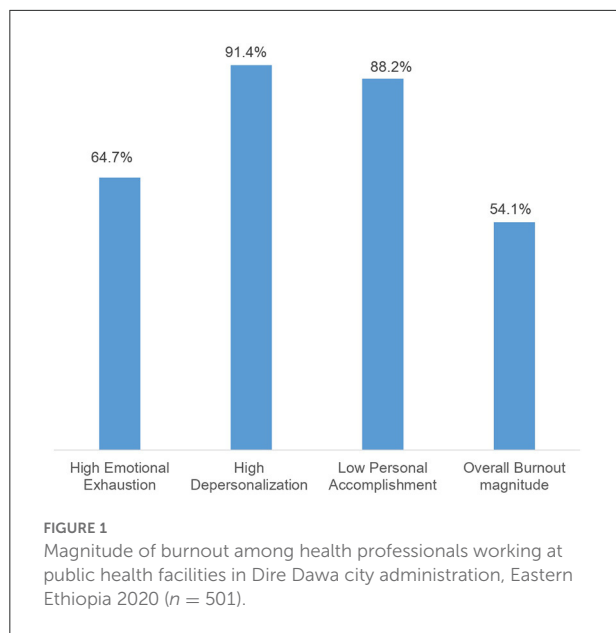
An average monthly payment of fewer than 10,000 ETB (AOR =5.69, 95%CI: 2.30, 14.07) and between 10,000 and 15,000 ETB (AOR =2.74, 95%CI: 1.22, 6.15) was a risk factor for burnout when compared to people who earn more than 15,000 ETB per month. In comparison to nurse professionals, midwives (AOR = 8.33, 95% CI: 3.11, 22.34), medical laboratories (AOR = 5.47, 95% CI: 2.06, 14.54), public health officers (AOR = 4.65, 95% CI: 1.85, 11.64), and other health professionals (AOR = 15.86, 95% CI: 6.00, 41.89) had higher burnout rates. Working in a pediatric unit increased the risk of burnout by 3.28 times compared to working in an adult OPD (AOR =3.28, 95% CI: 1.24, 8.70) (Table 3).

Discussion

The magnitude of burnout among health professionals working in public health institutions in the Dire Dawa City administration was investigated in this study. Accordingly, the magnitude of burnout was 54.1%, which corresponds to the findings of a study in Iran (52.9%) (20), Ethiopia (50.4%) (21), and Senegal (55%) (26). This result, however, is also higher than that of previous studies conducted in Ethiopia: 36.7%, 34.0%, 47.6% (22, 27, 28), Egypt (24.9%) (29), and China (2.46%) (30). This discrepancy could be attributed to participants' socio-cultural and demographic factors as well as the country's healthcare system structure. It could also be related to the difference in the study settings. Other studies included only single institutions (20, 21, 27, 28) or -one profession (22, 26, 28–30), while this study included both hospitals and health centers as well as multi-professions.

In this study, 64.7% of the respondents had high emotional exhaustion. This finding is consistent with the findings of research done at Debra Berhan University hospital (61.8%) (22). However, it is higher than the studies carried out in Iran (55.3%) (20) and China (24.83%) (30). Among participants, 91.4% had high depersonalization, which is in line with the findings of a study done in Iran (90.5%) (20). However, this finding is higher than the results of studies undertaken at Debra Berhan University hospital (47.9%) (22) and China (6.21%) (30). Furthermore, according to the results of this study, 88.2% of the participants had low personal accomplishments. This result is lower than that of an Iranian study (98.9%) (20). However, it is higher than research conducted at Ethiopia's Debra Berhan University Hospital (59.7%) (22) and China's Hubei (33.99%) (30). This disparity might be due to the differences in methodology used to define the three components of burnout. It could also be due to differences in study areas and socio-cultural differences among study participants.

When comparing health professionals working in hospitals to those working in health centers, the risk of burnout was 3.55 times higher. This finding is congruent with a study conducted in Malawi (31). The reason for this could be that hospitals have a higher patient flow and a lower patient to health professional ratio than health centers, which can result in a high workload. That is one reason for increased health professionals' stress and exhaustion. In fact, an overburdened work schedule, or having too little time and resources to complete a task, is a key cause of burnout (22). When work is so quick, employees lose their sense of belonging and their performance degrades because of lack of regular sleeping or eating routines due to the enormous job load.

Those in the age groups of 30–39 years and ≥40 years had 1.9 times and 3.98 times higher risk of burnout than those in the age group of below 30 years. This finding is backed up by findings from other studies done in the rural parts of Ethiopia (6). When comparing health workers with 6–11 years of experience to those with 5 years or less, the risk of burnout was nearly two times higher. This finding is in line with the findings of a study undertaken in Ethiopia (21, 25). This could be explained by the fact that when people stay at the same job for a long time, there is nothing new to do, making the job monotonous. Furthermore, because the individual has worked in the same job for a long time, there is a risk that they will overwork themselves and become exhausted.

