New evidence on the psychological impacts and consequences of COVID-19 on mental workload healthcare workers in diverse regions in the world

Edited by
Davod Afshari, Edith Kamaru Kwobah, Krystyna Kowalczuk
and Stephen X. Zhang

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New evidence on the psychological impacts and consequences of COVID-19 on mental workload healthcare workers in diverse regions in the world

Topic editors

Davod Afshari — Ahvaz Jundishapur University of Medical Sciences, Iran
Edith Kamaru Kwobah — Moi Teaching and Referral Hospital (MTRH), Kenya
Krystyna Kowalczuk — Medical University of Bialystok, Poland
Stephen X. Zhang — University of Adelaide, Australia

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Editorial: New evidence on the psychological impacts and consequences of COVID-19 on mental workload healthcare workers in diverse regions in the world

Stephen X. Zhang[1]* and Krystyna Kowalczuk[2]

[1]Adelaide Business School, University of Adelaide, Adelaide, SA, Australia, [2]Department of Integrated Medical Care, Medical University of Bialystok, Białystok, Poland

Editorial on the Research Topic
New evidence on the psychological impacts and consequences of COVID-19 on mental workload healthcare workers in diverse regions in the world

Introduction

After 3 years, the COVID-19 pandemic has become the "new normal" around the world, and it is time to revisit the evidence and update the literature on the mental health status of various populations around the world. It's now crucial to reassess the empirical data and revitalize the existing body of literature concerning the mental health conditions of diverse populations worldwide. Updated insights offer an opportunity to update and compare these new findings with previous meta-analyses predominantly focused on the mental health status during the early stages of the pandemic (1–6). Such comparisons allow us to see whether mental health conditions continue to be as bad or have improved for various professions in various locations.

The papers published in this Special Issue has provided some new evidence, update and enrich the existing literature of meta-analytical evidence (1–11) as COVID-19 evolves. We especially request, whenever possible, it is necessary for the studies to follow standard research and reporting procedures such as PRISMA 2020 statement (12) and use common and validated measurement as in past meta-analyses on similar topics (13) to make comparisons effective and accumulate meaningful evidence. The published empirical papers covers different populations (for instance, employees, self-employed, unemployed, healthcare workers, nurses, and managers) from various geographical regions. The papers study certain populations and from certain regions but also more importantly compare and discuss the findings in relation to other related populations and other regions around the world (1–14) so that the discussion is not limited just to the author's region, thus embedding the study in the overall COVID-19 mental health literature.

Summary of papers

Below, we provide a summary of the key findings of the papers in this special issue to provide readers with an overview of the research on this important topic.

Qin et al. conducted a study in China and found that burnout among healthcare professionals increased significantly during the COVID-19 pandemic, with higher levels observed among frontline workers. Socio-demographic factors such as age, work experience, and educational level were associated with burnout.

Makowicz et al. investigated the impact of the pandemic on job satisfaction among nurses in Poland, Germany, Italy, UK, and Sweden. The study found that the pandemic had a significant negative impact on job satisfaction among nurses in all five countries, with variations across the countries.

Jamebozorgi et al. conducted a study in the Middle East and found a high prevalence of depression, anxiety, and stress among healthcare workers across seven countries in the region. There were also significant differences in mental health outcomes among different countries.

Safwan et al. conducted a study in Lebanon and found a high prevalence of depression, anxiety, and stress among Lebanese pharmacists during the COVID-19 pandemic. The study also found associations between mental health and factors such as gender, age, marital status, and income.

Wang et al. explored the use of digital therapeutics for the treatment of mental health disorders. They discussed the potential benefits of digital therapeutics, provided examples of successful interventions, and highlighted challenges and future research directions.

Cayo-Rojas et al. discussed the impact of COVID-19 on the mental health of healthcare workers. They highlighted unique stressors faced by healthcare workers, such as fear of contracting the virus and ethical dilemmas, and emphasized the importance of support and resources for healthcare workers.

Osório et al. conducted a longitudinal study on the mental health and professional overload of health workers in Brazil during the first wave of the COVID-19 pandemic. They found high levels of psychological distress, burnout, and fatigue among health workers, associated with factors such as longer working hours, exposure to COVID-19 patients, and lack of workplace support.

Jaguga et al. focused on transcranial magnetic stimulation (TMS) as a treatment for depression, discussing mechanisms and evidence for its effectiveness. They highlighted the need for further research on optimal dosing and treatment protocols.

Chen et al. examined cognitive-behavioral therapy (CBT) as a treatment for anxiety disorders, discussing its theoretical basis and evidence for effectiveness. They concluded that CBT is a highly effective first-line treatment for anxiety disorders.

Ebrahimi Rigi et al. explored the bidirectional relationship between sleep and mental health, emphasizing the importance of addressing sleep problems in mental health treatment. Peng et al. investigated the relationship between night shifts, insomnia, anxiety, and depression among Chinese nurses during the COVID-19 pandemic, finding direct effects and associations between these factors.

Tong et al. highlighted the potential negative impact of excessive social media use on mental health during the COVID-19 pandemic. They suggested strategies to mitigate these effects, such as setting limits on social media use and engaging in offline activities. Hernández-Fernández and Meneses-Falcón discussed the use of social media to promote public health, highlighting benefits and drawbacks and emphasizing careful planning and evaluation.

Renzi et al. conducted a cross-sectional study on the mental health of Italian nurses during the second wave of the COVID-19 pandemic, finding high levels of anxiety, depression, and post-traumatic stress disorder (PTSD) symptoms. They identified female nurses and those with a history of mental health problems as higher-risk groups.

Ayalew et al. presented a cross-sectional study on the prevalence of PTSD symptoms among healthcare workers in southern Ethiopia following the COVID-19 pandemic. They found high levels of PTSD symptoms and identified female healthcare workers and those with a history of mental health problems as higher-risk groups.

Chung et al. investigated the influence of intolerance of uncertainty and viral anxiety on adherence to physical distancing among healthcare workers during the COVID-19 pandemic. They found a negative association between intolerance of uncertainty and physical distancing adherence, partially mediated by viral anxiety.

Ahn et al. validated the Grief Support in Healthcare Scale (GSHS) among frontline nursing professionals in Korea and found associations between grief support, emotional exhaustion, and job satisfaction.

Yi et al. conducted a cross-sectional study on the impact of the COVID-19 pandemic on non-frontline pediatric nurses in China, finding high levels of acute stress reaction, depression, anxiety, and stress. They identified job withdrawal behaviors associated with mental health issues.

Sun et al. conducted a cross-sectional study on the psychological status of medical staff involved in nucleic acid collection during the COVID-19 epidemic in China, finding high levels of anxiety, depression, and stress associated with lack of social support, exposure to COVID-19 patients, and concerns about personal safety.

Implications and future research directions

In conclusion, the collective findings of these studies underscore the profound impact of the COVID-19 pandemic on the mental health and wellbeing of diverse populations, across COVID waves and various countries and regions—see a definition of COVID-19 waves here (15). These findings serve as a clarion call that we proactively monitor the wellbeing and mental health of individuals and communities during and beyond the COVID-19 pandemic, particularly as countries have been closed and then reopened (16). This continuous monitoring will enable timely interventions and support systems to safeguard mental health and wellbeing in the face of ongoing challenges. Moreover, the

studies emphasize the urgent need for further research to deepen our understanding of the multifaceted factors contributing to mental health outcomes among diverse populations and across different countries. By gaining comprehensive insights into these factors, we can inform evidence-based interventions and update meta-analyses, ensuring that future epidemics are met with targeted strategies that prioritize mental health of the more vulnerable populations.

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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Post-traumatic Stress Disorder Symptoms and Its Predictors Among Healthcare Workers Following COVID-19 Pandemic in Southern Ethiopia: A Cross-Sectional Study

Mohammed Ayalew [1]*, Bedilu Deribe [1], Yacob Abraham [1], Yared Reta [1], Fikru Tadesse [1] and Semira Defar [2]

[1] School of Nursing, Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia, [2] Department of Midwifery, Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia

Background: COVID-19 causes immense psychological pressure on communities in addition to physical misery. There is currently a scarcity of data on the psychological impact of the COVID-19 epidemic on Ethiopian healthcare workers (HCWs). Therefore, this study was aimed to assess the post-traumatic stress disorder (PTSD) symptoms and its predictors following COVID-19 pandemic among healthcare workers (HCWs) in southern Ethiopia.

Methods: A hospital based cross-sectional study design was used among 387 randomly selected HCWs between September 25 and October 25, 2020 at four selected public hospitals in Sidama National Regional State, southern Ethiopia. Impact of Event Scale-Revised (IES-R) was used to collect data post-traumatic stress disorder (PTSD) symptoms. Logistic regression analyses with 95% CI were used to examine the relationship between independent and outcome variables.

Result: The prevalence of PTSD symptoms was found in 56.8% of participants. Significant factors that increase risk of PTSD symptoms were being female (AOR = 1.91, 95% CI = 1.19, 3.05), married (AOR = 1.87, 95% CI = 1.12, 3.14) and nurses (AOR = 3.31, 95% CI = 1.66, 6.63). On the other hand, HCWs working other than emergency unit such as inpatients/wards (AOR = 0.43, 95% CI = 0.24, 0.75), OPD (AOR = 0.48, 95% CI = 0.24, 0.97) and other units (AOR = 0.49, 95% CI = 0.25, 0.96) less likely to be affected by PTSD symptoms.

Conclusion: The current study showed high levels of PTSD symptoms as psychological challenges for HCWs. Sex, age, marital status, type of profession and working environment were significant factors for PTSD symptoms in HCWs during the pandemic. HCWs require mental health support during and after the pandemic.

Keywords: psychological trauma, PTSD symptoms, health care workers, COVID-19, Ethiopia

INTRODUCTION

The coronavirus disease (COVID-19) pandemic, which began in China, continues to pose a global health hazard (1). The COVID-19 outbreak was declared as a public health emergency of worldwide concern by the World Health Organization (WHO) on January 30, 2020 (2). Globally, there have been about 260 million confirmed cases and almost 5.2 million COVID-19 related deaths reported by the end of November, 2021 (3). In Ethiopia, there were about 371,000 confirmed COVID-19 cases and more than 6,700 deaths in the country by the end of November, 2021, with a 1.82% case fatality rate (4).

COVID-19's rapid spread around the world has placed significant strain on healthcare workers (HCWs) who are directly and indirectly combating the pandemic, potentially increasing the risk of negative mental health outcomes (5). COVID-19 causes significant psychological stress and other health-related issues in HCWs, as they are responsible for infected patients, have frequent interactions with patients' families/relatives, and are occasionally scrutinized by the public (6). HCWs also fear that they can develop COVID-19 themselves, because of the increased risk of exposure to the virus. They are concerned that the infection is brought home and passed on to families and friends (7). In addition, wearing protective equipment for extended periods of time causes breathing difficulties and limited access to toilets and water, resulting in physical and mental exhaustion (7). There are frequent reports of excessive job load, isolation and prejudice and so they are extremely prone to physical weariness, fear, emotional disturbance and sleep problems (8).

Previous studies indicated that health-related pandemic disasters have been linked to posttraumatic stress disorder (PTSD) symptoms (9–11). The COVID-19 pandemic has the potential to be a traumatic situation. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the presence of symptoms from the following four symptom clusters is required for the diagnosis of PTSD: Intrusion symptoms associated with traumatic event(s); persistent avoidance of stimuli associated with traumatic event(s); negative changes in cognition and mood associated with traumatic event(s); and significant changes in arousal and reactivity associated with traumatic event(s) beginning or becoming more severe following the occurrence of traumatic event(s) (12).

The psychological pressure on HCWs dealing with COVID-19 is great (13) such as post-traumatic stress symptoms. According to a study done in China during the initial outbreak of COVID-19, 53.8% of respondents rated moderate to severe level of psychological distress (14). A study conducted in health care workers in Singapore reported that 7.7% for clinical concern of PTSD (15). The prevalence of symptoms of PTSD in Oslo, Norway were 28.9% among HCWs (16). About one-fourth (27.7%) had clinically important symptoms of post-traumatic

stress among workers in Mexico in another study (17). A similar study in Chinese nurses showed that 16.8% had symptoms of PTSD (18). According to recent studies in Ethiopian HCWs, the prevalence of psychological distress or PTSD symptoms ranges from 51.6 to 78.3% (19–23).

HCWs who work in emergency rooms, intensive care units (ICU), and isolation wards are more likely to acquire psychological problems (24). According to a study conducted in Singapore, doctors and those who are single have a higher risk of developing psychiatric symptoms than nurses and those who are married, respectively (25). Moreover, lack of social support and communication, as well as maladaptive coping and a lack of training, are all major risk factors for developing psychological morbidities (24).

In a high-pressure, high-risk anti-pandemic situation, HCWs frequently experience a variety of psychological issues (26). As a result, psychological assessment and intervention in victims and rescuers, such as medical personnel and volunteers, are critical for pandemic control. This concept is beneficial not only for early actions and psychological intervention, but also for significantly improving pandemic control and accelerating social recovery (27). Therefore, the mental health of HCWs should be safeguarded, since this can impact the success of the healthcare delivery and the control of COVID-19 pandemic.

It is critical to have a reliable estimate of the prevalence of mental health problems among HCWs during the COVID-19 pandemic in order to prevent, identify, and treat it. Despite the fact that numerous studies on the psychological impact of HCWs during the pandemic have been conducted in various countries, there is still paucity of evidences in Ethiopia (19–23), particularly in the southern area. Thus, the aim of this study is to assess the PTSD symptoms and its predictors among healthcare workers (HCWs) during COVID-19 pandemic in southern Ethiopia.

Our findings could be useful in developing interventions to help HCWs cope with the COVID-19 pandemic and future outbreaks. Also, this could help government organizations and healthcare professionals protect the community's mental health as the COVID-19 pandemic spreads across Ethiopia.

MATERIALS AND METHODS

Study Area
This study was conducted at selected public hospitals (Hawassa University Comprehensive Specialized Hospital (HUCSH), Adare General Hospital, Leku Primary Hospital and Yirgalem General Hospital) in Sidama National Regional State.

Study Design and Period
Institution based cross sectional study design was conducted among HCWs between September 25 and October 25, 2020.

Study Subject
This study was conducted among front line HCWs working in medical and surgical inpatient units, intensive care units, emergency departments, and outpatient units. In addition, non-frontline health professionals who are working at regular

chronic care clinic, laboratory, pharmacy, delivery etc. units were included.

Sample Size and Sampling Procedure

The required sample size was determined using single population proportion formula $\mathbf{n = (Z_{\alpha/2})^{2*}\ p(1\text{-}p)/d^2}$, where n is the sample size, z is the standard normal score set at 1.96, d is the desired degree of accuracy and p is the estimated proportion of the target population. Due to the lack of previous research to inform our expected sample proportion (p), we use a value that gives our sample size maximum i.e., $p = 0.5$. Then by taking $P = 50\%$. $Z_{\alpha/2} = 1.96$ and w = 5%, the computed sample size was 384 and by taking 10% non-response rate, the total sample size computed was 422.

The overall sample size was proportionally allocated to each health institution. Then simple random sampling method was used to select the study participants by taking the lists from the human resource office of each respective health institution.

Data Collection Methods

The English version of the Impact of Event Scale-Revised (IES-R) was used to collect data. The IES-R is a self-administered questionnaire that has been used to assess the psychological impact (PTSD symptoms) of a public health crisis within 1 week of exposure (28). This is a 22-item Likert scale questionnaire ranging from 0 (not at all) to 4 (extremely), with a total score between 0 and 88. It is composed of three subscales and aims to measure avoidance, intrusion, and hyperarousal symptoms (29). It had high levels of internal consistency (Intrusion: Cronbach's alpha = 0.87–0.94, Avoidance: Cronbach's alpha = 0.84–0.87, Hyperarousal: Cronbach's alpha = 0.79–0.91) and test-retest reliability was ranged from 0.89 to 0.94 (9, 30, 31). The total IES-R score was divided into normal (0–23), mild (9, 24–31), moderate (14, 31–33), and severe (>37) psychological impact (PTSD symptoms). A score of 24 or more considered as a cut-off score for the presence of PTSD symptoms or psychological trauma (31). The internal consistency or Cronbach's alpha of IES-R in this study was 0.94.

Four nurses were involved in data collection after receiving a 2-day intensive training on data collection techniques. A pre-test was performed in 5% of the sample to identify potential problems with data collection instruments and to ensure the consistency of the questionnaires. During the data collection process, supervisors checked each questionnaire for completeness on a daily basis.

Data Processing and Analysis

Collected data were entered to Epi-data version 3.1 and exported to SPSS version 24 for windows for analysis. Descriptive statistics were used to identify distributions of socio-demographic characteristics of the study participants. The magnitude of psychological impact, were described as a percentage. Logistic regression analyses with 95% CI were used to see the association between each independent and outcome variable. Finally, those variables which showed statistical significance at $P < 0.05$ and 95% CI in the final model was reported as independently associated with psychological impact. The model fitness test was checked using the Hosmer and Lemeshow goodness of fit test.

RESULTS

Socio-Demographic Characteristics

The study included 387 health professionals, with a 91.7% response rate. The remaining 35 questionnaires were incomplete and were not analyzed. The majority of study participants 227 (58.7%) were male, 233 (60.2%) were aged 26–35 years, nearly half 191 (49.4%) were married, about three-fourth 298 (77.0) had BSc degree, 230 (59.4%) had ≤5 years of experience, 224 (57.9%) were living with their family, half 197 (50.9%) were nurses by profession and about one-third 138 (35.7%) were working at emergency department. Socio-demographic characteristics were described in **Table 1**.

Prevalence of PTSD Symptoms

The prevalence of PTSD symptoms was found to be 56.8% (**Figure 1**).

Moreover, about one-third 142 (36.7%) of participants have severe, 28 (7.8%) have moderate and 50 (12.9%) mild level of PTSD symptoms as illustrated by **Figure 2**.

Independent Predictors of PTSD Symptoms

Significant factors that increase risk of PTSD symptoms were being female (AOR = 1.91, 95% CI = 1.19, 3.05), married (AOR = 1.87, 95% CI = 1.12, 3.14) and nurses (AOR = 3.31, 95% CI = 1.66, 6.63). On the other hand, HCWs working other than emergency unit such as inpatients/wards (AOR = 0.43, 95% CI = 0.24, 0.75), OPD (AOR = 0.48, 95% CI = 0.24, 0.97) and other units (AOR = 0.49, 95% CI = 0.25, 0.96) less likely to be affected by PTSD symptoms (**Table 2**).

DISCUSSION

Millions of people have died as a result of the COVID-19 pandemic, which has had a dramatic impact on the global population, and health-care providers have had to work a much busier schedule and for longer hours than predicted during this pandemic time. This study evaluates the severity of psychological trauma, known as post-traumatic stress disorder (PTSD), among health care workers during the COVID-19 pandemic in southern Ethiopia. It is added to a few other studies that have investigated this issue in Ethiopia (19–23).

The prevalence of PTSD symptoms was found to be 56.8% and more than one-third (36.7%) of participants had severe levels of PTSD symptoms. This finding is similar with recent studies in different parts of Ethiopia such as North Shoa (58%) (21), Northwest Ethiopia (55.1%) (19), and Gedeo Zone (51.6%) (22). In addition, studies from China (53.8%) (14), Italy (55%) (32), Spain (56.6%) (33), UK (60.6%) (34), and New York, US (57%) (35) reported similar findings to our study. But, a higher prevalence of PTSD (78%) were reported in southwest Ethiopia (20). Similarly a recent research by Zhang et al. found out that nearly three-fourth (73.4%) (IES-R ≥ 9) of study participants

TABLE 1 | Socio-demographic characteristics of the study participants during COVID-19 pandemic in selected hospitals of Sidama National Regional State, southern Ethiopia 2020 (*n* = 387).

Variable	Category	Frequency	Percentage (%)
Sex	Male	227	58.7
	Female	160	41.3
Age	<25 years	112	28.9
	26–35 years	233	60.2
	≥36 years	42	10.9
Marital status	Single	185	47.8
	Married	191	49.4
	Divorced	11	2.8
Religion	Protestant	189	48.8
	Orthodox	159	41.1
	Muslim	23	5.9
	Others[a]	16	4.1
Educational status	Diploma	47	12.1
	BSc degree/equivalent	298	77.0
	MSc degree or above	42	10.9
Average monthly income	<145 USD*	233	60.2
	>146 USD*	154	39.8
Work experience in years	≤5 years	230	59.4
	6–10 years	121	31.3
	≥11 years	36	9.3
Place of residence	Rural	72	18.6
	Urban	315	81.4
Living status	With family	224	57.9
	Alone	143	37.0
	With others	20	5.3
Profession	Physician	88	22.7
	Nurses	197	50.9
	Other professionals[b]	102	26.4
Working environment	Emergency	138	35.7
	Inpatient units	120	31.0
	OPD	58	15.0
	Others[c]	71	18.3

NB: *USD, United States Dollar; [a]Catholic, traditional; [b]Public health officers, laboratory, midwives, pharmacists; [c]Delivery, laboratory, pharmacy, ART clinics, TB clinics etc.; OPD-outpatient department; BSc- Bachelor of Science; MSc- Masters of Science.

FIGURE 1 | Prevalence of psychological impact (PTSD symptoms) of the study participants during COVID-19 pandemic in selected hospitals of Sidama National Regional State, southern Ethiopia, 2020 (*n* = 387).
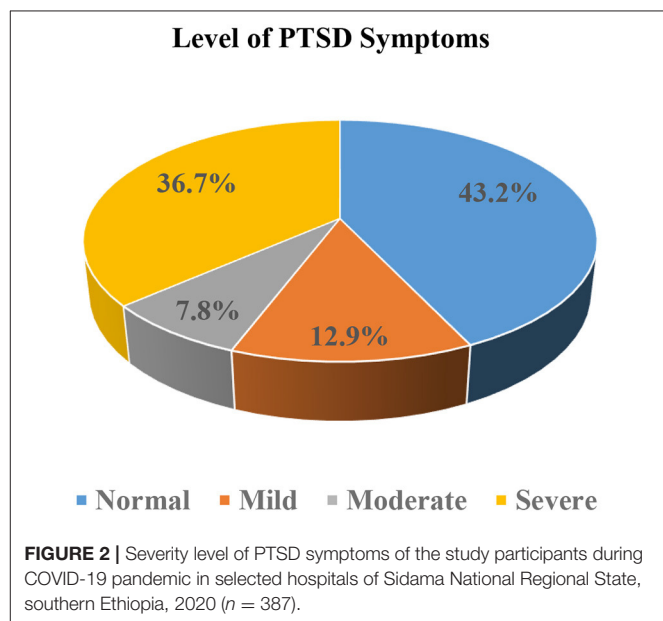
FIGURE 2 | Severity level of PTSD symptoms of the study participants during COVID-19 pandemic in selected hospitals of Sidama National Regional State, southern Ethiopia, 2020 (*n* = 387).

reported psychological trauma (36), which is higher than our finding. However, the prevalence of PTSD symptoms in this study was higher than in a study conducted in Oslo, Norway (28.9%) (16), Mexico (27.7%) (17), Italy (36.7%) (37), and Chinese nurses (16.8%) (18). Moreover, a recent literature review has shown that 11–74.4% of HCPs develop symptoms of PTSD (38). And also, several other investigations have shown very different results. Even if the same scale is employed, the use of diverse testing procedures and methodology in research, as well as the use of different classifications, contribute to widely disparate estimations of the prevalence of PTSD symptoms (39). In general, HCWs appear to be suffering from extensive mental health concerns during the COVID-19 epidemic (40, 41). Both before and after the epidemic, HCWs have a high demand for

psychological care. The significant prevalence of psychological trauma confirmed with this study and other previous studies (19–23) suggests that HCWs in Ethiopia will require psychiatric care in the future.