Female health workers were 2.41 times more likely to experience burnout than male health professionals to experience it. This result contradicts the findings of research done at Gondar University hospital (32), and Malawi (31). When compared to married health professionals, widowed health professionals had 3.39 times the risk of burnout. This finding is in line with the results of research conducted in North Showa, Amhara, Ethiopia (25). One possible explanation for this could be the socio-cultural aspects of being a woman and of marital status. Women in many African communities have

TABLE 3 | Multivariable logistic regression of factors associated with burnout of healthcare professionals working at public health facilities of Dire Dawa City, Eastern Ethiopia, 2020 (*n* = 508).

Variables	Categories	Burnout		COR (95% CI)	AOR (95% CI)
		Yes *N* (%)	No *N* (%)		
Health facility type	Hospital	128 (60.7)	83 (39.3)	1.59 (1.11, 2.27)	3.55 (2.00, 6.33)***
	Health center	143 (49.3)	147 (50.7)	1	1
Age	≤29 years	86 (49.7)	87 (50.3)	1	1
	30–39 years	155 (58.1)	112 (41.9)	1.40 (0.95, 2.06)	1.90 (1.08, 3.34)*
	≥40 years	30 (49.2)	31 (50.8)	0.98 (0.55, 1.76)	3.98 (1.60, 9.89)**
Sex	Female	147 (58.8)	103 (41.2)	1.46 (1.03, 2.08)	2.41 (1.37, 4.25)***
	Male	124 (49.4)	127 (50.6)	1	1
Marital status	Married	114 (51.4)	108 (48.6)	1	1
	Single	105 (52.5)	95 (47.5)	1.05 (0.71, 1.54)	1.24 (0.71, 2.16)
	Divorced	33 (61.1)	21 (38.9)	1.49 (0.81, 2.73)	1.56 (0.75, 3.25)
	Widowed	19 (76.0)	6 (24.0)	3.00 (1.16, 7.80)	3.39 (1.13, 10.18)*
Educational level	Diploma	116 (60.4)	76 (39.6)	1.91 (0.72,5.05)	8.81 (1.99, 39.98)
	BSc degree	147 (50.5)	144 (49.5)	1.28 (0.49, 3.33)	7.46 (1.85, 30.10)
	MSc and above	8 (44.4)	10 (55.6)	1	1
Residence area	Rural	102 (59.0)	71 (41.0)	1.35 (0.93, 1.96)	1.63 (0.91, 2.90)
	Urban	169 (51.2)	159 (48.8)	1	1
Intention to leave work	Yes	105 (63.3)	61 (36.7)	1.75 (1.20,2.57)	2.28 (1.35, 3.87)**
	No	166 (49.6)	169 (50.4)	1	1
Substance use	Yes	122 (60.1)	81 (39.9)	1.51 (1.05, 2.16)	2.24 (1.36, 3.69)**
	No	149 (50.0)	149 (50.0)	1	1
Total work experience	<5 years	59 (48.0)	64 (52.0)	1	1
	6–11 years	124 (60.8)	80 (39.2)	1.68 (1.07, 2.64)	2.17 (1.15, 4.06)*
	>11 years	88 (50.6)	86 (49.4)	1.11 (0.70, 1.76)	1.38 (0.73, 2.62)
Having job supervision	No	39 (75.0)	19 (25.0)	2.81 (1.46,5.40)	4.65 (2.07,10.43)***
	Yes	232 (51.7)	219 (48.3)	1	1
Monthly income (wage and incentive)	≤10,000 ETB	121 (61.4)	76 (38.6)	5.69 (2.30,14.07)	5.69 (2.30,14.07)***
	1,000–15,000 ETB	116 (50.7)	113 (49.3)	2.74 (1.22, 6.15)	2.74 (1.22, 6.15)**
	>15,000 ETB	34 (45.3)	41 (54.7)	1	1
Weekly working hours	>72 h	135 (48.0)	146 (52.0)	1.75 (1.22, 2.51)	1.24 (0.69, 2.22)
	≤72 h	136 (61.8)	84 (38.2)	1	1
Profession	Nurse	105 (44.1)	135 (55.9)	1	1
	Midwife	32 (64.0)	18 (36)	2.25 (1.20, 4.24)	8.33 (3.11,22.34)***
	Laboratory	38 (69.1)	17 (30.9)	2.83 (1.51, 5.30)	5.47 (2.06, 14.54)**
	Pharmacy	28 (52.8)	25 (47.2)	1.42 (0.78, 2.58)	2.43 (0.93, 6.37)
	Public Health/HO	21 (55.3)	17 (44.7)	1.57 (0.79, 2.58)	4.65 (1.85, 11.64)**
	Others*a	47 (70.1)	20 (29.9)	2.98 (1.66, 5.33)	15.86 (6.00,41.89)***
Current working unit or Service delivery unit	Adult OPD	36 (44.4)	45 (55.6)	1	1
	Under 5 OPD	21 (44.7)	26 (55.3)	1.01 (0.49, 2.08)	1.16 (0.48, 2.78)
	Emergency Unit	35 (63.6)	20 (36.4)	2.19 (1.08, 4.42)	2.14 (0.93, 4.96)
	Medical Unit	23 (45.1)	28 (54.9)	1.03 (0.51, 2.08)	1.31 (0.53, 3.25)
	Pediatric Unit	23 (63.9)	13 (36.1)	2.21 (0.99, 4.97)	3.28 (1.24, 8.70)*
	Surgical Unit	8 (36.4)	14 (63.6)	0.71 (0.27, 1.89)	1.03 (0.33, 3.26)
	Gyn/Obs. Unit	25 (53.2)	22 (46.8)	1.42 (0.69, 2.92)	0.49 (0.16, 1.49)
	Others*b	100 (61.7)	62 (38.3)	2.02 (1.17, 3.46)	1.23 (0.51, 2.97)
Position (management)	No	205 (48.0)	158 (52.0)	1.42 (0.96, 2.10)	1.08 (0.63, 1.86)
	Yes	66 (61.8)	72 (38.2)	1	1
Duration of consultation time	>30 min	42 (55.3)	34 (44.7)	1	
	≥20 min	119 (77.3)	35 (22.7)	1.64 (1.06–2.55)	1.45 (0.87–2.42)
	<20 min	244 (67.4)	118 (32.6)	1	