Females were shown to have more likely experience PTSD symptoms in this study. This is backed up by a slew of studies showing that women are more likely than men to suffer from "internalizing" mental illnesses (42, 43). Male sex was independently related with a decreased prevalence of peritraumatic dissociative symptoms, according to a study by Azoulay et al. (44). Women were more likely than men to suffer from post-traumatic symptoms as a result of the stressful work environment (32). Furthermore, recent studies on COVID-19's health outcomes among HCWs reveal a high prevalence of mental health issues, particularly among women (45–47). On the one hand, women may have felt the pressure of working in

TABLE 2 | Factors associated with PTSD symptoms of the study participants during COVID-19 pandemic in selected hospitals of Sidama National Regional State, southern Ethiopia, 2020 (n = 387).

Variable	Category	PTSD symptoms		COR (95% CI)	AOR (95% CI)
		Yes	No		
Age	<25 years	59	52	1	1
	26–35 years	142	103	1.09 (0.69, 1.72)	0.88 (0.50, 1.54)
	≥36 years	19	12	2.17 (1.01, 4.66)	1.36 (0.51, 3.67)
Sex	Male	111	116	1	1
	Female	109	51	2.23 (1.46, 3.41)	1.91 (1.19, 3.05)*
Marital status	Single	88	97	1	1
	Married	129	62	2.29 (1.51, 3.48)	1.87 (1.12, 3.14)*
	Divorced	3	8	0.41 (0.11, 1.61)	0.34 (0.07, 1.47)
Educational status	Diploma	34	13	2.38 (0.98, 5.73)	1.21 (0.43, 3.38)
	BSc degree	164	134	1.11 (0.58, 2.13)	0.68 (0.32, 1.44)
	MSc degree	22	20	1	1
Average monthly income	<145 USD	135	98	0.89 (0.59, 1.35)	0.89 (0.61, 1.57)
	>146 USD	85	69	1	1
Work experience in years	≤5 years	116	114	0.39 (0.18, 0.85)	0.81 (0.29, 2.20)
	6–10 years	78	43	0.69 (0.31, 1.58)	0.83 (0.32, 2.13)
	≥11 years	26	10	1	1
Living status	With family	137	87	1.28 (0.51, 3.24)	1.17 (0.69, 1.97)
	Alone	72	71	0.83 (0.32, 2.12)	1.40 (0.49, 4.01)
	With others	11	9	1	1
Profession	Physician	34	54	1	1
	Nurses	139	58	3.80 (2.25, 6.65)	3.31 (1.66, 6.63)*
	Other professionals[a]	47	55	1.36 (0.76, 2.42)	1.46 (0.74, 2.89)
Working environment	Emergency	96	42	1	1
	Inpatient units	60	60	0.52 (0.31, 0.88)	0.43 (0.24, 0.75)*
	OPD	28	30	0.50 (0.26, 0.94)	0.48 (0.24, 0.97)*
	Others[b]	36	35	0.62 (0.35, 1.11)	0.49 (0.25, 0.96)*

NB: *p-value < 0.05, USD, United States Dollar; OPD, outpatient department; [a]Public health officers, laboratory, midwives, pharmacists; [b]Delivery, laboratory, pharmacy, ART clinics, TB clinics etc.

the COVID-19 emergency more than their male counterparts because of the culturally bound double roles of women in the family, child-caring, and professional jobs. Women, on the other hand, place a higher value on their own internal experiences and the emotional states of others than men. Furthermore, a growing body of gender-specific research reveals that men use health-care services and report symptoms at a lower rate than women (48, 49).

In our study, we found out that the married HCWs were highly likely to experience PTSD symptoms than their counterparts. Similarly, PTSD symptoms were observed to be considerably greater among married employees in prior research conducted with healthcare professionals following COVID-19 outbreaks (50). Furthermore, in different studies conducted following the various outbreaks, married HCWs were found to be more concerned about their own health condition as well as the health of their families, leading to the conclusion that married HCWs experience more symptoms of psychological trauma (51, 52).

In comparison to physicians, nurses are more likely to experience PTSD symptoms, according to this study. Prior studies indicate that nurses are said to be at a higher risk of psychological disturbance or post-traumatic symptoms than doctors (19, 53–55). This may be due to nurses' workloads and night shifts, as well as being in contact with more risky patients than doctors (54). Of course, nursing personnel have longer and deeper interaction with COVID-19 patients, which provides the 24-h care, which raises the risk of psychological trauma, compared to other professionals (32). Physicians can be assumed to have certain unique somatization resistance which can be ascribed to their personal performance (56), professional experience, and self-awareness (57).

HCWs who worked in units other than emergency units were less likely to develop PTSD symptoms than those who worked in emergency units, according to our research. An Italian investigation came to a similar conclusion (32). Even though a patient's death is something that should be considered in any medical setting, especially in emergency rooms, it has been demonstrated to be one of the most common sources of stress for HCWs (58, 59). The emergency unit's so-called red zone, where most front-line HCWs perform their everyday operations, is a heavily contaminated and dangerous environment. Furthermore,

doctors, nurses, and technicians may have lost a patient because to the pandemic or another medical issue. HCWs who saw the death of one of their COVID-19-infected patients, on the other hand, reported higher levels of psychological trauma (32). It is fact that, the death of a patient may remain an unspoken emotion, especially if overburdened by guilt and a sense of professional failure, which can influence the efficacy of physicians and other HCWs working with patients, resulting in significant adverse psychological consequences.

Even though, this study provided a baseline data, and we use a standardized tool IES-R designed to assess psychological trauma (PTSD symptoms), there are certain limitations to this research. To begin, PTSD symptoms were assessed solely by self-administered questionnaires rather than a psychiatric interview. Second, because we were unable to meet with HCWs face to face, we were unable to acquire extensive information about psycho-traumatic symptoms history. Third, this is a cross-sectional research paper. Fourth, no information on the type of mental health support provided to HCWs could be found. Therefore, longitudinal studies are needed to determine the prevalence of PTSD symptoms and its causative factors after the COVID-19 pandemic in the future researches.

CONCLUSION

High levels of symptoms of PTSD symptoms emerged in the present study as psychological difficulties experienced by HCWs. Being female, married and nurses were significant factors associated with high risk of PTSD symptoms. Whereas, HCWs working other than emergency unit such as (inpatients, OPD and other units) were less likely to experience PTSD symptoms. Given the anticipated waves of COVID-19 and other healthcare crises, identifying risk factors for PTSD among HCWs and providing treatment for those who require it is crucial. Also, HCWs require psychiatric support at which monitoring and control can be performed during and after the pandemic. Furthermore, it is better if Ministry of Health and other concerned bodies provide mental health and psycho-social support (MHPSS) and arranging for in-service training to raise awareness for HCWs.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Hawassa University, College of Medicine and Health Sciences, Institutional Review Board (IRB) with reference number IRB/295/12. The participants provided their written informed consent to participate in this study. The same permission letter was written by the university to each health institution. The purpose of the study was explained for the respondents and the right to withdraw from the study at any time was assured. Coding was used to eliminate names and other personal identification of respondents throughout the study process to ensure participants confidentiality. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

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Nurses Burnout, Resilience, and Its Association With Socio-Demographic Factors During COVID-19 Pandemic

Majid Heidari Jamebozorgi[1], Ali Karamoozian[2,3], Tayebe Ilaghinezhad Bardsiri[4] and Hojjat Sheikhbardsiri[5*]

[1] Department of Public Health, Sirjan School of Medical Sciences, Sirjan, Iran, [2] Modeling in Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran, [3] Department of Biostatistics and Epidemiology, Kerman University of Medical Sciences, Kerman, Iran, [4] Department of Neonatal Intensive Care Nursing, Faculty of Nursing, School of Nursing and Midwifery, Sirjan University of Medical Sciences, Sirjan, Iran, [5] Health in Disasters and Emergencies Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran

Background: In the recent pandemic, nurses have faced workload and being exposed to burnout. Resilience helps address work-related psychological problems such as stressful events and burnout. According to the roles of nurses in the healthcare system, we investigated the relationship between resiliency and burnout in nurses.

Material and Methods: In this descriptive analytical cross-sectional study, 364 nurses participated from April to June 2021. Census sampling was used to recruit participants. Maslach burnout inventory (MBI), Connor-Davidson Resiliency Scale (CDRISC), and a demographic check-list were utilized to collect data. Data analysis was done using SPSS version 22. Shapiro-Wilk, Kruskal–Wallis test, Mann–Whitney U-test, correlation analysis, and generalized linear model were applied accordingly.

Results: Overall, the findings showed that nurses had severe symptoms of burnout and a moderate level of resilience. The two domains of burnout, emotional exhaustion and personal accomplishment had a significantly negative correlation with resilience ($r = -0.442$, $p < 0.001$ and $r = -0.351$, $p = 0.03$, respectively). Linear regression showed that demographic characteristics (Hospital type, ward type, gender, and overtime) were the major predictors of the 3 sub-categories of burnout. A significant negative correlation was observed between burnout and resilience highlighting the role of resilience in reducing burnout ($P < 0.05$).

Conclusion: In order to help nurses to tackle and endure burnout in pandemic times, there is a need to implement national and local policies to help them accordingly.

Keywords: burnout, resiliency, nurses, socio-demographic, COVID-19

INTRODUCTION

With its rapid global spread and concomitant mortality burden, the COVID-19 outbreak represents a global public health issue unseen in the last century. Health systems around the world have encountered unprecedented problems in resourcing a healthcare response as SARS-CoV-2 spreads fast (1–3). Amid the pandemic of COVID-19, burnout is a critical health-care issue which involves healthcare employees in numerous jobs, in particular nurses. With regard to the experience nurses

have concerning physical and psychological stressors, they face the phenomenon of occupational burnout. As a result, they are more vulnerable to negative mental health outcomes amidst COVID-19s (4–6).

Accordingly, nurses are one of the most crucial pillars of healthcare organizations during COVID-19, and any flaws will have irreversible implications owing to their critical role in patient care. As a result, it is critical to pay close attention to the factors that influence nurses' performance in this area (7, 8). Burnout among nurses, more than any other factors, jeopardizes patient recovery (9, 10). This issue is a major contributor to decreased productivity, and issues related to mental and physical topics (11). Due to the prevalence of COVID-19 and the heavy workload of nurses in hospitals and health care centers, managers must take heed to the burnout of nurses (12). During the COVID-19 outbreak period, few researches have been conducted on burnout levels among nurses. The study done by Bashirian et al. shows that, nurses experience more burnout in comparison to other health workers during the pandemic of COVID-19 (13).

Physical, emotional, and mental health are all harmed by burnout. Efficient managing of the sources of stress that contribute to burnout is one of the most significant factors in preventing burnout (14). The essential aspects of stress management and burnout prevention are an individual's personality qualities and psychological processes (15). Managing the issues related to pandemics, our knowledge and adaptation to come up with ways to overcome them is essential. Resilience is understood in this way. According to a literature, resilience has been a controlling factor against mental illnesses, including anxiety and depression. Studies suggest that resilience is relevant to health care workers' anxiety levels, in the sense that the more resilient a person is, the better his mental health will be (16, 17).

The concept of psychological resilience has arisen in recent years as a personality feature that protects against burnout. Despite a variety of explanations concentrating on various facets of resilience, which has a complex and teachable structure, the adaptation of a person to major stressful factors such as employment and financial challenges is defined as resilience (18). More resilient people are better equipped to deal with obstacles, uncertainty, and other unpleasant conditions, increasing their capacity to succeed. Nurses who have improved their resilience are better equipped to cope with bad situations, have increased their ability to adapt and achieve, and are likely to have less burnout (19–21).

Several studies on the association between resilience and burnout have been undertaken, but few have included nurses (19, 21–24). Nurse burnout is not just a problem in the workplace or a concern for policymakers; it has become a universal issue. Taking into account the nurse burnout and its relation to resilience are crucial for improving nurses' emotional and physical health, as well as the quality of care delivered by them Therefore, this study aims to investigate the level of burnout and resilience in nurses and to investigate whether there is a link between the level of resilience and burnout in nurses amid the pandemic of corona virus.

METHOD

Design and Participants

This self-reported cross-sectional study was undertaken based on quantitative data in April–June 2021. The study was conducted in two hospitals in southeastern Iran. Participants were recruited from the only COVID-19-designated hospitals. Our inclusion criteria encompassed having a bachelor's degree or higher and work experience more than of 6 months. We excluded participants on account of unwillingness to take part in research and not completed questionnaires. We obtained informed consent and assured them regarding the confidentiality of their information. The reminder messages were sent to the nurses by researchers, so most of the questionnaires (96%) were collected in June.

Sampling Method and Sample Size

The sample size was calculated using the findings of a former study (25) indicating that the prevalence of burnout among nurses was 30.6%. Therefore, with a $Z = 1.96$ and a $d = 0.05$, a sample size of 326 subjects was obtained. As the calculated sample size was almost equal to the size of the total population of nurses in the study setting, all eligible nurses in the setting were recruited to the study through a census sampling.

Data Collection

Because of COVID-19 outbreak, data were gathered through online questionnaires via the Porsline application to minimize the COVID-19 transmission risk between researchers and respondents. The survey was sent using Porsline online service system (https://survey.porsline.ir/s/gyAh8hB); the link to the survey was disseminated via social media (Telegram, WhatsApp, and Instagram). The participants gave informed consent before the initiation of the study. To avoid null values, all elements were adjusted as needed. In order to increase the response rate, the participants were reminded to complete the survey every week in April (during the pandemic) and the survey was closed on May 1, 2021. The survey tool consisted of 71 questions. It also included three well-recognized and validated tools. Three parts of the tool had to be completed: demographic characteristics information, the Maslach Burnout Inventory–Human Services Survey (MBI-HSS) questionnaire, and the Connor–Davidson Resilience Scale (CR-RISC) questionnaire.

Measurements

Socio-Demographic Attributes
The demographic characteristics information cheklist had two different parts. The first part encompassed demographic items (age, sex, marital status, and educational level), and the second part included career traits (years of professional work, type of ward, and overtime hours).

The Maslach Burnout Index
The used questionnaire has been developed and validated previously (26). It has 22 questions which divided into 3 sub-categories: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). In the dimension of EE, eight items were associated with fatigue, being tired, and decreased

emotional energy. In the dimension of DP, 6 items relate to the behavior of an individual lacking affection toward those being cared for and served. In the dimension of PA, 8 items identify situations in which a person feels sufficient and successful (10, 27). Each item has a 5-point Likert scale that varies from "never" or 0 to "every day" or 6. Although there is no defined cut-off for the MBI subscales, based on 'a previous study (28) which examined the most commonly used raw score threshold. For EE, scores of 27 or higher are classified as high, scores below 16 are low, and scores between 17 and 26 are moderate. For DP, a score of 13 or higher is classified as high, a score below 6 is low, and a score of 7 to 12 is moderate. For PA, a score of 31 or below is considered low, a score above 39 is high, and a score of 32 to 38 is moderate. Low, high, and moderate burnout levels are represented by scores ≤53, ≥79, and 54–78. To determine burnout, scores for the 3 sub-dimensions were evaluated separately. In this study, Cronbach's alpha coefficients for EE, DP, and PA were 0.89, 0.84, and 0.79, respectively.

Connor–Davidson Resilience Scale−25

This scale has 25 items over three sub-categories (tenacity, strength, and optimism) that evaluate resilience or flexibility to change and cope with adversity. A 5-point Likert scale was used

(0 = not true at all, 4 = always true). The total score ranges from 0 to 100, with higher scores indicating higher degrees of resilience. In our study, the Cronbach alpha coefficients of resilience and its three sub-categories were 0.89, 0.81, 0.79, and 0.76, respectively (29).

Data Analysis

In order to analyze data, we used SPSS software (v. 22.0). Mean and standard deviation (Mean ± SD) were calculated for numerical variables, while absolute and relative frequencies were calculated for categorical variables. We tested normality by using the Shapiro-Wilk test. In order to investigate the relationship between the variables in the present study, Mann-Whitney, Kruskal Wallis, Spearman correlation, and generalized linear regression models were used. Also, in order to determine the significance of the variables, a significance level of 5% was used and those variables whose p-value was estimated to be <0.05 were recognized as influential variables in the model.

RESULTS

The demographic characteristics as well as the MBI and CDRISC mean scores in each subscale of participants are presented in

TABLE 1 | The compare of resilience and burnout mean score of participant's base of demographic variables.

Variable	Resilience				Burnout			
	Frequency (%)	Mean ± SD	Median (IQR)	p-value	Frequency (%)	Mean ± SD	Median (IQR)	p-value
Hospital				0.17				**0.003**
Gharazi	113 (31.00)	55.94 ± 8.91	54 (10.50)		113 (31.00)	71.39 ± 11.73	70 (11)	
Emam Reza	251 (69.00)	57.37 ± 11.89	56 (11)		251 (69.00)	76.45 ± 14.59	74 (20)	
Hospital ward				0.76				**0.02**
Front	216 (59.30)	55.99 ± 10.26	55 (10)		216 (59.30)	74.32 ± 14.47	71 (15.75)	
Second	148 (40.70)	58.30 ± 12.03	57 (13.75)		148 (40.70)	75.69 ± 13.16	74 (13.75)	
Age				**0.01**				**<0.001**
≥40	196 (53.84)	52.24 ± 21.11	53 (11.03)		196 (53.84)	72.46 ± 8.31	73 (12.25)	
<40	168 (46.16)	58.91 ± 11.06	55 (10.87)		168 (46.16)	75.34 ± 14.75	72.50 (18.50)	
Experience work				**0.04**				0.61
≥15	192 (52.74)	51.61 ± 47.13	53 (11.12)		192 (52.74)	71.20 ± 6.38	72 (23.5)	
<15	172 (47.25)	58.02 ± 14.04	55 (11.62)		172 (47.25)	78.12 ± 16.52	74 (17.21)	
Gender				**0.01**				0.41
Male	58 (15.90)	56.70 ± 11.49	54.50 (10.50)		58 (15.90)	73.12 ± 24.2	73 (17.00)	
Female	306 (84.10)	56.97 ± 10.99	56 (11)		306 (84.10)	75.12 ± 46.84	72 (9.21)	
Marital				0.33				0.87
Unmarried	47 (12.90)	58.12 ± 10.69	55 (13)		47 (12.90)	74 ± 12.31	73 (12)	
Married	317 (87.10)	56.75 ± 11.12	56 (11)		317 (87.10)	75.01 ± 14.19	73 (15)	
Education				**0.03**				0.74
Undergraduate	329 (90.40)	56.70 ± 11.17	56 (11.50)		329 (90.40)	75.02 ± 14.22	73 (15)	
Postgraduate	35 (9.60)	59.06 ± 9.86	56 (13)		35 (9.60)	73.57 ± 11.24	73 (12)	
Overtime				0.44				**0.007**
<20	30 (8.20)	55.20 ± 12.43	53 (12.75)		30 (8.20)	75.96 ± 14.57	75.50 (25.75)	
20–60	107 (29.40)	57.02 ± 11.01	56 (13)		107 (29.40)	79.49 ± 18.01	75 (31.00)	
60–100	162 (44.50)	57.53 ± 11.24	56 (12)		162 (44.50)	72.57 ± 10.43	71 (10)	
>100	65 (17.90)	56.09 ± 10.09	54 (9)		65 (17.90)	72.55 ± 11.92	74 (16.50)	

SD, Standard deviation; IQR, Interquartile range. The bold values indicates P < 0.05.

	Mean ± SD	Total
Burnout dimensions		
Personal accomplishment	25.22 ± 4.67	74.88 ± 13.95
Depersonalization	18.25 ± 5.91	
Emotional exhaustion	31.40 ± 7.47	
Dimensions resilience		
Competence	17.93 ± 4.56	56.93 ± 11.06
Trusting	14.88 ± 3.47	
Change	12.46 ± 2.76	
Control	6.84 ± 2.07	
Spirituality	4.82 ± 1.77	

SD, Standard deviation.

Table 1. A total of 378 nurses in the study setting, 364 nurses (113 from public hospital and 251 from social security hospital) completely answered the study questionnaires (response rate: 96%). Most participants worked in second line departments (59.30%), were female (84.1%), held an undergraduate degree in nursing (90%), worked with a range from overtime between 60 and 100 h per month (44.5%), the means of their age and work experience were 37.20 ± 6.38 and 15.12 ± 6.52 years, respectively.

We observed a statistically significant relationship between burnout and hospital type, ward type, gender, and overtime ($P < 0.05$). Also, between the resilience of nurses and socio-demographic variables, there was a significant association regarding ward type, gender, education status, and work experience ($P < 0.05$) (shown in **Table 1**).

The results showed the burnout mean score of the nurses who participated in the present study was 74.88 ± 13.95, and the mean scores for emotional exhaustion, Depersonalization and Personal accomplishment were 31.4 ± 7.47, 18.25 ± 5.91, and 25.22 ± 4.67, respectively. The mean score for resilience was 56.93 ± 11.06, and the mean scores for competence, trusting, change, control, and spirituality were 17.93 ± 4.56, 14.88 ± 3.47, 12.46 ± 2.76, 6.84 ± 2.07, and 4.82 ± 1.77, respectively. Such findings highlight that, nurses had a moderate level of resilience (shown in **Table 2**).

The spearman correlation analysis showed that emotional exhaustion and reduced personal accomplishments were negatively correlated with total resilience ($r = -0.442$, $p < 0.001$ and $r = -0.351$, $p = 0.03$, respectively), but we did not observe a significant relation between depersonalization and resilience. In order to use the regression model to investigate the simultaneous effect of several variables on the variables of burnout and resilience and simultaneous control of some variables due to the abnormal distribution of residuals of both models, the generalized linear regression model was used (Generalized linear model). **Table 3** depicts the linear regression results for the association among burnout, resilience, and socio-demographic characteristics. Results indicated that variables of hospital type, ward type, gender, and overtime were the main predictors of a high level of burnout. Also, variables of ward type, gender, education status, and

Variables	Burnout dependent variable			Resilience dependent variable		
	β	SE	p-value	β	SE	p-value
Type of hospital	−4.41	1.53	0.004	−1.03	1.26	0.42
Hospital ward	−1.51	1.43	0.01	−2.16	1.16	0.06
Gender	−1.56	1.99	<0.001	0.02	1.63	<0.001
Marital	−1.31	2.15	0.60	0.57	1.76	0.74
Education	1.35	2.40	0.57	−2.08	1.96	0.02
Overtimes	2.71	3.03	0.37	−1.27	2.47	0.61
Age	6.04	2.16	0.005	0.42	1.78	0.81
	−0.58	2.01	0.77	1.14	1.64	0.49
	−0.29	0.34	0.39	−0.22	0.28	0.42
Experience work	0.23	0.33	0.48	0.17	0.27	0.01

β, Regression coefficient; SE, Standard error.

work experience were the main predictors of a high level of resilience.

DISCUSSION

This study aimed at investigating the burnout status and its relationship with resilience in nurses working in hospitals in Iran. Evidence highlights the impact of psychological stress on nurses in pandemic circumstances (27, 30). Our findings confirmed that the nurses' level of burnout was high; this is in line with the results of several earlier studies performed among healthcare providers during epidemics (31–33). According to previous studies, these findings are attributable to the physical exhaustion due to the excessive workload, shortage of staff and necessary equipment for care delivery to patients with COVID-19, death of patients, inequity, and respect to each other, different values regarding the organizations, lack of support from other organizations, working closely with infected patients for longer shifts, and fear of catching the disease or spreading it among people (5, 10, 12, 30). Also, Frontline nurses reported higher level of burnout in comparison with their co-workers in other parts. As stated in other researches, direct work with people infected with corona virus encompasses aggregated vicarious trauma for workers with direct impacts on burnout. This finding is consistent with the findings of other studies (9, 12). These findings express the need for hospitals to use protective strategies. In the pre-COVID-19 period, according to the reports, the overall prevalence of job burnout in the hospitals of Iran was 25% during 2000–2017. The highest job burnout was recorded in Tehran in 2009, 75% (34, 35), the prevalence burnout in our study was relatively higher.

High workloads of nurses can cause burnout regading emotional exhaustion, reduced personal accomplishment, and depersonalization (33). In this study, frontline nurses stated a moderate to a high level of burnout in emotional exhaustion

(29.13 ± 10.30) and depersonalization (12.90 ± 4.67) and burnout was less affected concerning personal accomplishment (37.68 ± 5.17). Among the sub-dimensions of burnout among respondents, emotional exhaustion was the most commonly detected, and roughly half of them in that study experienced it. Also, it is related to heavy activities, time constraint, stressful situation, inadequet PPE, and encounter with patients infected with COVID 19. This finding is consistent with the results reported by other studies (12, 30).

Our findings highlight that nurses have a moderate or high level of psychological resilience, which is in line with findings from recent studies (33, 36, 37). Our study revealed that more COVID-19 related burnout was related to less ability to bounce back quickly in difficult periods where changes, drawbacks, obstacles, disillusions, and lack of success are likely to happen. Moreover, the links between burnout and psychological resilience were also in line with present studies (36, 37). Accordingly, when people experience high stress and harsh situations, such as the pandemic of COVID-19, resilience is the adaptation process against distressful events, and can be considered as an efficient criteria in keeping mental health (17).

The two dimensions, emotional exhaustion, and reduced personal accomplishment, had meaningful negative correlations with resilience. The obtained correlation was weak (33), but in the study conducted by Rushton et al. the association between burnout and resilience was strong (38). A negative correlation between work-related burnout was observed in other studies (39, 40). In addition, the study by Azizi and Nazemi in Iran is in line with our investigations (41). Such findings confirm that a high level of resilience can manage stress and tackle obstacles in life.

A researcher showed that younger age, marital status, sex, workload, and management issues were related to burnout among participants (42). But a study revealed a relationship between emotional exhaustion and sex and education level of the frontline nurses. Besides, depersonalization was associated with sex, age, and clinical experience. The dimension of personal accomplishments was related to age, marital status, and clinical work exposure (32).

Another factor was the level of education. In our study, participants had better levels of resilience, as they used social resources more efficiently With an increase in educational level people perceive the importance of social support resources, learn how to get access to resources, and enhance their utilization. Our findings are inconsistent with the findings of another study (14).

In addition, the current findings have revealed an association between female sex and more risk for burnout. Based on literature, females have a tendency to be more susceptible to experiencing the signs of stress particularly, nurses (43, 44). Given that nurses with direct contact with COVID-19 patients; they had to have less contact with their own families. This caused greater emotional stress and physical exhaustion (43).

Nurses with more working experience had higher mean resilience scores (45). The major reason for that was related to the fact that nurses with more working experience could balance and deal with emergencies.

LIMITATIONS

Our study has several limitations. First, it has a cross-sectional design which limits the ability to interpret the causal relationships between the different variables in this study. Second, self-reporting has limitations regarding multiple biases. Third, the study sample was only chosen from one city. A wider geographical range is suggested. It is also recommended that future studies be conducted by using longitudinal research methods and randomized sampling.

CONCLUSION

Our findings showed that during COVID-19 the prevalence of burnout among nurses was high.

Due to the importance of identifying and decreasing the burnout of nurses, they should not experience emotional exhaustion, but should enhance their personal achievements. On the other hand, resilience is a protective criterion of the mentioned signs, so it would be suggested to include the promotion of resilience in the design of interventions to reduce burnout, as other authors have mentioned. In addition, the establishment of positive working conditions and the promotion of a healthy lifestyle are moreover suggested.

As the condition of COVID-19 lasts and there is a rise in workload in a context of uncertainty and insecurity, it is expected that burnout might get worse. The remedy will need increased money support for mental health, especially for people who report symptoms of burnout. It is essential to circumvent and decrease psychological distress among nurses. Future intervention plans should include appropriate psychosocial support, stress management programs, counseling, telemedicine, and informal support groups for nurses. They are one of the foremost important assets within the battle against the COVID 19 widespread. Thus, health policymakers and managers should hold such interventions and develop situation-specific ways to enhance a healthy workplace and preventing burnout amid the COVID-19 pandemic.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the datasets generated and/or analyzed during the current study are not publicly available due to restrictions of the Ethics Committee of Sirjan University of Medical Sciences. Requests to access the datasets should be directed to Hojjat Sheikhbardsiri, hojat.sheikhbardsiri@gmail.com.

ETHICS STATEMENT

Ethical approval was obtained from the Ethics Committee of Sirjan School of Medical Sciences, Sirjan, Iran (ethical approval code: IR.SIRUMS.REC.1400.008). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MJ was responsible for the analysis of the data as well as for writing the initial draft of the manuscript sections of methods and results. HS participated in the analysis of the data and design of the initial project. AK and TB were responsible for writing the initial draft of the manuscript sections of introduction and discussion. HS and AK were responsible for data collection, data cleaning, and data entry. MJ and HS were responsible for designing the project, overseeing the study, and finalizing the manuscript. All authors have read and approved the final manuscript.

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Harmful Alcohol Use Among Healthcare Workers at the Beginning of the COVID-19 Pandemic in Kenya

Florence Jaguga[1]*, Edith Kamaru Kwobah[1], Ann Mwangi[2], Kirtika Patel[3], Thomas Mwogi[4], Robert Kiptoo[1] and Lukoye Atwoli[5,6]

[1] Department of Mental Health, Moi Teaching & Referral Hospital, Eldoret, Kenya, [2] School of Science and Aerospace Studies, Moi University, Eldoret, Kenya, [3] Department of Pathology, School of Medicine, Moi University, Eldoret, Kenya, [4] Department of Internal Medicine, Moi Teaching & Referral Hospital, Eldoret, Kenya, [5] Department of Mental Health and Behavioral Sciences, School of Medicine, Moi University, Eldoret, Kenya, [6] Brain and Mind Institute and the Department of Internal Medicine, Medical College East Africa, Aga Khan University, Nairobi, Kenya

Background: Healthcare workers play a key role in responding to pandemics like the on-going COVID-19 one. Harmful alcohol use among them could result in inefficiencies in health service delivery. This is particularly concerning in sub-Saharan Africa where the health workforce is already constrained. The aim of this study is to document the burden and correlates of harmful alcohol use among healthcare workers at the beginning of the COVID-19 pandemic in Kenya with the aim of informing policy and practice.

Methods: This study was a cross-sectional analysis of data obtained from a parent online survey that investigated the burden and factors associated with mental disorders among healthcare workers during the COVID-19 pandemic in Kenya. We analyzed data obtained from a sub-population of 887 participants who completed the Alcohol Use Disorder Identification Test questionnaire. We used descriptive statistics to summarize the socio-demographic characteristics of the participants and multivariate analysis to determine the factors associated with harmful alcohol use.

Results: Three hundred and eighty nine (43.9%) participants reported harmful alcohol use. The factors significantly associated with increased odds of endorsing harmful alcohol use were: being male (AOR = 1.56; 95% CI = 1.14, 2.14; p = 0.006), being unmarried (AOR = 2.06; 95% CI = 1.48, 2.89; p < 0.001), having 11-20 years of experience as compared to having 20+ years of experience (AOR = 1.91; 95% CI = 1.18, 3.12; p = 0.009), and being a specialist (AOR = 2.78; CI = 1.64, 4.78; p = <0.001) or doctor (AOR = 2.82; 95% CI = 1.74, 4.63; p < 0.001) as compared to being a nurse.

Conclusions: A high proportion of healthcare workers reported harmful alcohol use at the beginning of the COVID-19 pandemic in Kenya. Males, the unmarried, those with 11–20 years of experience in the health field, doctors and specialists, were more likely to report harmful alcohol use. These findings highlight the need to institute interventions for harmful alcohol use targeting these groups of healthcare workers in Kenya during the COVID-19 pandemic in order to optimize functioning of the available workforce.

Keywords: alcohol, healthcare, workers, COVID-19, Kenya

INTRODUCTION

Healthcare workers play a critical role in responding to pandemics like the coronavirus disease of 2019 (COVID-19) (1). In addition to being involved in direct patient care, they are expected to educate the public and patients on infection prevention practices, conduct public health reporting, and at the same time strictly adhere to the established occupational health and safety procedures (2). Because of this central role in responding to the COVID-19 pandemic, the World Health Organization (WHO) recommends that a number of interventions (individual, organizational and systems level) are put in place in order to preserve, manage and optimize the health workforce during the pandemic (1). This is particularly important in resource-limited settings like Kenya, where the healthcare workforce is already constrained. For example as of 2017, Kenya had a total of 90,000 physicians and nurses (3), translating to a density of 2 skilled healthcare workers per 1,000 population against the minimum recommended 4.45 (4).

At the individual level, the WHO recommends that interventions that safeguard the mental health of healthcare workers are implemented (1). Health care workers are highly vulnerable to psychological distress during pandemics because they often have direct contact with infected persons, face increased workload, and are constantly exposed to potentially traumatic events in the course of disease outbreaks. Indeed studies conducted during the COVID-19 pandemic indicate a high psychological impact on health care workers including depression, anxiety and post- traumatic stress (5).

Harmful alcohol use is a particularly important mental health problem that could impact the availability and capacity of healthcare workers to deliver health services during the pandemic (6). Interventions targeting harmful alcohol use among healthcare workers during the COVID-19 pandemic need to be prioritized for two main reasons: Firstly harmful alcohol use is associated with reduced performance and productivity in the workplace emanating from associated ill health and cognitive impairments (6). Secondly, COVID-19 puts healthcare workers at risk of increased alcohol use as a result of maladaptive attempts at coping with the high levels of burnout, depression and anxiety associated with the pandemic (7–9). Indeed studies conducted among healthcare workers in Europe and the United States (US) have reported an increase in alcohol consumption after the onset of the COVID-19 pandemic (10–12).

The need for evidence on the prevalence of harmful alcohol use among healthcare workers during the COVID-19 pandemic is pressing, particularly in sub-Saharan Africa, which has one of the most significant healthcare worker shortages globally (13). Unfortunately, little has been done to explore the burden of harmful alcohol use in that region during the COVID-19 pandemic. Available work has mostly been conducted in western settings (14–16). Rates of problem drinking among healthcare workers during the COVID-19 pandemic have been reported as 7% in the United Kingdom (UK) (15), and 42.6% in the United States (US) (14) based on AUDIT-C cut-off scores of >7 and >4 respectively. One study conducted in Ethiopia reported the prevalence rate of alcohol use, once or more in the past 3 months, as 40.2% among medical and non-medical healthcare workers during the pandemic (17).

The aim of the present study is to report on the prevalence and factors associated with harmful alcohol use among healthcare workers at the beginning of the COVID-19 pandemic in Kenya. The first case of COVID-19 was confirmed in Kenya on 12th March 2020 (18). This study was conducted between April 27th and June 5th 2020, two months after the onset of the pandemic in Kenya. During the study period, new confirmed cases rose from 15 (19) to 124 (20) while COVID-19 related deaths increased from 21 (19) to 78 (20). Public health measures included targeted testing, travel restrictions, training health providers on COVID-19 and its management, and educating the public on preventive measures (19). Health care workers faced a number of challenges at that time including inadequate personal protective equipment; lack of quarantine facilities after shifts in the isolation wards and this exposed their families to the risk of contracting COVID-19; and hostile clients (20).

The findings of our study could be useful in implementing alcohol treatment and prevention interventions aimed at preserving and optimizing the health workforce, as well as maintaining health care worker well-being during the COVID-19 pandemic in Kenya and in other settings in sub-Saharan Africa.

MATERIALS AND METHODS

Data used for this study were derived from a parent online survey investigating the prevalence and correlates of mental disorders among healthcare workers (nurses, doctors, clinical officers[1] and public health officers[2] during the early phase of the COVID-19 pandemic in Kenya (7). These cadres of healthcare workers were directly involved in preventive, promotive and treatment activities during the covid-19 pandemic in Kenya. Eligible participants for the online survey were trained health professionals working in healthcare at the beginning of the pandemic in the country. Health professionals working outside hospital settings, e.g., insurance companies were excluded. A virtual snowball convenient sampling technique was utilized to recruit participants. We used this mode of sampling because there was no database for healthcare workers' contacts which would allow for randomization. In total, 1,190 healthcare workers consented to participate in the survey. Of these, 957 completed at least one or more of the questionnaires.

The survey instrument was programmed into Redcap (Research Electronic Data Capture) (21), a secure, web-based software platform designed to support data capture for research studies. The survey was comprised of the following questionnaires:

A researcher designed questionnaire was used for collecting socio-demographic data including age, sex

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[1]Clinical officers are non-physician clinicians whose role is to provide physician-type health services in Kenya. This cadre was introduced due to a shortage in qualified doctors in the country (24).
[2]The main role of public health officers in Kenya is to plan preventive and promotive health programs.

(male/female), marital status (married/not married), cadre (doctor/nurse/specialist/other), type of facility (public/private), contact with COVID-19 patients (yes/no), years of experience in healthcare (0–10, 11–20, 20+), and history of a chronic medical condition (yes/no).

The primary outcome for this study was harmful alcohol use. This was measured using the **Alcohol Use Disorder Identification Test (AUDIT)** which examined past year alcohol use and consisted of 10 questions with total scores ranging from 0 to 40 (22). A score of 8 and above was considered harmful alcohol use for our study (22). The AUDIT has been used among adults in Kenya (23).

Depression was measured using the **Patient Health Questionnaire-9 (PHQ-9)** (25). It is a 9-item self-report instrument with total scores ranging from 0 to 27. The PHQ-9 examined for depressive symptoms over the past 2 week period. A score of 0–4 was considered no depression, 5–9 mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression (25). The PHQ-9 has excellent reliability and validity. The PHQ-9 has been validated among adults in Kenya (26).

Generalized Anxiety Disorder (GAD) was measured using the GAD-7 scale, a seven item self-report instrument (27). The GAD-7 was used to examine for generalized anxiety symptoms among the participants over the past 2 week period. Total scores ranged from 0 to 21. A score of 0–4 was considered no GAD, 5–9 mild GAD, 10–14 moderate GAD, and 15–21 severe GAD for our study (27). The GAD-7 has been validated in Kenya (28).

The **Pittsburgh Sleep Quality Index (PSQI)** (29) was used to assess for sleep quality. It is a self-rated questionnaire which assesses for sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score. A score of 5 and above indicated poor quality sleep for our study. Such a score has a sensitivity of 89.6% and specificity of 86.5% in distinguishing good and poor quality of sleep (29). The tool has been used among adults in Kenya (30).

The online survey was sent to healthcare workers using various networks on Facebook, WhatsApp and E-mail. A weekly reminder to participate was sent through the various platforms between April 27th and June 5th 2020. The healthcare workers were requested to respond to the survey and share with their colleagues. A track of responses was kept using the Redcap software until there were no new responses for a period of 2 weeks, after which the survey was closed. The detailed methods for the parent study have been published elsewhere (7).

Statistical Analysis

The analysis for this study is based on data obtained from a sub-population of 887 participants who completed the AUDIT questionnaire (22). Regarding the non-respondents, there were 233 who consented but did not complete the socio demographic part of the questionnaire hence we would not have their demographic data to include in **Table 1**. Thus the only ones

TABLE 1 | Socio-demographic characteristics of the participants.

Variable		N (%)
Age in years	< 35	431 (48.6)
	≥35	456 (51.4)
Gender	Male	403 (45.4)
	Female	484 (54.6)
Marital status	Married	579 (65.3)
	Not married	308 (34.7)
Years of experience in healthcare	0-10	512 (57.7)
	11–20	219 (24.7)
	20+	156 (17.6)
Cadre	Doctor	354 (39.9)
	Nurse	167 (18.8)
	Other	216 (24.4)
	Specialist	149 (16.8)
Type of facility	Public	621 (70.0)
	Private	266 (30.0)
Have a chronic medical condition	Yes	202 (22.8)
	No	685 (77.2)
Contact with COVID-19 patients	Yes	212 (23.9)
	No	675 (76.1)

who did not respond to the AUDIT were 70 i.e., 7.3% of those with demographic data. This is low and excluding them would therefore not bias the results.

Descriptive statistics were used to summarize the socio-demographic characteristics of the participants. Chi square test was used in the bivariate analysis, to assess for the association between harmful alcohol use and socio-demographic factors as well as the association between harmful alcohol use and depression, generalized anxiety and sleep quality. Significant variables were subjected to the multivariate logistic regression analysis and presented as adjusted odds ratios (AORs) and 95% Confidence Intervals (CIs).

Since the percentage of completion for each questionnaire was not the same. The regression analysis was based on the complete case analysis of those who had data on the variables included in the regression model. Data analysis was performed using R Core Team (31). In all analyses a p-value <0.05 was considered significant.

RESULTS

Socio-Demographic Characteristics of Participants

Most of the participants were aged 35 years and above (51.4%); most were female (54.6%); most worked in public health facilities (70.0%); and most had 10 years or less of experience in healthcare (57.7%). Less than one third of the participants (24.0%) had come into contact with a patient diagnosed with COVID-19. Forty percent of the participants were doctors, 18.8% were nurses, 16.8% were specialists, and 24.4% belonged to other cadres (**Table 1**).

TABLE 2 | Mental health characteristics of the participants who completed the AUDIT.

Depression[a] (N = 858[b])	n (%)
Mild	581 (67.7)
Moderate	144 (16.8)
Severe	133 (15.5)
GAD[c] (N = 807[b])	
None	516 (64.0)
Mild/Moderate	232 (28.7)
Severe	59 (7.3)
Sleep quality[d] (N = 772[b])	
Poor quality of sleep	189 (24.5)
Good quality of sleep	583 (75.5)

[a]A score of 5–9 mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression (25).
[b]Out of the 887 participants who responded to the AUDIT questionnaire, 858 (96.7%) completed the PHQ-9; 807 (91.0%) completed the GAD-7, and 772 (87.0%) completed the PSQI.
[c]Score of 0-4 was considered no GAD, 5-9 mild GAD, 10-14 moderate GAD, and 15-21 severe GAD.
[d]A score of 5 and above on the PSQI indicated poor quality sleep.

Mental Health Characteristics of the Participants

Out of the 887 participants who responded to the AUDIT questionnaire, 858 (96.7%) completed the PHQ-9; 807 (91.0%) completed the GAD-7, and 772 (87.0%) completed the PSQI. All the participants (100%) who completed the PHQ-9 endorsed some level of depression. Thirty six percent of those who completed the GAD-7 reported some level of GAD, while poor sleep quality was endorsed by 24.5% of those who completed the PSQ-I (**Table 2**).

Prevalence of Harmful Alcohol Use

Three hundred and eighty nine (43.9%) participants reported harmful alcohol use based on an AUDIT score of 8 and above (95%CI: [40.6,47.2%]).

Factors Associated With Harmful Alcohol Use

In bivariate analysis, gender, marital status, cadre and years of experience in the health field were significantly associated with harmful alcohol use (**Tables 3**, **4**). In multivariate analysis, the factors significantly associated with increased odds of endorsing harmful alcohol use were: being male (AOR = 1.56; 95% CI = 1.14, 2.14; p = 0.006), being unmarried (AOR = 2.06; 95% CI = 1.48, 2.89; p < 0.001), having 11–20 years of experience in healthcare as compared to having 20+ years of experience (AOR = 1.91; 95% CI = 1.18, 3.12; p = 0.009), and being a specialist (AOR = 2.78; CI = 1.64, 4.78; p < 0.001) or doctor (AOR = 2.82; 95% CI = 1.74, 4.63; p < 0.001) or other cadre (AOR = 2.59; CI = 1.57,4.34; p < 0.001) as compared to being a nurse. Age, and endorsing depression or generalized anxiety disorder were not associated with harmful alcohol use (**Table 5**).

TABLE 3 | Bivariate analysis of socio demographic factors and harmful alcohol use.

Variable		Alcohol use (N = 887)		p-value
		Harmful[a] N (%)	**Not Harmful** N (%)	
Age in years	< 35	198 (45.9)	233 (54.1)	0.251
	≥35	191 (41.9)	265 (58.1)	
Gender	Male	198 (49.1)	205 (50.9)	0.005
	Female	191 (39.5)	293 (60.5)	
Marital status	Married	224 (38.7)	355 (61.3)	< 0.001
	Not married	165 (53.6)	143 (46.4)	
Years of experience in healthcare	0–10	238 (46.5)	274 (53.5)	0.001
	11–20	104 (47.5)	115 (52.5)	
	20+	47 (30.1)	109 (69.9)	
Cadre	Doctor	178 (50.3)	176 (49.7)	< 0.001
	Nurse	38 (22.8)	129 (77.2)	
	Other	104 (48.1)	112 (51.9)	
	Specialist	68 (45.6)	81 (54.4)	
Type of facility	Public	265 (42.7)	356 (57.3)	0.312
	Private	124 (46.6)	142 (53.4)	
Have a known medical condition	Yes	97 (48.0)	105 (52.0)	0.202
	No	292 (42.6)	393 (57.4)	
Contact COVID-19 patients	Yes	92 (43.4)	120 (56.6)	0.940
	No	297 (44.0)	378 (56.0)	

[a]Harmful alcohol use was defined by a score of 8 and above on the AUDIT.

TABLE 4 | Bivariate analysis of mental disorder and harmful alcohol use.

Variable		Alcohol use (N = 887)		p-value
		Harmful[a] N (%)	**Not Harmful** N (%)	
Depression	Mild	241 (41.5)	340 (58.5)	0.065
	Moderate	63 (43.8)	81 (56.2)	
	Severe	70 (52.6)	63 (47.4)	
GAD	None/minimal	211 (40.9)	305 (59.1)	0.061
	Mild/Moderate	115 (49.6)	117 (50.4)	
	Severe	29 (49.2)	30 (50.8)	
PSQI	Poor quality sleep	86 (45.5)	103 (54.5)	0.672
	Good quality sleep	253 (43.4)	330 (56.6)	

[a]Harmful alcohol use was defined by a score of 8 and above on the AUDIT.

DISCUSSION

This cross-sectional study found that 43.9% of the healthcare workers in Kenya reported harmful patterns of alcohol use at the beginning of the COVID-19 pandemic in Kenya. Our findings are consistent with those reported by Hennein et al. (14) who found that 42.6% of healthcare workers in the US met criteria for probable alcohol use disorder, based on the AUDIT-Concise, during the COVID-19 pandemic. Much lower rates of harmful alcohol use (using the AUDIT-Concise) have

TABLE 5 | Multivariate analysis of association between harmful alcohol use and socio-demographic and mental health factors.