Others*a = Specialist., medical doctor, IESO, anesthesia and Physiotherapy; Others*b = MCH, ophthalmic, dental clinic, psychiatry unit, ART and TB clinic, and ICU, *** = P-value <0.001, ** = P-value<0.01, * = P- value<0.05.

additional responsibilities outside of their work, both socially and culturally. This might cause stress and weariness. Moreover, having an unstable marital status might lead to additional duties, which can lead to increased stress and a loss of interest in one's current employment.

Compared to nursing professionals, midwives, medical laboratories, public health officials, and other health professionals, they had a higher risk of burnout. Compared to working in an adult OPD, working in a pediatrics unit had a higher risk of burnout. Such differences could be explained due to the nature of their profession and related workload. Those who had the intention of leaving work had around 2.28 times higher odds of burnout compared with their counterparts. This finding is in line with the study conducted in the Amhara region (21). This could be explained by the fact that professionals who are planning to leave their jobs experience sentiments of dissatisfaction and frustration, which lead to in personal non-achievement and eventually changing careers.

Those who used at least one substance had 2.24 times the risk of burnout, and those who worked without supervision had 4.65 times the risk of burnout. This finding is supported by a study conducted in Malawi (31, 33–35). This could be due to the fact that substance use can lead to depression, tension, and reliance. Every profession necessitates the employee's commitment and time, and substance users may find it difficult to meet these needs. This could result in lower job performance and weariness. Moreover, job supervision is important for helping employees adapt to the working environment, so that it will reduce the challenges and stress in the working area and have a significant impact on the burnout of staff.

The odds of burnout were 5.69 and 2.74 times higher among health professionals who earn an average monthly payment of <10,000 ETB and between 10,000 and 15,000 ETB compared to those who earn above 15,000 ETB per month, respectively. A study conducted in Ethiopia backs up this finding (17). This could be explained by the fact that the income (incentive) of an employee is one of the motivational factors for conducting job effectively.

Limitations of the study

There are certain limitations to this finding. Because it is a cross-sectional study, it can only reflect health professionals' experiences at the time of evaluation; hence, a causal relationship between health professional burnout and its predictors cannot be established. The other is that the study only included health professionals who worked in public health facilities. As a result, this may not be representative of health professionals that work in private health facilities.

Conclusion

The findings revealed that the majority of health professionals working at Dire Dawa public health facilities had burnout. Working at the hospital, being 40 or more years of age, being female, being widowed, having an intention to leave work, using at least one substance, having 6–11 years of work experience, having no job supervision, earning an average monthly payment of <10,000 ETB and between 10,000 to 15,000 ETB, being a midwife, medical laboratory, and public health, and working in the pediatric unit were significantly associated predictors of burnout. We recommend the health facility manager focus on the female health professional's wellbeing to make them ready to give quality care. Establish mechanisms to improve staff retention; create different incentive mechanisms that increase staff income; and conduct regular supervision.

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 Institutional Health Research Ethical Review Committee (IHRERC) at Haramaya University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study's conception and design, as well as the acquisition, analysis, interpretation of data, drafting and revising of the article, gave final approval of the version to be published, agreed to submit it to the current journal, and agreed to be accountable for all aspects of the work.

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Conflict of interest

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

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