Characteristic	AOR[a]	95% CI[b]	p-value
Age in years			
< 35	1		
≥35	1.10	0.70, 1.72	0.700
Gender			
Female	1		
Male	1.56	1.14, 2.14	0.006
Marital status			
Married	1		
Not married	2.06	1.48, 2.89	< 0.001
Years of experience in healthcare			
20+	1		
11–20	1.91	1.18, 3.12	0.009
0-10	1.53	0.88, 2.69	0.140
Cadre			
Nurse	1		
Specialist	2.78	1.64, 4.78	< 0.001
Doctor	2.82	1.74, 4.63	< 0.001
Other	2.59	1.57, 4.34	< 0.001
PHQ			
Mild	1		
Moderate	1.15	0.73, 1.81	0.500
Severe	1.50	0.90, 2.52	0.120
GAD			
None/minimal	1		
Mild/Moderate	1.07	0.72, 1.57	0.700
Severe	1.13	0.52, 2.44	0.800

[a]Adjusted Odds Ratio.
[b]Confidence Interval.

been reported among healthcare workers in Europe i.e., 7% in the UK and 9.1% in Italy. Possible reasons for differences in rates include variations in alcohol control policies across regions during the pandemic (32) and disparities in the availability of treatment and prevention services for harmful alcohol use (33), emphasizing the need for context specific evidence. Another potential reason for varied findings could be related to differences in cut-off scores used to make a diagnosis. While Hennein et al. used a cut-off score of 4 or more, the studies conducted in the UK (15) (Greenberg) and Italy (16) used a cut-off score of >7.

The high rate of harmful alcohol use found in our setting in the early phase of the COVID-19 pandemic in Kenya is worrying. Firstly, such high rates threaten to reduce the capacity of the health workforce in Kenya to adequately respond to the pandemic. Secondly, consumption of alcohol use is expected to rise during the pandemic in Kenya. Studies conducted among healthcare workers in Europe and the United States (US) have reported increases in alcohol consumption among health providers as the number of COVID-19 cases rise and the preventive measures intensify (10–12). Thirdly, Kenya is already plagued by existing health worker shortages (3) and

there is need to optimize the available human resources. We therefore call on the government through the relevant ministries to urgently put in place measures to mitigate the negative impact of harmful alcohol use on health service delivery during the pandemic.

In our study, being male was associated with increased odds of harmful alcohol use. This finding is consistent with prior studies conducted among healthcare workers (34) and the general population (35) in Kenya, and among healthcare workers during the COVID-19 pandemic in Italy (16). This might be explained by the fact that in many cultures, traditional gender roles, as well as strict cultural beliefs and values, may prevent the development of problematic substance use for women (36). In addition, men have been shown to have more opportunities to use substances like alcohol, as compared to women (37). Unmarried healthcare workers were more likely to report harmful alcohol use compared to the married. This is finding is consistent with other studies that have shown a higher prevalence of alcohol use among single or divorced persons (38). Being unmarried may be associated with social isolation, a welldocumented risk factor for harmful substance use (39, 40). Specialists, doctors and other cadres were significantly more likely to endorse harmful alcohol use as compared to nurses. A likely reason for this is that a majority of doctors in Kenya are male (and being male was associated with higher odds of endorsing harmful alcohol use in our study) while most nurses are female. In addition, nurses in Kenya have strong social support systems (e.g., they frequently turn to each other for emotional and practical support during times of distress), that could potentially prevent the use of alcohol as a way of coping with stress during the pandemic. Having 11–20 years of experience in the health profession was associated with increased odds of harmful alcohol use as compared to having 20+ years or having 0–10 years of experience. Findings concerning the association between years of experience and harmful alcohol use have been inconsistent. Obadeji et al. (41) in a study conducted among doctors in Nigeria reported no association between years of experience and hazardous alcohol use (42). Kenna and Lewis found alcohol use disorder among healthcare providers to be associated with having younger licensees (43). A possible reason for significant harmful alcohol use among healthcare workers in Kenya with 11–20 years of experience could be that that phase represents a period of heightened psychological stress linked to residency, and increasing family and work place responsibilities. Our study reported no significant differences in the rates of harmful alcohol use among healthcare workers with and without depression and generalized anxiety. This is inconsistent with studies showing alcohol use to be associated with mental health problems among healthcare workers during the pandemic (12, 17). Future longitudinal studies ought to shed more light on this finding.

Implications for Practice
In order to optimize healthcare worker productivity during the COVID-19 pandemic in Kenya, it is important that interventions targeting harmful alcohol use are put in place for the at risk groups. Unmarried males, those working in doctor or specialist

positions, and those with 11–20 years of experience were found to be at risk of harmful alcohol use during the pandemic. The Ministry of Health in partnership with the National Authority for the Campaign Against Alcohol and drug Abuse (NACADA) ought to implement programs for the at risk groups including: (i) routine screening and brief interventions for harmful alcohol use targeting the at risk groups (ii) health education on the harmful impact of alcohol use and debunking of myths that encourage alcohol use during the pandemic (ii) education on strategies for health promotion and self-care such as a healthy diet, adequate sleep, physical activity, and stress management to discourage use of alcohol as a way of coping (44, 45). The health education sessions and brief interventions should be tailored to be acceptable to, and focus on the needs of doctors and specialists, males, the unmarried and those with 11–20 years of experience.

Health care workers have professional associations that conduct regular continuous professional development sessions virtually. These form an avenue through which the education interventions outlined above may be delivered by fellow doctors. The Ministry of Health has established a call centre whose aim is to offer both knowledge and psychosocial support to frontline health workers (46). Brief interventions could be delivered by counselors or psychologists using this channel. At institutional level, facility heads should implement regular education sessions for staff and these ought to be done virtually in compliance with COVID-19 measures. Treatment and prevention interventions for harmful alcohol use among healthcare workers ought to be incorporated in national and institutional policies for managing the health workforce in Kenya during the pandemic in order to guide and encourage implementation.

Finally, it is important that mental health systems are strengthened overall. This way, mental health services will be accessible not only for the health care providers who need them, but for the entire population as well.

We acknowledge some limitations. Firstly, this being an online survey, it may have been less accessible to people who lacked internet access e.g., healthcare workers living in marginalized areas. Our findings may therefore not include their experiences. Secondly, we used a convenience sample hence the results may not be generalizable to other settings. Thirdly, this was a cross-sectional study and therefore no causal relationships may be determined. Fourthly, our sample was not representative of the composition of healthcare workers in Kenya. Our sample was comprised of mostly doctors while nurses comprise more than a half of healthcare workers in Kenya. Finally, we did not conduct sub-analyses by gender yet gender may have played an important role in explaining some associations. Nonetheless this study provides for important information on harmful alcohol use among healthcare workers at the beginning of the COVID-19 pandemic in a sub-Sahara African country.

CONCLUSION

In conclusion, a high proportion of healthcare workers reported harmful alcohol use at the beginning of the COVID-19 pandemic in Kenya. Males, the unmarried, those with 11–20 years of experience in healthcare, and healthcare workers other than nurses, were more likely to report harmful alcohol use. Given the potential negative impact of harmful alcohol use not only on health service delivery but also on the mental and physical health of the healthcare workers, it is critical that the government puts in place interventions to address this problem. Specifically, we recommend that two key interventions be implemented (i) health education be done on the harmful effects of alcohol use and on strategies for promoting mental health (ii) screening and brief interventions for harmful alcohol use. Virtual platforms and mobile health strategies could be utilized to deliver these interventions in light of the COVID-19 preventive measures.

DATA AVAILABILITY STATEMENT

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Moi University/Moi Teaching Referral Hospital Institutional Research and Ethics Committee. The Ethics Committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

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Meta-Regression on the Heterogenous Factors Contributing to the Prevalence of Mental Health Symptoms During the COVID-19 Crisis Among Healthcare Workers

Xi Chen[1], Jiyao Chen[2], Meimei Zhang[3], Rebecca Kechen Dong[4], Jizhen Li[5], Zhe Dong[6], Yingying Ye[7], Lingyao Tong[8], Ruiying Zhao[8], Wenrui Cao[9], Peikai Li[9] and Stephen X. Zhang[10]*

[1] Chinese Open Science Network, Xiamen, China, [2] Department of Strategy and Entrepreneurship, College of Business, Oregon State University, Corvallis, OR, United States, [3] Department of Speech-Language-Hearing Sciences, Texas Tech University Health Sciences Center, Lubbock, TX, United States, [4] UniSA Business, University of South Australia, Adelaide, SA, Australia, [5] Department of Innovation, Entrepreneurship and Strategy, School of Economic and Management, Tsinghua University, Beijing, China, [6] Department of Sociology and Interuniversity Center for Social Science Theory and Methodology (ICS), University of Groningen, Groningen, Netherlands, [7] Department of Psychology and Behavioral Sciences, Zhejiang University, Hangzhou, China, [8] Department of Clinical, Neuro- and Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, [9] Department of Social, Health and Organizational Psychology, Utrecht University, Utrecht, Netherlands, [10] Entrepreneurship, Innovation and Family Enterprise Discipline, Adelaide Business School, University of Adelaide, Adelaide, SA, Australia

Objective: This paper used meta-regression to analyze the heterogenous factors contributing to the prevalence rate of mental health symptoms of the general and frontline healthcare workers (HCWs) in China under the COVID-19 crisis.

Method: We systematically searched PubMed, Embase, Web of Science, and Medrxiv and pooled data using random-effects meta-analyses to estimate the prevalence rates, and ran meta-regression to tease out the key sources of the heterogeneity.

Results: The meta-regression results uncovered several predictors of the heterogeneity in prevalence rates among published studies, including severity (e.g., above severe vs. above moderate, $p < 0.01$; above moderate vs. above mild, $p < 0.01$), type of mental symptoms (PTSD vs. anxiety, $p = 0.04$), population (frontline vs. general HCWs, $p < 0.01$), sampling location (Wuhan vs. Non-Wuhan, $p = 0.04$), and study quality ($p = 0.04$).

Conclusion: The meta-regression findings provide evidence on the factors contributing to the prevalence rate of mental health symptoms of the general and frontline healthcare workers (HCWs) to guide future research and evidence-based medicine in several specific directions.

Systematic Review Registration: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=220592, identifier: CRD42020220592.

Keywords: meta-regression, systematic review, meta-analysis, COVID-19, mental health, healthcare workers, frontline healthcare workers

INTRODUCTION

Since the first publicly known cases in Wuhan, China, on November 17, 2019, the COVID-19 (coronavirus disease 2019) crisis has become one of the worst epidemics in human record (1). The sudden outburst of this highly infectious disease and the containment measures such as quarantine and social distancing have posed immense pressure on the work and life of the healthcare workers (HCWs) (2–4). During the COVID-19 pandemic, HCWs have to face increased workload and extended working hours, shortage of medical resources, risk of nosocomial infection, stigmatization and other related problems (5–7). These work-related issues may induce the emotional distress of HCWs to cause mental health symptoms such as anxiety, depression, burnout, or sleep issues (8). Frontline HCWs are in a unique position to suffer mentally in particular. They have to deal with the ethical dilemma of resources allocation and the work pressure of hospice care (5, 9, 10) while being exposed to a high risk of infection in COVID-infected wards. The infection or death of any family member or colleague could act as additional stressors resulting mental health problems (11, 12).

Several early (rapid) meta-analysis papers have appeared but they pooled HCW of different countries all together. However, such practices inadvertently contribute to the differences in their prevalence rates, given the large heterogeneity in terms of not only the COVID cases and deaths but also the containment strategies and hospital capacities and readiness to handle COVID-19 cases across countries (13, 14). To rule out such heterogeneity at the same time, we conducted meta-regression analysis by focusing on a single country, China, which has had a sufficient number of empirical studies to analyze several factors at the same time to better understand the heterogenous factors contributing to the prevalence rate of mental health symptoms of the general and frontline healthcare workers (HCWs) (15, 16). Such evidence on the heterogenous factors contributing to the prevalence rate of mental health symptoms provide directions to better guide this important and proliferating stream of research.

METHODS

This meta-regression analysis with a systematic review and meta-analysis conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement 2019 and registered in the International Prospective Register of Systematic Reviews (PROSPERO: CRD42020220592).

Data Sources and Search Strategy

We conducted a comprehensive literature search in the databases of *PubMed*, *Embase*, and *Web of Science*. Our search query, shown in **Supplementary Table S1**, was entered with Boolean operators to search the titles, abstracts, keywords, and subject headings (for example, Mesh terms) in each database. To account for preprints, we searched *medRxiv* (medrxiv.org). We started our search on November 10, 2020, and finalized it on November 16, 2020, in order to cover the first year when HCWs faced a crisis of the COVID-19, as after 1 year the number of COVID-19 cases dropped significantly in China to no longer pose a crisis

situation for HCWs (17). **Figure 1** details the flow chart of our search process.

Selection Criteria

The studies are included in our meta-analysis based on the following criteria:

a. Context: COVID-19 crisis in China.
b. Population: frontline HCWs, general HCWs, and general adult population (for comparison).
c. Outcome: at least one mental symptom outcomes, e.g., anxiety, depression, distress, insomnia, and PTSD.
d. Instrument: validated scales with cutoff points for the mental health outcomes.
e. Language: English.

According, we excluded studies that meet the following criteria:

a. Population: children, adolescents, or specific niche adult populations such as COVID-19 patients, inpatients, or other patients, adults under quarantine, pregnant/postpartum women.
b. Methodological approaches: Non-primary studies such as reviews or meta-analyses, qualitative or case studies without a validated instrument, interventional studies, interviews, or news reports.
c. Measurements: Non-validated mental health instruments (i.e., self-made questionnaire) or instruments without a validated cutoff score to calculate a prevalence rate (i.e., STAI, SCL-90 for anxiety and depression).

We contacted the authors of papers that missed some critical information if the articles:

a. Contain primary data on mental health of relevant population using established instruments under COVID-19 period but do not report the prevalence rates. For example, a study may report the mean and SD of our outcomes but not their prevalence rates.
b. Surveyed a sample that mixed our targeted population and other populations, such as children, in a manner such that we could not extract the prevalence rate(s) for our targeted population. We included the studies that authors provided prevalence rate for our targeted population only and excluded the studies with mixed populations.
c. Miss some critical information, such as the data collection time or location.
d. Are unclear on critical information. For example, some articles are unclear whether they used the cutoff for above mild or above moderate symptoms to calculate the overall prevalence rates of mental health symptoms. When a cutoff point is reported for an overall prevalence, above mild or above moderate was assigned based on the typical cutoff point of that instrument.

Selection Process and Data Extraction

The articles that passed the inclusion criteria were exported into an EndNote library where we identified duplications and then imported to Rayyan for screening. Two researchers (L.T. and

FIGURE 1 | The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flow diagram.
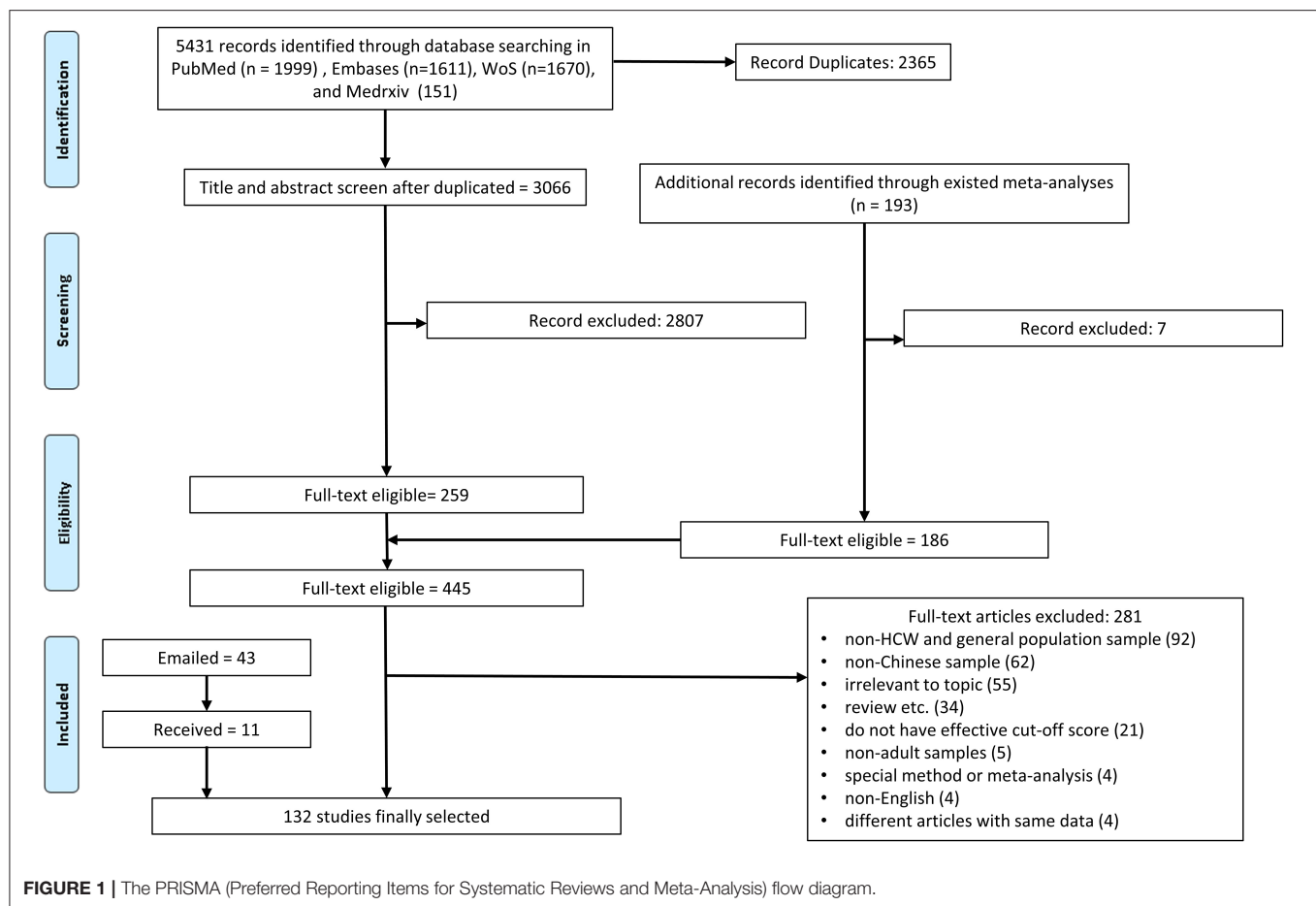
Y.Y.) independently screened the articles based on their titles and abstracts. If both coders excluded an article independently, it was excluded.

Six researchers (X.C, M.Z., R.C., Z.D., R.D., B.C.) were paired to assess the eligibility of each paper based on reading its full text and extracting the relevant data into a coding book based on a coding protocol. The coding book records information such as the authors and year of the paper, title, publication status, sample locations, date of data collection, sample size, response rate, population, age (mean, SD, min and max), gender proportion, instruments, cutoff scores used, the prevalence/mean/SD of the mental health outcome, and other notes or comments. Pairs of researchers first double-coded and crosschecked each paper independently. The remaining discrepancies after the crosscheck were discussed between the pair of coders. In cases where a pair of coders continued to disagree, a lead coder (X.C.) checked the paper independently and discussed it with the two original coders to determine its coding. The lead coder also integrated and reviewed all the coding information. Particularly, the lead coder checked the mental outcomes, instruments, outcome levels, and cutoff scores reported given the multitude of reporting practices in individual papers. We were able to identify papers that used unusual cutoff scores later for sensitivity analysis.

Assessment of Bias Risk

Following other meta-analyses (18, 19), we used the Mixed Methods Appraisal Tool (MMAT) (20), including seven questions to conduct the quality assessment of the studies. Pairs of coders independently evaluated the risk of bias and quality of the studies and rated them based on the MMAT. Most discrepancies were resolved through a discussion between the pair of researchers, and any disagreement after discussions was resolved by a lead researcher. Papers were classed into high (6–7) or medium quality (lower than 6).

Statistical Analysis

To analyze the data in a consistent manner, we ensure the independence of mental health symptoms and samples. For instance, for studies that examine a mental health outcome with more than one instrument, we report the results based on the most popular instrument. If a study reported several prevalence rates by several cutoffs, we use one of them, in the following order of preference: above severe, above moderate, and above mild. Thus, only one prevalence rate for a mental health outcome in a sample is entered to ensure the samples remain independent.

The overall prevalence and 95% confidence intervals of psychological outcomes were pooled using Stata 16.1. Similar to

prior studies on the prevalence of mental symptoms, the random-effects model was used to extract the pooled estimates (21). We reported the heterogeneity by the I^2 statistic, which measures the percentage of variance resulting from true differences in the effect sizes rather than the sampling error (22). We performed subgroup analyses by the key potential sources of heterogeneity of outcomes (five types of mental health symptoms), severity of outcome (above mild/above moderate/above severe), three major population groups (frontline HCWs, general HCWs, and general population for comparison), and instrument type for each outcome. Furthermore, given the high degree of heterogeneity of the true differences in the effect sizes, we ran a meta-regression to regress the prevalence upon not only these three category variables (outcome, severity, and population) but also female proportion, data collection time, data collection location (Wuhan vs. Non-Wuhan), sample size, and study quality. We included data collection time to examine whether the mental symptoms change over time dynamically. While the COVID-19 crisis continues to evolve, there is a lack of dynamic analysis on the mental symptoms of any population over time. Sensitivity analysis was conducted, and Funnel plots were used to assess publication bias. Significance level was set as two-sided and $p < 0.05$.

RESULTS

Study Screening

Our systematic search (**Figure 1**) across all the databases yielded 5,431 potentially relevant papers, out of which 2,365 were duplications and removed. Of the remaining 3,066 papers, we screened their titles and abstracts in the first stage and the full text of the 445 articles in the second stage. We also emailed the authors of 43 articles that missed critical information and were able to get the information to include 11 additional studies. Altogether, the process generated 132 articles.

Study Characteristics

The 132 papers included contains 171 samples (**Supplementary Table S2**) with a total of 645,805 individual participants. **Table 1** summarizes their key characteristics. Among the 171 independent samples, about a quarter of them studied frontline HCWs and general HCWs (27.5 and 26.2%, respectively), and almost half studied the general population (43.3%) as a comparison. More than one-third of samples covered anxiety and depression. Another one-third investigated other mental symptoms including insomnia, PTSD, and distress, (15.9, 9.3, and 3.0%, respectively). Respectively, 20.7, 41.6, and 32.0% of samples reported prevalence rates at the mild above, moderate above, and severe above level by the severity of the symptoms.

Almost all the studies, 126 out of 131, employed cross-sectional surveys; specifically, 9 (6.1%) conducted the survey in January 2020, 90 (65.9%) in February, 23 (17.4%) in March, and 14 (10.6%) in April or later. Almost one-quarter of them (20.5%) contained a sample targeting populations in Wuhan. Most studies were published in journals, and 10

TABLE 1 | Characteristics of the studies on mental health in China in a year of COVID-19 epidemic.

Characteristics	Total number of studies/samples	Percent	Level of analysis
Population			Sample
Frontline HCWs	47	27.5	
General HCWs	50	26.2	
General population (for comparison)	74	43.3	
Outcome			Prevalence
Anxiety	123	36.8	
Depression	117	35.0	
Distress	10	3.0	
Insomnia	53	15.9	
PTSD	31	9.3	
Severity			Prevalence
Above mild	69	20.7	
Above moderate	139	41.6	
Above severe	107	32.0	
Overall	19	5.67	
Sampling location			Article
Wuhan	35	20.5	
Non-Wuhan	136	79.5	
Sampling date			Article
January 2020	9	6.1	
February 2020	90	65.9	
March 2020	23	17.4	
April 2020	9	6.8	
May 2020	1	0.6	
June 2020	2	2.3	
July 2020	2	0.8	
Design			Article
Cross-sectional	128	97.0	
Cohort	4	3.0	
Publication status			Article
Preprint	10	7.6	
Accepted	1	0.8	
Published	121	91.7	
Quality			Article
Good	92	77.3	
Medium	30	22.7	

	Median	Range	
Number of participants	742	30–123,768	Article
Female portion	69%	12–100%	Article
Response rate	85%	14–100%	Article

(7.6%) studies remained as preprints. The assessment based on the Mixed Methods Appraisal Tool (MMAT) indicated 100 (77.3%) studies were of good quality (score no <6 out of 7) and 31 studies were of medium quality (score <6 but >4). The median number of individuals per sample was

742 (range: 30–123,768) with a median female proportion of 69% (range: 12–100%) and a median response rate of 85% (range: 14–100%).

The 131 papers employed a wide arrange of instruments to assess mental health (**Supplementary Table S3**). GAD (61.8%) and SAS (23.6%) are the first and second most popular measures for anxiety, and PHQ (65.0%) and SDS (14.5%) for depression; distress is measured the most by K6 (50.0%); insomnia is measured by ISI (66.0%) and PSQI (26.4%); and PTSD by IES-R (41.9%), PCL-C (25.8%), and PCL-5 (25.8%). Please see the details in **Supplementary Table S3**.

Pooled Prevalence Rates of Mental Health Symptoms

The prevalence rates of the 171 samples were pooled by the subgroups one at a time (**Table 2**). First, the overall prevalence rates of mental health symptoms that surpassed the cutoff values of mild, moderate, and severe were 30, 15, and 2%, respectively. The overall prevalence of mental health symptom frontline HCWs and general HCWs are 16 and 13%, respectively, and in comparison, the prevalence in the general population is 13%. The overall prevalence of anxiety, depression, distress, insomnia, and PTSD are 11, 14, 15, 17, and 21%. **Figure 2** graphically depicts such findings of the pooled analysis by subgroups using forest plots.

Meta-Regression on the Prevalence of Mental Health Symptoms

As pooled sub-group analysis takes account of only one factor at a time, to better explain the heterogeneity of the prevalence of mental health symptoms, **Table 3** reports the results of a meta-regression analysis that takes account of several factors at the same time. The meta-analytical model explained over 40% of the variance of mental health symptoms among these studies (R-$squared$ = 56.8%, tau^2 = 0.09).

The prevalence of severe mental health symptoms is significantly lower than that of moderate mental illness (p < 0.001), which is in turn significantly lower than those of mild mental illness (p < 0.001). The prevalence of mental health symptoms of frontline HCWs is significantly higher than that of general HCWs (p = 0.005). General HCWs and the general population do not differ in their mental health prevalence rates. The prevalence rates of PTSD (p = 0.039) is significantly higher than that of anxiety. Interestingly, the prevalence of mental health symptoms of participants in Wuhan, the epicenter of the COVID-19 crisis in China, was significantly lower than that in Non-Wuhan samples (p = 0.038). The prevalence rates of mental health symptoms were higher in studies of papers with a higher quality rating (p = 0.036). The female proportion (p = 0.233), date of data collection (p = 0.392), sample size of studies (p = 0.124), or publication status (p = 0.265) did not predict the prevalence rates significantly.

The meta-analytical regression results enable the prediction of prevalence rates while taking account of the influence of multiple factors and hence offer a superior model over the earlier pooled analyses. In other words, the meta-regression model considers multiple predictors of mental health symptoms in a single model at the same time instead of the approach of considering one predictor at a time by pooled prevalence, the typical method to estimate the prevalence of mental health symptom in prior meta-analytical papers in COVID-19 literature.

Hence, based on the results of the meta-regression, we report the predicted prevalence rates of varying severity levels of the different mental health symptoms of frontline HCWs, general HCWs, and the general population. **Table 4** show the predicted prevalence rates of mental health symptoms by populations,

TABLE 2 | The pooled prevalence rates of mental health symptoms by subgroups of population, outcome, and severity.

First-level subgroup	Second-level subgroup	Number of samples (*K*)*	Percent (%)	Sample size (*N*)	Prevalence (%)	95% CI	*P* value
Population	Frontline HCWs	47	27.5	66,208	16	13–19	<0.001
	General HCWs	50	29.2	92,357	13	10–16	<0.001
	General population (for comparison)	74	43.2	487,240	13	11–15	<0.001
Outcome#	Anxiety	123	36.8	306,102	11	9–13	<0.001
	Depression	117	35.0	157,254	14	11–17	<0.001
	Distress	10	3.0	71,675	15	8–25	<0.001
	Insomnia	53	15.9	87,426	17	13–21	<0.001
	PTSD	31	9.3	23,348	21	12–32	<0.001
Severity#	Above mild	69	20.7	52,448	30	27–33	<0.001
	Above moderate	139	41.6	242,030	15	14–16	<0.001
	Above severe	107	32.0	323,777	2	2–3	<0.001
	Overall	19	5.67	27,550	30	27–33	<0.001

CI, Confidence Interval.

*The total independent samples are larger than the number of studies because some studies included multiple samples.

#The total sample sizes are larger than the total sample of the 171 independent samples because one sample can assess multiple mental health outcomes.

outcomes, and severity by the meta-analytical regression model. The prevalence rates vary greatly by the mental health outcomes and severity. The prevalence rates are lower when using a higher level of severity, which drives the heterogeneity of prevalence rate to a large degree. Among the different types of mental health outcomes, distress seems to be the most prevalent among all three populations.

Sensitivity Analysis

Our meta-analytical regression model was able to take account of the impact of several factors, such as publication status (insignificant), sample size (insignificant), and article quality score (significant). Furthermore, we conducted our analysis with the exclusion of each study one-by-one from the meta-analytic model and found it did not significantly alter the findings. The

Figure 2 | Continued

Figure 2 | **(A)** A forest plot of the pooled prevalence by outcomes. **(B)** A forest plot of the pooled prevalence by outcome levels. **(C)** A forest plot of the pooled prevalence by population.
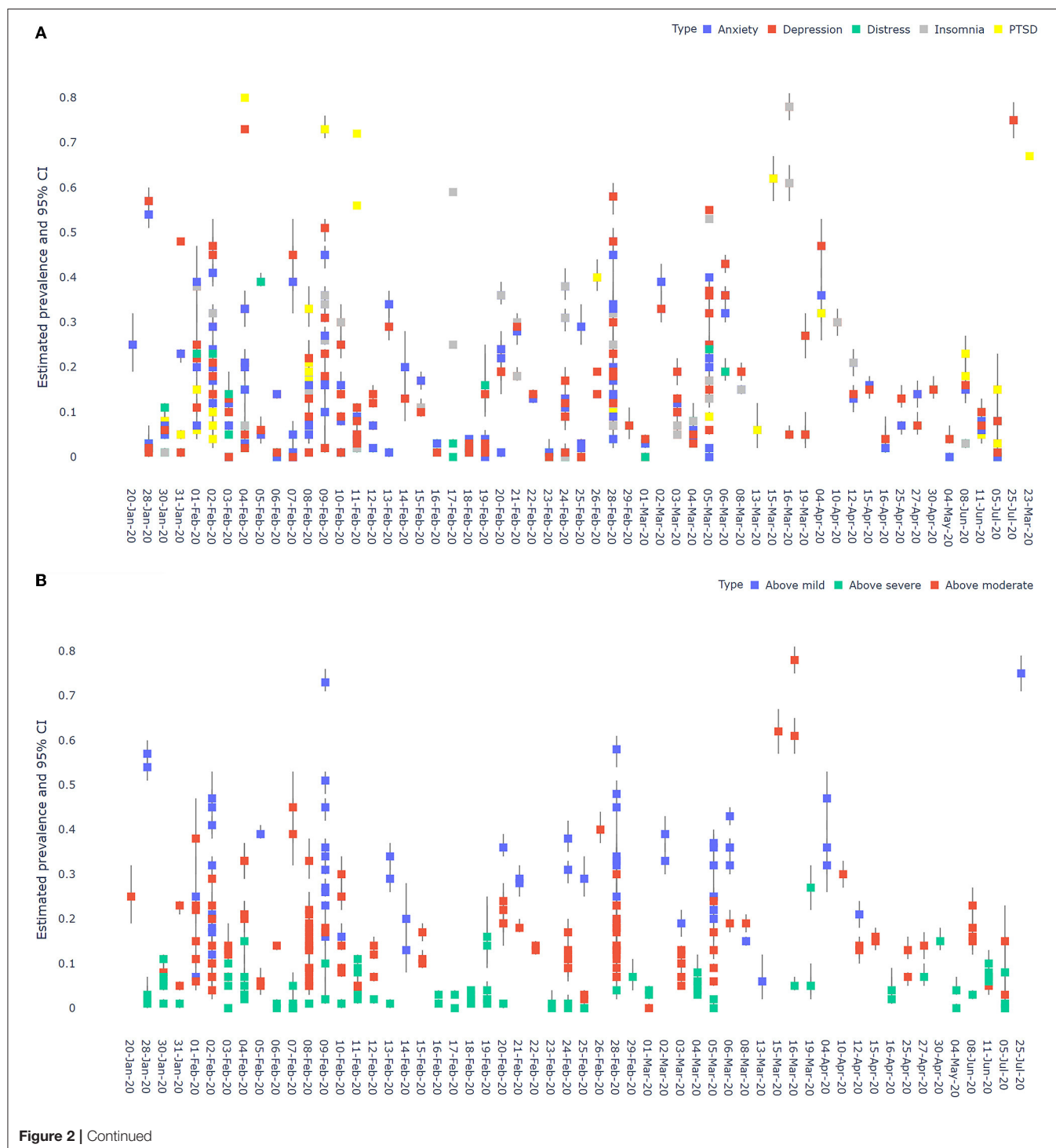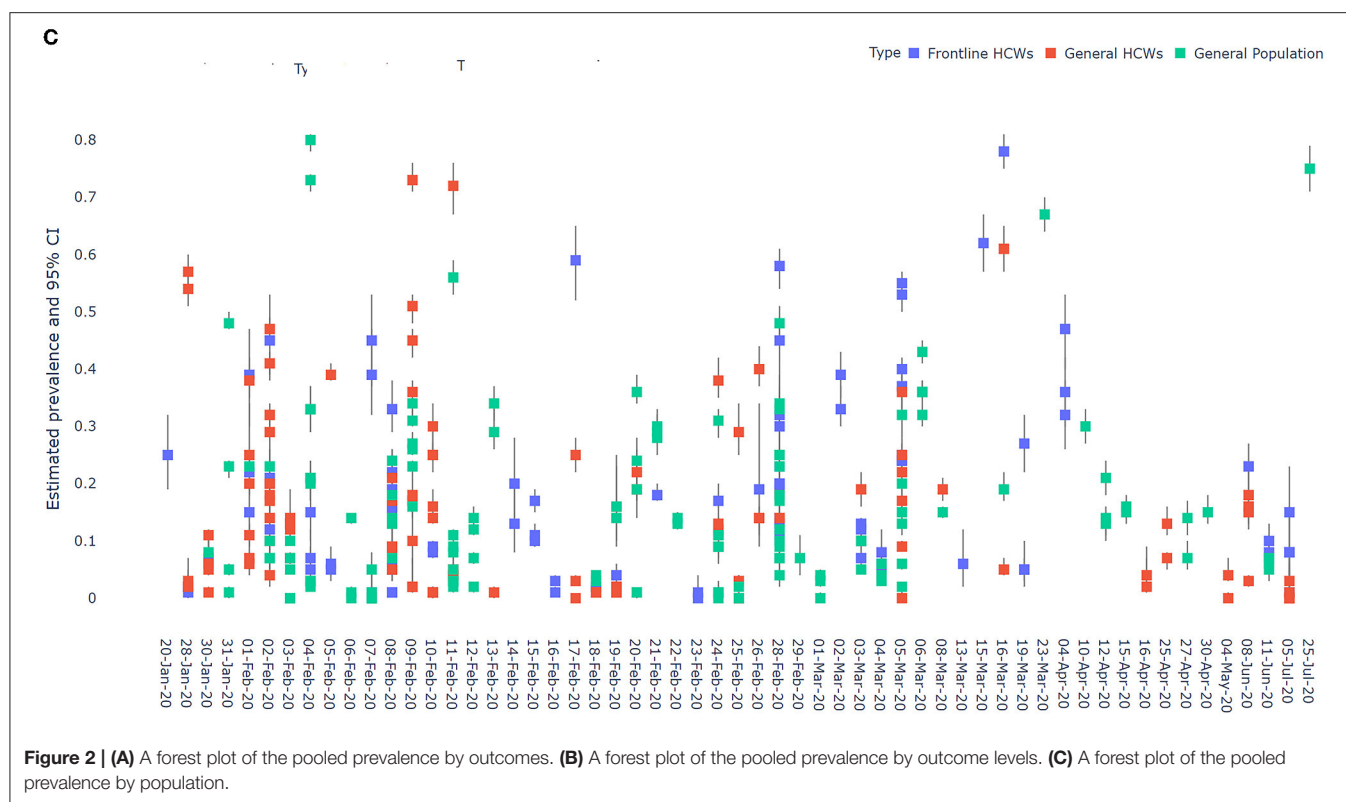
visual inspection of the sensitivity plot however revealed that there is significant asymmetry. **Figure 3** reports the DOI plot in combination with the Luis-Kanamori (LFK) index, which has higher sensitivity and power than a funnel plot (23, 24). An LFK index scores of ±1, between ±1 and ±2, or ±2 indicating "no asymmetry", "minor asymmetry", and "major asymmetry", respectively, and hence the LFK index of 3.7 represents major asymmetry. Therefore, the presence of publication bias is likely.

DISCUSSION

Our meta-regression analysis from a systematic review comprises 171 independent samples with 645,805 participants from 132 studies, at least an order of magnitude larger than the prior meta-analyses that included 7–50 studies with 2,123–62,382 participants (15, 16, 25–27). Moreover, prior meta-analyses examined the prevalence rates of mental health symptoms based on one level of the severity of symptoms (i.e., above mild), and we included articles that reported the prevalence at varying levels of severity of symptoms. Our meta-regression results based on multiple factors are consistent yet fine-tune the previous results, a comparison reveals that our pooled prevalence rates largely fall between the findings of previous meta-analyses, suggesting. For example, our findings show similar prevalence of depression (32 vs. 32%) but a higher prevalence of anxiety (29 vs. 24%) for frontline HCWs reported by Bareeqa et al. (15). Similarly, our findings show similar prevalence of anxiety for the general HCWs (23 vs. 23%), but a higher prevalence of depression (27

vs. 23%) in Pappa et al. (16). The two differences between our prevalence rates and the prior reports are statistically significant given the large sample size involved, and hence we significantly update the cumulative evidence on mental health prevalence rates in COVID-19.

Meta-Regression Findings

We were able to conduct meta-regression to account for the influence of multiple predictors at the same time to enable better prediction on the prevalence of each mental health symptom thanks to the large number of samples in China over a year of the COVID-19 crisis. The meta-regression evidence shows that several predictors are significantly associated with prevalence rates of mental symptoms during COVID-19, including the population, the severity and type of mental symptoms, sampling location, and study quality.

Frontline HCWs suffered more than general HCWs and the general population did across all five types of mental symptoms. It is also worth noting the general HCWs did not significantly differ from general populations across any mental symptoms. Such a result implies that whether a HCW is frontline could be a major factor in shaping her/his mental health, because of the risk of more direct exposure to the COVID crisis situation. In other words, the fact that general HCWs work in the medical field alone may not trigger much mental health symptoms than the general population has. Hence, our evidence suggests that policymakers need to prioritize frontline HCWs in particular in this ongoing pandemic. We call upon healthcare organizations to test specific

TABLE 3 | The results of meta-regression of mental health symptoms during COVID-19.

Variables	Coefficient (CI, 95%)	Std. Err.	P-value
Outcome			
Anxiety (reference)			
Depression	0.07 (−0.00 to 0.14)	0.04	0.064
Distress	0.03 (−0.16 to 0.21)	0.10	0.817
Insomnia	0.06 (−0.04 to 0.15)	0.05	0.251
PTSD	0.13* (0.01 to 0.25)	0.06	0.039
Severity			
Above mild	−0.30** (−0.45 to −0.15)	0.08	<0.001
Above moderate	−0.64*** (−0.78 to −0.50)	0.07	<0.001
Above severe	−1.05*** (−1.20 to −0.90)	0.08	<0.001
Overall (reference)			
Population			
Frontline HCWs	0.12** (0.03 to 0.20)	0.04	0.005
General HCWs (reference)			
General population	0.08 (−0.01 to 0.17)	0.04	0.078
Publication Status			
Preprint (reference)			
Accepted	−0.23 (−0.65 to 0.18)	0.21	0.265
Published	−0.06 (−0.20 to 0.07)	0.07	0.338
Female proportion	0.15 (−0.09 to 0.39)	0.12	0.233
Date of data collection	0.00 (0.00 to 0.00)	0.00	0.392
Wuhan vs. Non-Wuhan sample	−0.09* (−0.17 to −0.00)	0.04	0.038
Sample size	0.00 (0.00 to 0.00)	0.00	0.124
Quality	0.07* (0.01 to 0.13)	0.03	0.036
Constant	−8.01	10.4	0.438
R^2	0.56		
Wald X^2 (16)	419.18***		<0.001

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

psychological support intervention programs as well as mental health prevention plans to help HCWs (28).

The severity of mental symptoms, which has been unaccounted for in prior meta-analyses, was found to contribute greatly to the heterogeneity of prevalence rates, hence individual mental health papers need to pay special attention to the severity with clarity. Otherwise, researchers and practitioners might mix the severity of severe, moderate, and mild mental illness. Since prior meta-analyses largely examined the prevalence rates of mild mental health symptoms, yet psychiatrists care not only the mild symptoms, and the significant differences revealed by this study call for more meta-regression analyses on varying levels of severity to provide evidence for practitioners relevant to their concerns.

Among the five mental health symptoms examined, PTSD had the highest prevalence rates in both general and frontline HCWs. Our findings suggest that practitioners need to be aware and pay more attention to PTSD under the COVID-19 pandemic. Moreover, given that more than three-quarters of

existing empirical studies focused on anxiety and depression, we call out for future research to focus on mental PTSD.

Past mental health research has reported inconsistent results on the relationship between individuals' mental symptoms and their locations. Some studies reported that mental symptoms increase along with the distance to the epicenter in the COVID-19 pandemic, known as "typhoon eye effect" (29–31). However, other findings have demonstrated an opposite effect, where mental symptoms decrease as the distance to the epicenter increases, known as the "ripple effect" (32, 33). Our accumulative evidence shows that people in the epicenter of China in Wuhan suffered less mental symptoms than those outside of Wuhan, lending support to the typhoon eye effect. This finding suggests future research to differentiate, report, and possibly model sampling locations based on the epicenter of a pandemic to enable better geographical identification of mental symptoms (34–36).

Our findings that the samples in papers with higher quality tend to find higher prevalent rates of mental symptoms suggest study quality may matter. Particularly, future meta-analysis may pay attention to the representativeness of sampling, the response rate, etc., to better account for the heterogeneity in the pooled prevalence rates.

As the COVID-19 epidemic evolves, we expected the mental symptoms may change over time. However, the evidence of meta-regression using time as a predictor failed to reveal significant effect, and a potential reason might be the development of COVID-19 in various parts of China happened at varying paces, and more refined studies are needed to uncover the change of prevalence rates effect over time across COVID waves (37).

Study Limitations and Future Research

This research has a few limitations. First, the validity of our findings rests upon the quality and reporting of the original studies. While we paid extra attention to the severity, the cutoff points, and the ways in which individual articles used this information, the multitude of varying practices contributes to additional noise and variance in the analysis. Second, since we included studies in English, which may result in some biases. Third, 97.9% of the primary studies included were cross-sectional surveys, and we call for more cohort studies to examine the effect of time. Fourth, we examine the major adult population of interest, and future research could examine other populations that could be vulnerable, such as hospitality workers, professional athletes, and managers (38– 41). As research on COVID pandemic continues to develop, future research may also explore other factors, such as age, health conditions, COVID testing availability, and conspiracy belief in COVID (42–44).

Finally, we only focus on studies that collected data in one country (China) to reduce the heterogeneity of different situations across countries, and we call for future meta-analyses in other countries or regions where data are sufficient -see meta-analyses on several regions including Africa, Eastern Europe, Latin America, South Asia, Southeast Asia, and Spain (45–50).

TABLE 4 | The predicted prevalence rates of mental health symptoms by populations, outcomes, and severity by the meta-analytical regression model.

Mental health symptoms above certain severity	Prevalence rate (95% CI)		
	Frontline HCWs	General HCWs	General population (for comparison)
Above mild anxiety	0.29 (0.24–0.33)	0.23 (0.19–0.28)	0.27 (0.23–0.31)
Above moderate anxiety	0.15 (0.12–0.18)	0.11 (0.08–0.14)	0.13 (0.11–0.16)
Above severe anxiety	0.04 (0.02–0.05)	0.02 (0.01–0.03)	0.03 (0.02–0.04)
Above mild depression	0.32 (0.27–0.36)	0.27 (0.22–0.31)	0.3 (0.26–0.35)
Above moderate depression	0.17 (0.14–0.21)	0.13 (0.1–0.16)	0.16 (0.13–0.19)
Above severe depression	0.05 (0.03–0.07)	0.03 (0.02–0.04)	0.04 (0.03–0.06)
Above mild distress	0.3 (0.21–0.39)	0.24 (0.16–0.33)	0.28 (0.19–0.37)
Above moderate distress	0.16 (0.09–0.23)	0.12 (0.06–0.18)	0.14 (0.08–0.21)
Above severe distress	0.04 (0.01–0.09)	0.02 (0–0.06)	0.03 (0.01–0.08)
Above mild insomnia	0.31 (0.26–0.37)	0.26 (0.21–0.31)	0.29 (0.24–0.35)
Above moderate insomnia	0.17 (0.13–0.21)	0.13 (0.1–0.16)	0.15 (0.12–0.19)
Above severe insomnia	0.05 (0.03–0.07)	0.03 (0.01–0.05)	0.04 (0.02–0.06)
Above mild PTSD	0.34 (0.28–0.41)	0.29 (0.23–0.36)	0.33 (0.26–0.39)
Above moderate PTSD	0.2 (0.15–0.24)	0.15 (0.11–0.2)	0.18 (0.14–0.23)
Above severe PTSD	0.06 (0.03–0.1)	0.04 (0.02–0.07)	0.05 (0.03–0.09)

CI, Confidence Interval.

Figure 3 | The DOI plot and the Luis Furuya–Kanamori (LFK) index.
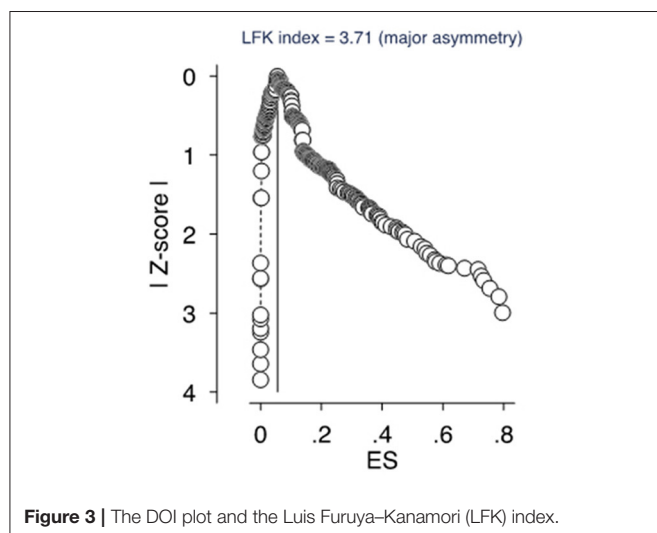
CONCLUSION

This meta-regression analysis takes account of several heterogeneities to analyze the evidence on the prevalence rates of mental health symptoms of healthcare workers under the COVID-19 crisis to provide a foundation of the past research and to guide future effort. Our findings suggest further research and practices on mental health symptoms need to better specify and account for the heterogeneous factors identified as such heterogeneity contribute to significant differences of the prevalence of mental health symptoms reported.

AUTHOR CONTRIBUTIONS

XC: investigation, data curation, visualization, writing—original draft, writing—review and editing, and project administration. JC: conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, visualization, writing—original draft, writing—review and editing, and supervision. JL: investigation, writing—review and editing, and resources. MZ, RD, ZD, YY, and LT: investigation (Data). RZ, WC, and PL: investigation. SZ: conceptualization, methodology, validation, formal analysis, investigation, data curation, writing—original draft, writing—review and editing, and supervision. XC, JC, and SZ: co-lead this project. All authors were involved in approving the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Monitoring the Mental Health and Professional Overload of Health Workers in Brazil: A Longitudinal Study Considering the First Wave of the COVID-19 Pandemic

Flávia L. Osório[1]*, Antonio Waldo Zuardi[1], Isabella L. M. Silveira[1], José Alexandre S. Crippa[1], Jaime Eduardo Cecílio Hallak[1], Karina Pereira-Lima[2] and Sonia R. Loureiro[1]

[1] Medical School of Ribeirão Preto, University of São Paulo, São Paulo, Brazil, [2] Department of Psychiatry, Federal University of São Paulo, São Paulo, Brazil

Few longitudinal studies assessed the less immediate consequences of the COVID-19 pandemic on health workers' mental health, especially in less developed countries. The objective was to assess the evolution of mental health indicators of Brazilian health workers providing care to COVID-19 patients, considering the beginning and first wave of the pandemic, identifying risk and protective factors. A non-probabilistic sample of health professionals was assessed for 6 months at seven different points in time using standardized instruments to measure anxiety, depression, insomnia, posttraumatic stress, and burnout symptoms. Risk and protective factors were assessed using a questionnaire addressing socio-demographic, clinical, occupational variables, and COVID-19 risk perception. The results indicate high rates for all the indicators (>30%) throughout the follow-up; only anxiety symptoms decreased in the different phases compared to the baseline. Depression and insomnia symptoms showed a significant drop in isolated points of the assessment, which were not maintained at the final follow-up. Burnout indicators concerning emotional exhaustion and depersonalization remained stable (40 and 20%), while professional achievement decreased by approximately 19%. Occupational and personal characteristics (profession and work setting), perceptions regarding protective measures imposed by the institutions, and future professional prospects stood out as risk/protective factors in mental health. Unlike European and Asian countries, where mental distress symptoms tended to decrease over the pandemic, this study's results suggest alarming indicators of mental health problems remaining stable with burnout symptoms on the rise. Hence, the different contexts across countries, with different management resources and investments in health actions, seem to influence workers' mental health differently, demanding constant attention and monitoring and measures to minimize the impacts on individuals and collectives, especially in less developed countries like Brazil.

Keywords: anxiety, mental health, follow-up, COVID-19, healthcare personnel, burnout, psychological

INTRODUCTION

Health workers are considered vulnerable to mental health problems within the COVID-19 pandemic due to their intense exposure to multiple stressors, suggesting a need for public health policies intended to favor personal conditions and the quality of care delivery (1).

The prevalence of mental health problems among health workers is highly reported in studies conducted in various countries, in different times of the COVID-19 pandemic (2), especially anxiety, depression, insomnia, posttraumatic stress, and burnout, in addition to other general concerns with one's health and fear of infection (3).

Previous studies conducted in the last 20 years in epidemic and pandemic contexts worldwide, including the COVID-19, report various risk conditions leading to the development of mental symptoms and disorders among health workers, mainly: being a woman, working in the nursing field and the frontline, longer shifts, having inappropriate personal protective equipment, having insufficient knowledge regarding the virus, inappropriate training, fewer years of professional experience, and lack of social support (4).

Considering the current pandemic, Osório et al. (5) identified that occupational variables stand out as risk factors for different groups of professionals providing care to individuals with COVID-19 in Brazil. Despite the recognition that multiple conditions represent risk factors for the exacerbation of mental health problems, in low- and middle-income countries, such as Brazil, the scarcity of health system resources exerts additional pressure, associated with the lack of basic equipment and treatment resources (6, 7), making fighting the pandemic even more challenging.

In addition, multiple conditions represent risk factors that compound mental health problems in low- and middle-income countries, such as Brazil, and the scarcity of health system resources exerts extra pressure, associated with a lack of basic equipment and care resources (6, 7) so that fighting the pandemic is even more challenging.

There are few longitudinal studies thus far assessing the less immediate consequences of the pandemic on the health workers' mental health. Most studies assessed the initial impact of the pandemic and specific aspects of its evolution, which, from an epidemiological perspective, is constantly changing worldwide, though it remains persistent with times in which the pandemic peaks and then subsides (8, 9). The few longitudinal studies available are concentrated in European and Asian countries, which restrict the generalization of studies, given social and economic specificities, especially compared to Latin American and African countries; thus, studies addressing these contexts are needed. To the best of our knowledge, only one longitudinal study was conducted in Latin America (10).

Therefore, this study's primary objective was to assess the evolution of mental health indicators of Brazilian health workers providing care to COVID-19 patients, considering the beginning and first wave of the pandemic, identifying risk and protective factors.

METHOD

This longitudinal study, called MENTALvid, included a non-probabilistic sample composed of Brazilian health professionals from different fields, responsible for providing care to COVID-19 patients during the beginning and first wave of the pandemic, including physicians (regardless of the specialty), nursing workers (nurses, nursing technicians/aids, and radiology technicians), and other professionals (bachelor's degree holders working in the hospital setting: psychologists, physical therapists, speech therapists, occupational therapists, dentists, pharmacists, and social workers). The participants were recruited on social media (e.g., Facebook, Instagram, WhatsApp), traditional media (TV and radio), and by contacting class councils and health organizations in the various Brazilian regions. Participation in the study was voluntary and required signing a free and informed consent form. All the participants who completed the instruments at the baseline were included. The study was submitted to and approved by the Institutional Review Board (Process 4.032.190).

Data collection was initiated on May 19th (baseline) and lasted until August 23rd, 2020, when the mark of 1,500 individuals (expected sample) was obtained according to criteria proposed by the Chinese pioneer study (11). At the beginning of the study, the first COVID-19 case had been officially diagnosed in Brazil 82 days ago. The number of confirmed cases was 271,628 and 17,971 deaths, with peaks in various Brazilian regions. The follow-up (D90) ended on November 21st, 2020, with 6,052,786 cases and 168,989 deaths. The daily growth rates of new cases in the months when data were collected were: May 6.2%, June 3.3%, July 1.4%, August 1%, September 0.7%, October 0.4%, November 0.5% (12).

Instruments

(a) To characterize the sample and assess protective and risk factors in mental health:
- A questionnaire was developed to characterize socio-demographic and occupational factors and identify risk perception of COVID-19. The instrument is composed of 39 questions addressing numerical variables such as age and years of professional experience, and categorical variables including sex, marital status, whether the individual lives alone or with a partner and/or children, has a religion (yes/no), smoke, use drugs, consume alcohol (yes/no), regular exercise (yes/no), previous psychiatric care and psychiatric diagnosis (yes/no), physical illness/medication use (yes/no), profession (nurse/physician, others), workplace (public/private hospital), type of care facility (secondary/tertiary care) and whether it is a referral center for COVID-19 (yes/no), frontline (yes/no), extra working hours (yes/no), desire to quit job (never-rarely/often-always), positive professional prospects (yes/no), whether is satisfied with the physical protective measures adopted by the facility (never-rarely/often-always), receives any support from the institution (yes/no), social/emotional support from coworkers (yes/no), was infected by the Sar-CoV-2 (yes/no), is concerned with being infected or infect family members

with the Sar-CoV-2 (yes/no), notices that people avoid social contact because of the profession (yes/no).

(b) To assess outcomes:

- Generalized Anxiety Disorder-7 (GAD-7): a 7-item self-report instrument that screens anxiety-associated symptoms rated on a three-point scale ranging from 0 (never) to 3 (almost every day). It was proposed by Spitzer et al. (13) and validated in Brazil by Moreno et al. (14). A cutoff score $\geq$ 10 corresponds to 89% of sensitivity and 82% of specificity;

- Patient Health Questionnaire-9 (PHQ-9): a 9-item self-report instrument intended to assess depression indicators. It was proposed by Kroenke et al. (15) and validated in Brazil by Osório et al. (16). Its items are rated from 0 ("never") to 3 ("almost every day"), and a cutoff score $\geq$ 10 corresponds to 100% sensitivity and 98% of specificity;

- Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): a self-report instrument used to assess symptoms of posttraumatic stress disorder using the criteria established by the DSM-5. The short version (eight items) translated, adapted, and psychometrically assessed by Osório et al. (17) and Pereira-Lima et al. (18) was used. A cutoff point $\geq$ 14 corresponds to sensitivity equal to 0.97 and specificity equal to 0.61.

- Insomnia Severity Index (ISI): a 7-item self-report instrument rated on a 5-point Likert scale intended to assess the severity of insomnia in the last 2 weeks. It was adapted and validated in Brazil by Castro (19), with a cutoff point $\geq$ 8, sensitivity of 73%, and specificity of 80% to detect positive and negative cases of chronic insomnia.

- Abbreviated Maslach Burnout Inventory – Human Services Survey (aMBI-HSS). It assesses the burnout syndrome based on the following dimensions: emotional exhaustion, depersonalization, and professional achievement. This self-report instrument was developed by Maslach et al. (20) and later adapted and validated in Brazil by Carlotto and Câmara (21). Its short version, proposed for and validated among health workers (22), was adopted in this study, in which a cutoff point $\geq$ 9 indicates emotional exhaustion, $\geq$ 6 indicates despersonalization, and $\geq$ 10 professional accomplishment.

Procedures

Data were collected and managed using REDCap (Research Electronic Data Capture). The participants were granted access to the survey through an electronic link generated by the SURVEY application. Data were collected at seven different points in time, with a 15-day interval (Baseline, D15, D30, D45, D60, D75, and D90). A total of 1,522 participants accessed the platform, and all those who concluded the baseline assessment (n = 916) received the links to assess all the follow-up phases, regardless of whether they had answered the previous stages or not. The participants answered a questionnaire at the baseline to characterize the sample and the instruments intended to assess mental health. Only the instruments intended to measure mental health outcomes were completed in the follow-up. In this stage, even if the participants had not completely answered all the instruments, having completed at least one of the instruments ensured their participation in the follow-up.

Data Analysis

Data were statistically analyzed using Statistical Package for Social Science (SPSS), version 23.0 (IBM, 2015). The responses to the different outcome instruments were dichotomized according to the cut-off points established by the aforementioned psychometric studies. Descriptive statistics were performed, and a non-parametric test (Chi-square) was used to compare the frequencies above the instruments' cutoff points obtained at the baseline and each of the follow-up stages. Binary logistic regression analyses were performed to assess potential risk and protective factors for mental health outcomes and potential survival bias. The independent variables were presented together with the description of the socio-demographic questionnaire (socio-demographic, occupational, health conditions, and perception of support and risk associated with COVID-19). For the assessment of survival bias, the outcome variables were included in the regression analysis. Odds ratios are presented with a 95% confidential interval. No methods were used to impute missing data. All the statistical tests were conducted at a 0.05 significance level.

RESULTS

The initial sample was composed of 916 participants from different Brazilian states/regions (Southeast region predominate). The study's remaining phases presented 55.7–22.8% response rates (D15: N = 510; D30: N = 401; D45: N = 319; D60: N = 284; D75: N = 240; D90: N = 209). The socio-demographic, occupational, and clinical characterization of the participants included in the baseline and final follow-up are presented in **Table 1**.

Table 1 shows that the groups differed significantly regarding previous psychiatric care, psychiatric diagnosis, physical illness, medication use, years of professional experience, whether they worked in a COVID-19 referral center, worked in a public hospital, had previously been infected with SARS-COV-2, and whether they held positive professional prospects. Considering the high rate of loss to follow-up, we checked whether there was potential survival bias among the participants, impacting the results. Adjusted logistic regression analyses indicated that having more years of experience (OR = 1.04; CI 95%: 1.02–1.06; p < 0.001) and working in a public hospital (OR = 1.79 CI 95%: 1.03–3.11; p = 0.04) positively impacted whether the participants remained in the study. Note that the sample that completed the study does not differ from the initial sample regarding the initial outcome measures; that is, these variables did not impact survival.

Data concerning the progression of emotional exhaustion indicators throughout the follow-up are presented in **Table 2**.

High rates were found throughout the study for all the indicators of mental distress (except despersonalization) at all stages of data collection (>30%), especially insomnia (>51%). However, anxiety indicators were the only ones that presented

TABLE 1 | Socio-demographic, clinical, and occupational characterization and participants' risk perception at the baseline and final follow-up.

Variables	Respondents N (%)		Crude OR (95%CI) (P)	Adjusted OR# (95%CI) (P)
	Baseline **N = 916**	**Completed all the surveys (7)** **N = 201**		
Gender				
Female	730 (79.7)	160 (79.6)	0.993 (0.673–1.464) (0.97)	
Male	186 (20.3)	41 (20.4)		
Age - mean (CI 95%)	35.2 (34.1–38.3)	38.4 (37–39.7)	1.002 (0.998–1.007) (0.32)	
Marital status				
Single	482 (52.6)	99 (49.3)	1.189 (0.869–1.626) (0.28)	
Stable union	434 (47.4)	102 (50.7)		
Lives alone				
Yes	159 (17.4)	31 (15.7)	1.114 (0.725–1.712) (0.62)	
No	757 (82.6)	167 (84.3)		
Religion				
Yes	750 (81.9)	164 (81.6)	0.976 (0.651–1.462) (0.91)	
No	166 (18.1)	37 (18.4)		
Smoker				
Yes	94 (10.5)	19 (9.5)	1.123 (0.661–1.91) (0.67)	
No	822 (89.7)	182 (90.5)		
Alcohol abuse				
Yes	121 (13.2)	26 (12.9)	1.031 (0.648–1.642) (0.90)	
No	795 (86.8)	175 (87.1)		
Drug use N				
Yes	38 (4.3)	7 (3.5)	1.298 (0.564–2.987) (0.53)	
No	877 (95.7)	194 (96.5)		
Physical exercise				
Yes	408 (44.5)	86 (42.8)	0.913 (0.666–1.252) (0.57)	
No	508 (55.5)	115 (57.2)		
Previous psychiatric care				
Yes	152 (16.6)	54 (26.9)	0.432 (0.296–0.631) (<0.001)*	0.619 (0.372–1.030) (0.07)+
No	764 (83.4)	147 (73.1)		
Psychiatric diagnosis				
Yes	198 (21.6)	67 (33.3)	0.474 (0.335–0.671) (<0.001)*	0.760 (0.471–1.225) (0.26)
No	718 (78.4)	134 (66.7)		
Physical illness				
Yes	269 (29.4)	81 (40.3)	0.528 (0.381–0.733) (<0.001)*	0.702 (0.471–1.047) (0.08)+
No	647 (70.6)	120 (59.7)		
Medication use				
Yes	393 (42.9)	109 (54.2)	0.556 (0.406–0.762) (<0.001)*	0.847 (0.566–1.266) (0.42)
No	523 (57.1)	92 (45.8)		
Occupation				
Nurse	376 (41.0)	73 (36.3)	0.775 (0.561–1.072) (0.12)	
Other (Ω)	540 (59.0)	128 (63.7)		
Professional experience mean (CI 95%)	10.2 (9.6–10.7)	13.2 (11.8–14.5)	1.049 (1.031–1.067) (<0.001)*	1.041 (1.023–1.060) (<0.001)*
Works in COVID referral center				
Yes	601 (65.6)	67 (33.3)	0.663 (0.472–0.930) (0.02)*	0.777 (0.542–1.115) (0.171)
No	315 (34.4)	134 (66.7)		
Works in a public hospital				
Yes	572 (62.4)	183 (91.0)	1.770 (1.045–2.995) (0.03)*	1.790 (1.031–3.108) (0.04)*
No	344 (37.6)	18 (9.0)		

(Continued)

TABLE 1 | Continued

Variables	Respondents N (%)		Crude OR (95%CI) (P)	Adjusted OR# (95%CI) (P)
	Baseline **N = 916**	**Completed all the surveys (7)** **N = 201**		
Works in a tertiary care facility				
Yes	445 (48.6)	94 (46.8)	0.788 (0.576–1.078) (0.14)	
No	471 (51.4)	107 (53.2)		
Work in the COVID-19 frontline				
Yes	712 (77.7)	151 (75.1)	0.829 (0.575–1.196) (0.32)	
No	204 (22.3)	50 (24.9)		
Previous SARS-COV-2 infection				
Yes	131 (14.3)	19 (9.5)	1.779 (1.064–2.974) (0.03)*	1.435 (0.844–2.442) (0.18)
No	585 (85.7)	182 (90.5)		
Concerns with being infected				
Yes	728 (79.5)	163 (81.1)	0.878 (0.591–1.305) (0.52)	
No	188 (20.5)	38 (18.9)		
Concerns with a family member being infected				
Yes	879 (96.0)	192 (95.5)	0.869 (0.403–1.874) (0.72)	
No	37 (4.0)	9 (4.5)		
People avoid contact				
Yes	389 (42.5)	86 (42.8)	1.017 (0,741–1.395) (0.92}	
No	527 (57,5)	115 (57.2)		
Satisfied with protective measures				
Yes	400 (43.7)	85 (42.3)	0.930 (0.678–1.277) (0.66)	
No	516 (56.3)	116 (57.7)		
Considers quitting the job				
Yes	149 (6.3)	30 (14.9)	0.879 (0.569–1.358) (0.56)	
No	767 (93.7)	171 (85.1)		
Positive expectation for the future				
Yes	707 (77.2)	145 (72.1)	1.419 (0.993–2.026) (0.05)+	1.042 (0.709–1.533) (0.84)
No	209 (22.8)	56 (27.9)		
Works longer than usual				
Yes	460 (50.2)	96 (47.8)	0.882 (0.645–1.206) (0.43)	
No	456 (49.8)	105 (52.2)		
Receives some support from the institution				
Yes	160 (17.5)	29 (14.4)	0.871 (0.560–1.353) (0.54)	
No	756 (82.5)	172 (85.6)		
Anxiety (GAD-7 > 10)				
Yes	397 (43.3)	91 (45.3)	1.106 (0.807–1.515) (0.53)	
No	519 (56.7)	110 (54.7)		
Depression (PHQ-9 >10)				
Yes	368 (40.2)	80 (39.8)	0.980 (0.712–0.349) (0.90)	
No	548 (59.8)	121 (60.2)		
Emotional exhaustion (aMBI exhaustion > 8)				
Yes	336 (36.7)	82 (40.8)	1.251 (0.908–1.723) (0.17)	
No	580 (63.3)	119 (59.2)		
Depersonalization (aMBI depersonalization > 5)				
Yes	167 (18.2)	33 (16.4)	0.852 (0.561–1.293) (0.45)	
No	749 (81.8)	168 (83.3)		
Professional achievement (aMBI perso.accomp. > 9)				
Yes	760 (83.0)	164 (81.6)	0.885 (0.589–1.330) (0.56)	
No	156 (17.0)	37 (18.4)		

(Continued)

TABLE 1 | Continued

Variables	Respondents N (%)		Crude OR (95%CI) (P)	Adjusted OR# (95%CI) (P)
	Baseline **N = 916**	**Completed all the** **surveys (7)** **N = 201**		
Post-traumatic stress (PCL-5 > 13)				
Yes	330 (36.0)	76 (37.8)	1.103 (0.798–1.525) (0.55)	
No	586 (64.0)	125 (62.2)		
Insomnia (ISI > 7)				
Yes	563 (61.5)	123 (61.2)	0.986 (0.715–1.359) (0.93)	
No	356 (38.5)	78 (38.8)		

#*Adjusted for variables with significant crude OR p (<0.05) or with a tendency toward significance (p < 0.1).*
**Significant; +tendency toward significance (p < 0.1).*
Ω: *Other = Baseline: 30% physicians; 29% other professions (11.4% physical therapists, 6.2% psychologists, 3.1% nutritionists, 2.8% pharmacists, 2.0% speech therapists, 1.7% social workers, 1.1% dentists, 0.7% were occupational therapists); All surveys: 31.3% physicians; 32.4% other professions (11.9% physical therapists, 6.5% psychologists, 5.0% nutritionists, 2.0% pharmacists, 3.5% speech therapists, 1.0% social workers, 1.5% dentists, 1% were occupational therapists).*

TABLE 2 | Follow-up of mental health indicators amog Brazilian health workers providing care to COVID-19 patients.

Measures	Days of follow-up						
	Baseline	**15**	**30**	**45**	**60**	**75**	**90**
Anxiety							
Number of respondentes	916	510	401	319	284	240	209
% of GAD 7 ≥ 10	43.3	36.5*	31.7*	32.9*	29.2*	30.8*	30.6*
Depression							
Number of respondentes	916	501	399	315	277	277	205
% of PQH 9 > 10	40.2	36.7	34.8	37.1	37.2	33.1*	35.1
Insonia							
Number of respondentes	916	485	391	304	271	229	201
% of ISI ≥ 8	61.5	59.0	55.5*	54.3*	56.5	51.5*	59.2
Posttraumatic stress disorder							
Number of respondents	916	488	392	305	271	230	201
% of aPCL 5 > 13	36.0	35.7	32.7	34.8	32.1	32.2	35.3
Burnout (emotional exaustion)							
Number of respondents	916	495	395	310	273	234	202
% of AMBI-EE > 8	36.6	42.28*	41.3	38.7	42.9	39.7	8.1
Burnout (depersonalization)							
Number of respondents	916	495	396	311	273	235	202
% of AMBI-D > 5	18.2	20.2	20.7	20.3	19.8	24.7*	22.3
Bunout (professional achiviement)							
Number of respondents	916	495	395	310	273	235	202
% of AMBI-PA >9	83.0	71.5*	74.7*	71.4*	68.9*	65.5*	67.3*

**The difference between the baseline and follow-up day was statistically significant (Chi-square – p < 0.05).*

a statistically significant decrease in all the phases compared to baseline.

Depression and insomnia symptoms showed a significant drop in isolated points of the assessment, which were not maintained at the final follow-up. Posttraumatic stress indicators remained stable throughout the study, as did Burnout indicators related to emotional exhaustion and depersonalization, 40 and 20%, respectively. In turn, professional achievement significantly decreased by approximately 19%.

Logistic regression analyses were performed to identify potential risk and protective factors associated with indicators of emotional overload at the end of the follow-up. The multicollinearity analysis shows coefficients of tolerance >0.1 (0.30–0.93) and VIF < 10 (1.08–4.4), suggesting that the independent variables are not correlated. Furthermore, the Hosmer-Lemeshow goodness of fit test for the set of independent variables indicates that the model was adequate. Occupational and personal characteristics, such as profession (other health

professions: OR = 3.26; IC 95%: 1.31–8.09; p = 0.01), lack of positive professional prospects (OR = 2.16; IC 95%: 0.86–5.42; p = 0.10), and religion (OR = 3.70; IC 95%: 1.13–12.05; p = 0.03) were associated with a greater likelihood of decreased anxiety symptoms. In addition, conditions concerning the organizational contexts were considered risk factors for the professional achievement outcome: working in a private hospital (OR = 7.30; IC 95%: 2.12–25.19; p = 0.002), in a secondary care facility (OR = 7.30; IC 95%: 2.12–25.19; p = 0.002), and being dissatisfied with physical health-protective measures (OR = 3.10; IC 95%: 1.27–7.57; p = 0.01). Being a physician or a nursing staff member appeared as a risk factor preventing professional achievement though it was not significant in the adjusted OR. These findings are presented in **Table 3**.

DISCUSSION

To the best of our knowledge, this is the first study analyzing the progression of mental health indicators among Brazilian health professionals providing care to COVID-19 patients. There was a considerable loss to follow-up (78%); however, this rate is in line with those reported by similar studies such as Czeisler et al. (23) in the United States (76.8%) and Fancourt et al. (24) in the United Kingdom (89.9%). These studies addressed the general population and possibly portray the peculiarities of studies adopting online surveys in the pandemic context.

Nevertheless, comparisons of the our samples at the beginning of the study and end of the follow-up did not show significant differences regarding the socio-demographic variables (e.g., age, sex, marital status, and profession) and interest variables (baseline mental health and burnout indicators), suggesting that the results are comparable without the presence of bias in participant retention. This aspect deserves attention and should be highlighted as a differential of the study, since in follow-up studies in the area of mental health before (25, 26) or during the pandemic (23) biases in relation to demographic aspects were commonly portrayed.

For example, in Lamers et al. (26) and Czeisler et al. (23) greater loss to follow-up was observed when participants were younger and less educated, as well as in relation to the participants' previous mental conditions (greater loss to follow-up among participants with greater depressive and/or anxious symptoms (23, 27, 28). These factors may favor a bias in the reading of the data, with more optimistic interpretations of the results. In different longitudinal studies carried out in countries such as China (29–31), Belgium (32), Argentina (10), Netherlands (33) and Singapore (34), to assess the progression of mental health indicators among workers during pandemic, controversial results are reported, and the authors rarely pay attention to this aspect, which may be one of the factors that explain such divergences.

Concerning the study's primary objective, our findings indicate that depression, post-traumatic stress, and insomnia indicators remain high compared to studies conducted before the pandemic in Brazil (35, 36). On the other hand, the results also indicate that anxiety symptoms decreased during

the follow-up, suggesting that workers are less apprehensive with the COVID-19 context than at the beginning of the pandemic or due to attenuating the number of new cases as the end of the first wave approaches. Despite this, professional accomplishment remained lower than baseline throughout the follow-up, suggesting dissatisfaction with working conditions.

Studies conducted in Europe and Asia indicate a general tendency toward decreased mental distress symptoms (e.g., anxiety, depression, impact of adverse events, perceived stress, stigma, and somatization) in specific populations such as nurses, resident physicians, and other health workers (29, 30, 32–34). Institutional factors were accounted for decreased symptoms in these countries because health managers quickly organized and arranged more beds and field hospitals, implemented rotation schedules to enable workers to rest, and provided protective equipment, among others, which decreased pressure on the health system and improved the quality of working conditions (34). This drop in the indicators was also associated with strengthening the professionals' coping strategies as they often received emotional support to adapt to the pandemic more competently, which was gradually controlled with social isolation measures (29). In addition, the governments of some countries provided financial support and cared for the workers' families, which may have contributed to alleviating their concerns (29, 34). Stigma, initially experienced by health workers (37, 38), also subsided through the media and community actions intended to sensitize the population regarding these professionals' contributions during the pandemic (34).

On the other hand, a study conducted in Argentina, a Latin American country with social and economic conditions and pandemic indicators similar to those in the Brazilian context, reported an increase in common mental disorders and decreased perceived performance (10). This result, coupled with this study's finding that professional achievement decreased, suggests that, in addition to institutional peculiarities, the various world realities, with different resources for management and investment in health actions, can have a different impact on the mental health of health professionals and on professional achievement/satisfaction. According to Freitas et al. (7), some countries such as Brazil, with high levels of social inequalities and low investment in public and health policies, suffer the impact of the pandemic in a more pronounced way compared to more developed countries, with an impact on different levels. Thus, there seems to be a greater fragility regarding the mental health of health professionals from low- and middle-income countries, which should be explored and better understood in future studies that have this specific objective. In addition, it should be noted the need to invest in care, assistance and support actions for health professionals to better cope with the pandemic in these realities, as occurred in countries such as China (29).

Despite this, it is noteworthy that a study carried out in the Netherlands (33) found an increase in the rates of burnout indicators (about 13%) comparing the onset of the pandemic and the period of greater control of the same in that country (December 2019 and June 2020). Hence, even in countries with more resources, fighting the pandemic led to feelings of hopelessness, lack of control, and inability,

TABLE 3 | Characteristics at the baseline associated with a decreased number of participants with anxiety (GAD 7>10).

Characteristics	Change in anxiety diagnosis (GAD > 10) N (%)			Crude OR (IC-95%) (p)	Adjusted OR# (IC-95%) (p)
	Baseline + End point +	Baseline + End point −	Total		
Occupation					
Other health professions	19 (35.8)	34 (64.2)	53 (100)	2.526 (1.094–5.837) (0.03)*	3.260 (1.313–8.091) (0.01)*
Nurse	24 (58.5)	17 (41.5)	41 (100)		
Religion					
Yes	32 (41.6)	45 (58.4)	77 (100)	2.578 (0.864–7.692) (0.09)+	3.697 (1.134–12.054) (0.03)*
No	11 (64.7)	06 (35.3)	17 (100)		
Positive expectations for the future					
No	25 (39.7)	38 (60.3)	63 (100)	2.105 (0.878–5.043) (0.09)+	2.156 (0.857–5.421) (0.10) +
Yes	18 (58.1)	13 (41.9)	31 (100)		

Characteristics	Change in professional achievement (aMBI perso.accomp > 10) N (%)			Crude OR (IC-95%) (p)	Adjusted OR# (IC-95%) (p)
	Baseline + End point +	Baseline + End point −	Total		
Occupation					
Other health professions	91 (82.0)	20 (18.0)	111 (100)	1.916 (0.897–4.091) (0.09)+	1.930 (0.838–4.445) (0.12)
Nurse	38 (70.4)	16 (29.6)	54 (100)		
Other health professions	85 (73.9)	30 (26.1)	115 (100)	2.588 (1.002–6.686) (0.05)+	1.931 (0.643–5.797) (0.24)
Doctor	44 (88.0)	6 (12.0)	50 (100)		
Type of hospital					
Private hospital	7 (46.7)	8 (53.3)	15 (100)	4.980 (1.667–14.876) (0.004)*	7.302 (2.117–25.189) {0.002)*
Public hospital	122 (81.3)	28 (18.7)	150 (100)		
Type of care					
Secondary care	54 (72.0)	21 (28.0)	75 (100)	4.980 (1.667–14.876) (0.004)*	7.302 (2.117–25.189) {0.002)*
Tertiary care	75 (83.3)	15 (16.7)	90 (100)		
Satisfaction with protective measures					
No	63 (70.8)	26 (29.2)	89 (100)	2.724 (1.215–6.104) (0.02)*	3.104 (1.273–7.566) (0.01)*
Yes	66 (86.8)	10 (13.2)	76 (100)		

#*Adjusted for variables with significant crude OR p (<0.05) or with a tendency toward significance (p < 0.1).*
Significant; + tendency toward significance (p < 0.1).

decreasing professional achievement, engagement in activities (depersonalization), and favoring exhaustion and moral distress (33). This fact may favor an increase of risk factors against physical and mental health, commonly associated with burnout, including the consumption of alcohol, isolation, risk of suicide, poor self-care, and medical errors (39, 40).

The fact that the rates of mental problems in our sample are still possibly high compared to the pre-pandemic period, suggests that the pandemic has been eroding the workforce in a worrying way. This is also the case in other countries, including those where a reduction in indicators has been observed (2, 3, 41, 42), indicating an important public health problem and considerable risks for work performance and patient safety (43). This is because previous studies point to an important association between the presence of burnout, cognitive dysfunction, professional performance, medical errors, client dissatisfaction and inadequate preparation for the response to COVID-19 (44–47).

In addition, previous studies conducted during the SARS (Severe acute respiratory syndrome) outbreak report persistent psychiatric symptoms among health workers from 1 to 3 years later, indicating the future is uncertain and responses to the psychological stress caused by the pandemic may change anytime depending on the context (34), so that, the need for constant monitoring and identification of risk and protective factors in mental health is essential.

In our study, the type of profession stood out as protective factors, especially for the reduction of anxiety symptoms. Professionals in fields other than nursing fields show greater chances of having reduced anxiety experiences, a fact that in cross-sectional studies has been attributed to the condition of these professionals having less and less costly contact with the patient, not always acting in the line of front (5). Nevertheless, the longitudinal study conducted by Lui et al. (29) reports that nursing workers presented the most significant improvement in mental health indicators; this group obtained the worst scores at the beginning of the pandemic. Various governmental actions supporting the fight against the pandemic were accounted for such improvement. Factors such as religion also stood out as a social determinant of health (48–50). A curious fact is that workers presenting less positive expectations regarding their professional future were more likely to experience decreased anxiety. Such finding is possibly explained by the fact that demotivated workers, or those experiencing high burnout levels even before the pandemic or with negative professional prospects, were less intensively impacted by the pandemic, reflecting defense mechanisms based on conformism and avoidance (51).

Risk factors for burnout/professional frustration include the workplace (private hospital and secondary care facility) and dissatisfaction with physical protective measures, possibly emphasizing the role of the specific conditions of the settings where the services are provided, such as workers having received training to care for patients requiring less complex care and lack of equipment required in emergencies, among others.

International studies report individual variables such as previous history of stress (32), being concerned with potential infection (10) and the pandemic repercussions (10, 30), living alone, especially during social isolation (34), and perception of not having been adequately qualified/trained for the job (30), were the main risk factors reported by some longitudinal studies addressing mental health problems.

The findings show that the indicators of emotional distress of professionals are high, and that only the symptoms of anxiety decreased in the different phases of the study, in relation to the baseline. On the other hand, the professional fulfillment of around 19% of the participants also declined over the course of the pandemic. The data portray the mental health condition of Brazilian health professionals who provide care to patients with COVID-19, but they need to be viewed and generalized with caution, given some possible limitations of the study: (a) sample loss (which may be associated with several factors, including the long length of the data protocol and the substantial number of reassessments); (b) the lack of control over the different sources of recruitment and the participant's professional status (since proof of work in the health area and with patients

with COVID-19 was not required for inclusion in the study); (c) data collection methodology (online recruitment, self-report instruments); (d) lack of control over participants' pre-pandemic mental health measures; (e) the fact that Brazil is a continent-spanning country that presents peculiar characteristics regarding the evolution of the pandemic.

CONCLUSION

Even though the results indicate that anxiety indicators among health workers decreased through the first wave pandemic, the remaining indicators remain high compared to parameters from before the pandemic. On the other hand, professional overload seems to be on the rise, which requires constant attention and monitoring, in addition to measures intended to minimize impacts on individuals and the collective. We can hypothesize that socioeconomic differences between countries could impact workers' mental health care to COVID-19 patients. They directly influence working conditions, which can act as protective or risk factors for a better response to the emotional impacts associated with the COVID-19 pandemic. Future studies that more specifically explore the impact of these variables are opportune.

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 Comitê de Ética em Pesquisa com Seres Humanos do Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto – USP. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FO, AZ, JC, JH, KP-L, and SL: conception and design and substantial contributions to drafting the article or revising it critically for important intellectual content. FO, IS, AZ, and SL: collect, analysis, and interpretation of data. FO, AZ, IS, JC, JH, KP-L, and SL: final approval of the version to be published. All authors contributed to the article and approved the submitted version.

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Self-Sacrifice in a Distressful and Threatening Environment: The Consequences of the COVID-19 Crisis in Intensifying Workplace Violence

Zahra Ebrahimi Rigi[1†], Parvin Mangolian Shahrbabaki[2†], Fazlollah Ahmadi[3†] and Ali Ravari[4†]*

[1] Nursing Research Center, Kerman University of Medical Sciences, Kerman, Iran, [2] Nursing Research Center, Department of Critical Care Nursing, Razi Faculty of Nursing and Midwifery, Kerman University of Medical Sciences, Kerman, Iran, [3] Department of Nursing, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran, [4] Geriatric Care Research Center, School of Nursing and Midwifery, Rafsanjan University of Medical Sciences, Rafsanjan, Iran

Background: The stress and mental pressure resulting from the challenges posed by the COVID-19 crisis exacerbated occupational stressors such as workplace violence against nurses even though nurses were endangering their lives to provide high-quality care and reduce patients' suffering. Therefore, the present study aimed to explain Iranian nurses' experiences of workplace violence during the COVID-19 crisis.

Materials and Methods: This study was conducted using a qualitative approach. Twenty-five semi-structured interviews were conducted with nurses who had experienced workplace violence at COVID-19 referral centers in Kerman during the COVID-19 crisis. Conventional content analysis was used to analyze the data, and the research was reported *via* the COREQ checklist.

Results: Analysis of the findings led to one main category, "nurses' self-sacrifice in a distressful and threatening environment," and four subcategories, which included "omitting entertainment and fun activities," "having challenging duties in unsafe conditions," "receiving insufficient support," and "nurses' toleration of disrespect."

Conclusion: Crises can exacerbate workplace violence toward nurses. Thus, it is necessary to design educational programs and prevention strategies to manage the destructive psychological and occupational impact of the crises on nurses. Nurses should receive training in crisis management to cope with the intensified aggressive behavior of managers, colleagues, patients, and patient companions during the crisis. Policy-makers must be prepared to deal with crises, and they should take measures to improve nurses' mental health and quality of care.

Keywords: workplace violence, nurses, COVID-19, crisis, self-sacrifice

INTRODUCTION

The COVID-19 pandemic has been the most significant global health crisis in recent decades (1). Beyond its health consequences, the pandemic has significantly affected health systems (2). Nurses are valuable assets of the health system who work in the frontline of health care provision during the pandemic; this means that they are the personnel most affected by it (2). The nursing profession is inseparable from values such as "empathy, love, and self-sacrifice," so a culture of self-sacrifice has become an integral element of this occupation (3). In spite of the harsh conditions, nurses make sacrifices, provide for patients' needs, and disregard their own needs and wellness, spending all their power on providing quality care and fulfilling patients' needs (4). From the beginning of the COVID-19 crisis, nurses have faced threats, danger, and uncertainty caused by infection, fear of transmitting the virus (5), death anxiety (6), and the necessity of quick adaptation to rapid changes in care procedures (7). These concerns and challenges impose significant mental pressure on nurses (7). The continuation and exacerbation of stressful conditions can aggravate other occupational stressors such as workplace violence (8). Workplace violence is an occupational psychosocial risk factor; psychosocial risk factors are classified into two categories: those of an individual and malicious nature (violence in the workplace including harassment, bullying) and those of a culpable and collective nature (burnout syndrome and work-related stress), which can aggravate each other and damage the worker's health (9). Workplace violence refers to any incident or situation in which a person is subjected to abuse, harassment, threat, or assault at their workplace or in the circumstances related to their work (10). Nurses are the most common victims of workplace violence (11). The growth of workplace violence is a serious threat to nurses' mental health (12). It leads to decreased resistance, clinical burnout, and the inability to provide high-quality and professional care in nurses (13). A recent systematic review reported that the prevalence of workplace violence against nurses was 67.5–90.4% (14). A study in Iran found that violence in nurses' workplaces is committed by their colleagues and superiors or patients and their relatives. Also, depending on various complicated factors at individual and organizational levels, this violence may be caused by unmet expectations of patients or their relatives, inefficient administrative management, and improper professional communication (15). Most recent descriptive and analytical studies conducted on the effects of the COVID-19 crisis on nurses have focused on nurses' work quality (16), mental health (7), self-efficacy, and psychological disorders, such as anxiety and depression (17), emotional responses to fear and stress (18), occupational dissatisfaction (19), and job burnout (20). Qualitative studies have also focused on similar issues (21) and also on nurses' experiences with COVID-19 patients (22).

Critical circumstances such as the COVID-19 crisis cause high levels of stress and anxiety (23). For example, the explosion in the number of new COVID-19 infections and the high mortality rate have caused public fear and anxiety. Plus, people were asked to strictly avoid familial gatherings and trips, which led to increased stress. Hence, there was increased friction between the management and the medical staff, including nurses, which added much psychological pressure to the already increased workload of nurses (1). Moreover, nurses' tireless efforts in such difficult conditions were sometimes unappreciated (24). The social and cultural context affected these complex and multidimensional phenomena (2). Because this phenomenon has a subjective nature and cannot be measured by quantitative methods, it seems that qualitative research is required to explain how the COVID-19 crisis has affected the prevalence of workplace violence. Therefore, qualitative research can help achieve a correct understanding of nurses' experiences and create opportunities for discovering the problems and dealing with them (15).

Workplace violence is a topic of great importance to healthcare personnel, especially to nurses. The growth in workplace violence against nurses has become a severe issue that can be aggravated even further in critical circumstances. Numerous studies have been conducted on the effects of the COVID-19 crisis on nurses (2, 16, 23); however, there is little information on workplace violence during the COVID-19 crisis. Also, we did not find any study on the impact of the COVID-19 crisis on workplace violence against nurses in Iran. Therefore, the present study aimed to explain Iranian nurses' experiences of workplace violence during the COVID-19 crisis.

MATERIALS AND METHODS

Study Design

This qualitative study applied the conventional content analysis method with a descriptive-explorative approach (25). A qualitative study is a critical tool for studying emotions, perceptions, and knowledge about the complexities of human reactions, which cannot be obtained *via* quantitative research. Content analysis is a systematic coding and categorizing method used to understand, analyze, and conceptualize the underlying concepts of qualitative data (26).

Sample and Setting

Due to the qualitative nature of the data, the study settings had to be real, so this study's setting included public and semi-private referral hospitals of Kerman. A total of 25 individuals (including 18 female nurses and 7 male nurses) participated in this study (**Table 1**). Nurses who had experienced workplace violence during the COVID-19 crisis were selected from referral centers in Kerman. Interviews were done in prearranged meetings at the participants' convenience. Participants were selected for purposeful sampling from May 2020 to July 2022, and interviews continued until data saturation was reached when no new concepts were extracted from new data (26). The present study reached saturation after interviewing 22 participants, but three additional interviews were conducted to confirm data saturation. The criteria for selecting the participants included having experienced workplace violence in the COVID-19 crisis and willingness to recount these experiences. The participants who had a history of mental illness or those taking sedatives or antianxiety or antidepressant medications were excluded from

TABLE 1 | Characterstics of participants (*N* = 25).

Participants	Age (years)	Gender/marital status	Experience in nursing (years)	Duration of working at corona wards
1	24	Female/single	6 months	15-day rotation
2	36	Female/married	11	From the beginning of the coronavirus outbreak
3	43	Female/married	15	Admission and care of patients
4	23	Male/single	3	Admission and care of patients
5	32	Female/married	6	From the beginning of the coronavirus outbreak
6	32	Male/married	8	From the beginning of the coronavirus outbreak
7	34	Female/single	10	From the beginning of the coronavirus outbreak
8	32	Female/single	7	Auxiliary force
9	24	Male/single	3	From the beginning of the coronavirus outbreak
10	32	Female/married	3	From the beginning of the coronavirus outbreak
11	26	Female/single	4	From the beginning of the coronavirus outbreak
12	25	Male/single	3	Auxiliary force
13	38	Female/married	11	From the beginning of the coronavirus outbreak
14	28	Male/single	5	Auxiliary force
15	36	Female/married	9	Auxiliary force
16	27	Female/married	3	From the beginning of the coronavirus outbreak
17	26	Female/married	4	Admission and care of patients
18	37	Female/single	9	Auxiliary force
19	24	Male/single	6 months	15-day rotation
20	32	Female/single	9	Admission and care of patients
21	25	Female/widow	4	Admission and care of patients
22	44	Male/married	18	From the beginning of the coronavirus outbreak
23	43	Female/single	15	Auxiliary force
24	32	Female/single	11	Admission and care of patients
25	35	Female/single	9	Admission and care of patients

the study. Participants were selected based on the maximum variation principle, with different ages, genders, work experience, work experience in COVID-19 wards, and working shifts. Personal information such as marital status, academic degree, and position was recorded for a broader range of information. In-depth interviews were performed individually and face-to-face. Each interview lasted from 45 to 90 min.

Data Collection Procedure

Open-ended, semi-structured, in-depth interviews were conducted for data collection. Initially, some prepared questions were asked to familiarize the researcher with the participant and produce a pleasant atmosphere. Then the interview was guided toward the aim of the study. Also, field notes were taken for collecting data. The primary question asked from the participants was, "Please talk about your experience of workplace violence during the COVID-19 crisis." Based on the participant's answers, exploratory questions, like "Could

you explain more?" or "Would you give an example?" were asked to obtain more in-depth information. All interviews were performed by the first author, who had adequate experience in conducting interviews. After obtaining informed written consent for data recording and ensuring the participants of the confidentiality of data, the interview started by giving some information, including study aims and collection method, to the participants. The MAXQDA 10 was used to code and extract categories and themes.

Ethical Considerations

The Ethics Committee of Kerman University of Medical Sciences approved all the procedures used in the study (code: IR.KMU.REC.1398.174). This study was conducted following the ethical guidelines outlined in the Declaration of Helsinki. The study aims and collection method were clearly explained when recruiting participants, and written informed consent was obtained. Participants were informed of the recording of the

interviews. The place and time of the interviews were chosen according to the participants' preferences. The participants were assured of the confidentiality of all the gathered data. All audio files were stored securely and deleted after the final report. Participants were able to withdraw from the study at any time. In addition, participants were requested to contact us if they had any questions.

Data Analysis

Data analysis was done using content analysis and based on Graneheim and Lundman's five steps (27). The researcher transcribed the recordings immediately after conducting the interviews. In the second step, the full texts of the interviews were read repeatedly to gain a general understanding of their content. In the third step, all the transcripts of the interviews were read to determine the meaning units relevant to the aim of the study; the meaning units were summarized, maintaining their content, and labeled with suitable codes. In the fourth step, the researchers created subcategories based on similarities and differences of codes. **Table 2** presents some examples. The first and second authors separately coded one interview to evaluate agreement on the codes, and 84% agreement was observed. In the fifth step, after identifying latent content, subcategories were placed in the main categories, which were conceptually more comprehensive and abstract. Although the analysis was systematic, there was a back-and-forth movement between the whole and parts of the text. All extracted categories and themes were reviewed and approved by the authors.

Trustworthiness

Guba and Lincoln's criteria were used to determine the trustworthiness of the data (28). Credibility was confirmed by the researcher's prolonged engagement with data, maximum variety in participants, and member and peer checks. The participants reviewed a short report of the analyzed data (member check) to see how it reflected their experiences and attitudes. Moreover, the confirmability of data was approved by two researchers (peer check) by assessing agreement on codes and themes and reviewing the text, codes, and extracted categories of the interviews while observing researcher neutrality. Data transferability was ensured through a comprehensive explanation of the data, including data collection, data analysis, direct quotations, and examples, which improved the generalizability of the findings.

Findings

Analysis of the findings led to the concept of "self-sacrifice in a distressful and threatening environment: The consequences of the COVID-19 crisis in intensifying workplace violence." There are 17 primary categories, four subcategories, and one main category (**Table 3**). After the continuous comparative analysis, condensation, and integration of the codes, 350 codes remained. **Figure 1** presents how the affective event intensified workplace violence in the COVID-19 crisis.

Main Category: Self-Sacrifice in a Distressful and Threatening Environment: The Consequences of the COVID-19 Crisis in Intensifying Workplace Violence

According to the participants' experiences, the impact of the COVID-19 crisis on intensifying workplace violence includes four subcategories: "omitting entertainment and fun activities," "having challenging duties in unsafe conditions," "receiving insufficient support," and "nurses' toleration of disrespect."

Omitting Entertainment and Fun Activities

The participants' experiences revealed that omitting entertainment and fun activities was one of the causes of an increase in violence among colleagues during the COVID-19 crisis. Nurses fear being infected and are afraid of transmitting the virus to others; they are away from the family for prolonged periods, which leads to high stress. Also, nurses are frequently exposed to dying patients and incurable diseases, which is an important cause of occupational stress and leads to negative emotional behaviors such as violence among nurses. In this regard, three subcategories were extracted:

Canceling Recreational Gatherings

The participants' experiences revealed that as workplace stress was not relieved due to the cancelation of gatherings and recreational plans, occupational stress increased; moreover, this led to increased conflicts due to a decrease in intimacy among the personnel, leading to workplace violence. In this regard, two subcategories were extracted.

> "We used to go on group trips or gather around in the ward; these are all gone, and this has led to an increase in conflicts among the personnel." (P3)

Being Away From the Family for Prolonged Periods

The participants' experiences revealed that being forced to stay away from the family, not being able to relieve workplace stress, and working harder due to the intense situation resulting from the COVID-19 crisis led to mental fatigue and disorders in nurses' clinical function, leading to workplace violence.

> "I have not seen my family for months; being with family strengthens our mental status and decreases workplace tension; we are exhausted and burnt out; our mistakes have increased, and this has led to an increase in violence." (P9)

Having Challenging Duties in Unsafe Conditions

The participants' experiences revealed that although nurses need more management support in stressful conditions, such as the COVID-19 crisis, they face unreasonable expectations and harassment from their managers. Nurses were forced to work in non-standard conditions that harmed their health during the COVID-19 crisis. For example, lack of proper ventilation and placing patients infected with COVID-19 and non-infected patients in the same rooms result in anxiety and fear related to the transmission of the COVID-19 disease and increase the aggression of the companions. Also, the heavy workload, long

TABLE 2 | Example of qualitative content analysis process.

Category	Subcategories	Examples of codes	Condensation	Meaning unit
Omitting entertainment and fun activities	Canceling recreational gatherings	Canceling of gatherings and recreational plans increasing conflict	Due to the cancelation of gatherings and recreational plans, conflicts among the personnel increased	"We used to go on group trips or gather around in the ward; these are all gone, and this has led to an increase in conflicts among the personnel." (P3)
	Being away from the family for prolonged periods	Staying away from the family increasing tension and violence	Due to the not being able to relieve workplace stress, violence among the personnel increased	"I have not seen my family for months; being with family strengthens our mental status and decreases workplace tension; we are exhausted and burnt out; our mistakes have increased, and this has led to an increase in violence." (P9)

TABLE 3 | The category and subcategory related to the experiences of nurses of workplace violence in COVID.

Theme	Categories	Subcategories
Self-sacrifice in a distressful and threatening environment	Omitting entertainment and fun activities	- Canceling of recreational gatherings - Being away from the family for extended periods
	Having challenging duties in unsafe conditions	- Working with insufficient or low-quality protective equipment - Working under unfavorable physical conditions - Working in unsafe and non-standard environments - Working outside nurses' job description - Inconsistency between duties and nurses' abilities - Stressful and tense working conditions
	Receiving insufficient support	- Not understanding problems and lack of commitment to solving them - A lack of psychological support through counseling - Ignoring the nurses' self-sacrificing efforts - Discriminatory attitude toward nurses - Imposing overtime work with low wages - A lack of legal support
	Nurses' toleration of disrespect	- Visiting prohibition - Patient death, and the feeling of nurses not doing enough - Expressing stress through aggression

working hours, and inconsistency between duties and nurses' abilities lead to burnout, emotional exhaustion, and increased interpersonal workplace conflicts between colleagues. In this regard, six subcategories were extracted.

Working With Insufficient or Low-Quality Protective Equipment

The participants' experiences revealed that managers endangered the personnel's lives by forcing them to work in unsafe conditions.

"At the beginning of the outbreak, there were not enough scrubs, N95 face masks, and shields, and when we objected, they said that we had to accept the circumstances." (P14)

Working Under Unfavorable Physical Conditions

The participants' experiences showed that one form of the managers' violence was forcing nurses to work despite their poor physical condition due to COVID-19 infection; this leads to failure in providing adequate care, disorders in nurses' clinical function, and an increase in the prevalence of mistakes, which may be the cause of increased violence against them.

"Even if nurses' physical conditions were not good, they were forced to come to work. For example, I took care of patients using volume

expanders, and I could not finish all the work, and the nurse in charge yelled at me." (P18)

Working in Unsafe and Non-standard Environments

The participants' experiences showed that forcing nurses to work in unsafe and non-standard environments without considering occupational safety was one form of harassment by managers.

"The ward we were transferred to was not standard in terms of ventilation and equipment; staff health did not matter, and our objections were pointless as if our lives did not matter." (P15)

Working Outside Nurses' Job Description

The participants' experiences revealed that managers imposed their duties on nurses without paying attention to their heavy workload.

"In CPR emergencies, all the follow-ups must be done by the supervisor, but they forced us to do things that were not our responsibility in such a critical situation; our objection was pointless." (P7)

Inconsistency Between Duties and Nurses' Abilities

The participants' experiences showed that nurses with little experience were sent to COVID-19 wards with patients who

FIGURE 1 | Process of the influential event on intensifying workplace violence in the COVID-19 crisis.
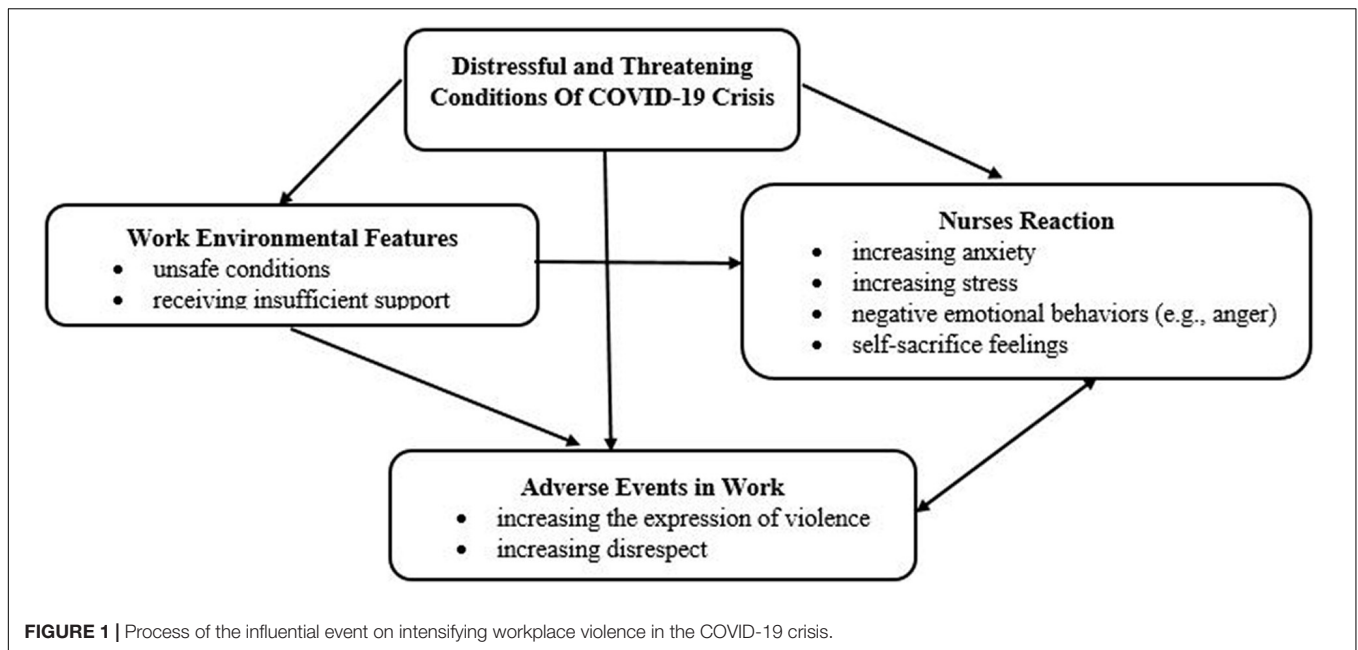
require different levels of care, leading to failure in providing adequate care and following the patient treatment plan, which may be a cause of violence against the nurses.

"I have not had the experience of taking care of patients in critical conditions. Once, one of my patients was in bad condition, and I could not take care of my other patients. I was reprimanded for this." (P8)

Stressful and Tense Working Conditions

The participants' experiences showed that nurses with less experience suffered from more anxiety and stress in critical situations due to insufficient knowledge and skill. Insufficient knowledge and skill lead to a decrease in concentration and an increase in the prevalence of mistakes and provide excuses for violence against nurses. Also, increased stress and tension due to patients' bad conditions, heavy workload, and the unknown nature of the COVID-19 led to nurses' irritability and increased interpersonal conflicts between colleagues in the workplace.

"The workload was exhausting, and my patient was coded; I mistakenly opened the wrong medication container during CPR, and my superior yelled at me. This happens a lot." (P16)

Receiving Insufficient Support

The participants' experiences revealed that managers' failure to pay attention to and solve nurses' problems, lack of solidarity and empathy, and discrimination and injustice are examples of the causes of violent behavior of managers in the workplace. On the other hand, insufficient training for nurses, failure to provide counseling services to reduce nurses' stress and anxiety in the COVID-19 crisis, and the lack of legal protection for maltreated nurses were factors that intensified workplace violence against nurses. In this regard, six subcategories were extracted.

Not Understanding Problems and Lack of Commitment to Solving Them

The participants' experiences showed that a lack of managers' commitment to solving issues related to nurses could lead to violence against nurses.

"We had two isolation rooms, and both were full. The supervisor called and said they were sending a COVID-19 patient. We objected, but the supervisor sent the patient anyway. Because of this, a companion of a non-COVID-19 patient became agitated and abusive." (P1)

A Lack of Psychological Support Through Counseling

The participants' experiences revealed that ignoring counseling services during the COVID-19 crisis has led to depression, resulting in negative emotional behaviors such as violence among nurses.

"We were suffering from depression; we were upset and had sleep disorders, and we got angry quickly. We told the authorities to bring in a psychologist to talk to the personnel, but they did not do it due to financial issues." (P2)

Ignoring the Nurses' Self-Sacrificing Efforts

The participants' experiences revealed that managers disregarded the nurses' outstanding performance and self-sacrificing efforts; their selfless efforts were not appreciated, and they were even subjected to violence for minor issues.

"It's been several months that we are working under increased pressure; we sacrificed our lives, and we were responsible for taking care of patients whose families may have been afraid to take care of them. We need to be encouraged; if they do not appreciate us, at least they can ignore our 10- or 15-minute delays; they do not see the things we do and reprimand us for delays." (P25)

Discriminatory Attitude Toward the Nurses

The participants' experiences revealed that managers did not treat the personnel equally and had a discriminatory and unjust attitude.

> "When the ward was less crowded, they gave off days mostly to senior nurses while we were forced to come to work, even when we were sick." (P10)

Imposing Overtime Work With Low Wages

The participants' experiences demonstrated that although the nurses had made much self-sacrificing effort during the COVID-19 crisis and had done everything in their power, they did not receive any financial benefits to stay motivated.

> "Our payment is quite low, and they have even further decreased our payment even though our work has not decreased but even increased due to the COVID-19 crisis. I am working by patients' bedsides day and night. We cannot do anything about this injustice." (P24)

Lack of Legal Support

The participants' experiences showed that managers did not provide legal support for maltreated nurses, and this facilitated workplace violence against nurses.

> "The authorities do not do anything against aggressive companions; unfortunately, the patients' rights charter has several articles, but the nurses' rights chart has only one." (P22)

Nurses' Toleration of Disrespect

The participants' experiences revealed that nurses were subjected to violence by patients and their companions for unfair reasons; moreover, the stressful circumstances of the COVID-19 crisis led to irritability and aggression in the personnel, especially physicians. In this regard, three subcategories were extracted.

Visiting Prohibition

The participants' experiences revealed that companions did not understand the limitations of visiting COVID-19 patients and directed their anger toward nurses.

> "Due to the COVID-19 crisis, we tell companions that for their safety, visiting is prohibited; however, patients' companions get upset and insult us." (P21)

Patient Death and the Feeling of Nurses Not Doing Enough

The participants' experiences showed that companions accuse nurses of irresponsibility and subject them to violence because they cannot cope with the death of their loved ones. Nurses who had done their best to care for the patients felt that they were subjected to disrespect and violent treatment unfairly.

> "During this time, we have experienced different types of violence; even though we were exhausted and weak and we did our job the best that we could, our tireless efforts were ignored. For instance, when I gave the news of the death of a patient to their companions, they grabbed me and pushed me with force and punched and kicked me." (P19)

Expressing Stress Through Aggression

The participants' experiences revealed that the stressful circumstances of the COVID-19 crisis and the unknown nature of the disease led to the irritability of the personnel, especially the physicians, and they expressed this stress and anxiety through aggression toward nurses.

> "One of the physicians was unable to intubate a COVID-19 patient and threw the tracheal tube at us angrily without any reason, not considering that we did not have any glasses or shields; We cannot do anything about this violent behavior, and our objections are pointless." (P13)

DISCUSSION

This qualitative study aimed to study Iranian nurses' experiences of workplace violence during the COVID-19 crisis. This study emphasizes the need to design educational programs and prevention strategies to manage the destructive psychological and occupational effects of the crisis on nurses. The current study revealed that despite the nurses' good performance and selfless efforts, their hard work was ignored, and they were subjected to disrespect and violent treatment. Despite numerous studies in Iran on the impact of the COVID-19 crisis on nurses, this is the first qualitative study about how the COVID-19 crisis has intensified workplace violence. The analysis of nurses' experiences revealed: four subcategories: "omitting entertainment and fun activities," "having challenging duties in unsafe conditions," "receiving insufficient support," and "nurses' toleration of disrespect."

Omitting Entertainment and Fun Activities

Nurses experienced stressful lifestyles and work conditions due to the COVID-19 pandemic, which increased irritability and anger due to the lack of opportunities and services to help reduce stress and depression. Studies conducted in several hospitals in Iran showed that most nurses in COVID-19 wards had high levels of anxiety and depression [29]. Additionally, the results of a systematic review revealed that workplace violence has a positive relationship with anxiety and burnout [30]. According to a study, there is a relationship between anger and symptoms of depression; moreover, stress causes symptoms of anxiety and depression, and these factors are influential in causing anger [31]. Similarly, Magnavita et al. [32] discovered a relationship between workplace violence and symptoms of anxiety [32]. It can be stated that nurses' failure to relieve workplace stress and the increased workplace' tension caused by the special conditions of the COVID-19 pandemic result in more anxiety and depression; these factors are barriers to anger management and they intensify violence among nurses.

Having Challenging Duties in Unsafe Conditions

During the COVID-19 pandemic, nurses were harassed by managers who forced them to do extra work in non-standard work environments and unfavorable physical conditions. Some studies have shown that nurses experienced a lot of stress and anxiety during the pandemic due to limited access to personal

protective equipment (2). The results of a study conducted in Iran on the experience of emergency nurses in the COVID-19 pandemic indicated that most hospitals are far from ideal: Patient care is sometimes inadequate, nurses' experience is limited, the number of nurses is low, support services are inadequate, and good quality equipment is often unavailable (33). According to studies, heavy workload, unsafe work environments, limited resources, patient care problems, and conflicts with colleagues and supervisors can become constant sources of stress in nurses' workplaces (34). Increased work-related stress and anxiety will potentially increase violence (35, 36). Not receiving enough support in spite of the heavy workload and their demanding duties has worsened nurses' emotional and mental health, which can increase the violence they are subjected to (14). Nurses suffer from high levels of stress due to working in unsafe conditions, which, coupled with inadequate support from managers, makes them vulnerable to physical and emotional exhaustion. Managers expect nurses to be committed to their duties, even by resorting to violence toward the nurses. Nurses who had experienced long-term stress due to forced work in unsafe conditions and perceived violent behavior were at risk of depression and anxiety. In addition to physical and emotional burnout, these factors could provide bases for nurses' irritability, aggression, and violent behaviors to each other.

Receiving Insufficient Support

The non-supportive work environment increased violence against nurses. Hospitals face many crises; nurses are constantly experiencing these crises and have to cope with them. Poor crisis management leads to more crises and imposes extra workload on the nurses (33), with the increased workload increasing the violence in the workplace (36). Also, studies have shown the positive effect of psychological counseling in reducing occupational stress (34). In this regard, a study has emphasized the necessity of attention to health promotion programs and preventive intervention in the workplace, considering the significant psychological impact the COVID-19 crisis has had on healthcare workers; this study recommended that policy-makers plan interventions, including supplying pertinent information and psychosocial support, acknowledging success, increasing resilience, and monitoring the health status of staff (37). Studies have also shown that the culture of self-sacrifice leads to increased physical and emotional exhaustion in the nurse's workplace (3). According to studies, occupational stress, whether accompanied by workplace violence or not, increases the risk of harm associated with facing violence (32). Also, a study has shown that the COVID-19 crisis highlighted the existing structural problems in health management. Programs for the COVID-19 crisis management were either not completely developed or not correctly implemented. Tension, complaints, and despair can lead to conflict in healthcare settings. Lack of coordination between managers and policy-makers escalates conflicts, and the resulting complaints are not addressed (38). Managers did not have the necessary preparation for the crisis, and they forced nurses to work in these conditions without proper facilities and support, even by resorting to violence toward the nurses. They expected nurses who work selflessly to be committed to their

patients and profession. Nurses experienced stress because they were unprepared for the crisis; they were forced to work in these circumstances and experienced injustice and violent behavior. Furthermore, providing optimal care and self-sacrifice leads to mental and physical fatigue in nurses. Thus, chronic workplace stress, extreme fatigue, and burnout could increase the risk of workplace violence against nurses.

Nurses' Toleration of Disrespect

Although nurses worked selflessly and did their best to take care of the patients, they were subjected to disrespect and violence by the patients' companions. Also, the tense circumstances increased irritability in the personnel, especially physicians, and led to violence against nurses (15). Also, according to research, misunderstandings and high levels of anxiety and stress in patients and their companions during emergencies and poor stress management increase violence against nurses (15). In addition, nurses provide 24-h direct care for the patients; prolonged exposure makes them more likely to experience patients' and their companions' aggressive behavior (10). Furthermore, in the COVID-19 crisis, because health care providers were under high job pressure, they had very limited time to interact with the patient's relatives. Limited interaction with relatives increases the risk of misunderstandings and the danger of negligence litigation, so when they had to report the failure of treatment to the families, the risk of violent reaction was higher (38). Some people have problems in anger management, and when they lose a loved one, they do not know how to cope with it; because people are not trained for this and nurses are the first healthcare providers that they meet in hospitals, they direct their aggression toward nurses. People's inadequate awareness of the nature of COVID-19 and unawareness of the nurses' efforts were other reasons for violence against nurses. Also, the harsh situation and poor stress and anxiety management in health care providers, especially in physicians, decreased their tolerance; these healthcare providers subjected the other personnel, especially nurses, to their aggression as a negative coping strategy for adapting to this stress.

Limitations

The limitation of this study is that it may not be generalizable to all cultures because experiencing workplace violence may be affected by cultural and social factors. Therefore, we recommend that similar studies be conducted in other societies.

CONCLUSION

In conclusion, the COVID-19 crisis caused distressful and threatening conditions aggravated by unsafe work conditions and insufficient support from managers, leading to intensified workplace violence against nurses; despite the nurses' self-sacrificing efforts, they were subjected to them to disrespect and violence. It is recommended that managers and health policy-makers consider the long-term psychological consequences of COVID-19 as a significant public health problem, especially

regarding the most vulnerable personnel. Providing educational courses for crisis management and stress and anger management helps nurses deal with such problems.

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 IR.KMU.REC.1398.174. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.848059/full#supplementary-material

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Viral Anxiety Mediates the Influence of Intolerance of Uncertainty on Adherence to Physical Distancing Among Healthcare Workers in COVID-19 Pandemic

Seockhoon Chung [1*†], Taeyeop Lee [1], Youjin Hong [2], Oli Ahmed [3,4], Washington Allysson Dantas Silva [5*†] and Jean-Philippe Gouin [6]

[1] Department of Psychiatry, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea, [2] Department of Psychiatry, GangNeung Asan Hospital, University of Ulsan College of Medicine, Gangneung, South Korea, [3] Department of Psychology, University of Chittagong, Chattogram, Bangladesh, [4] National Centre for Epidemiology and Population Health, Australian National University, Canberra, ACT, Australia, [5] Department of Psychology, Universidade Federal da Paraíba, João Pessoa, Brazil, [6] Department of Psychology, Concordia University, Montreal, QC, Canada

Introduction: The aims of this study were to examine the mediation effect of viral anxiety of healthcare workers on the influence of their intolerance of uncertainty on the adherence to physical distancing during the COVID-19 pandemic.

Methods: An online survey was conducted among 329 healthcare workers (female: 81.4%, nursing professionals: 59.0%, and shift workers: 22.3%) on November 29, 2021. Participants responded to questionnaires on adherence to physical distancing, health beliefs, and perceived social norms, and rating scales of the Stress and Anxiety to Viral Epidemics-6 items (SAVE-6), Patient Health Questionnaire-9 items (PHQ-9), and the Intolerance of Uncertainty-12 items (IUS-12) scale.

Results: Adherence to physical distancing of healthcare workers was predicted by perceived benefits of physical distancing ($\beta = 0.13$, $p = 0.01$), personal injunctive norms ($\beta = 0.32$, $p < 0.001$), SAVE-6 score ($\beta = 0.13$, $p = 0.02$), and IUS-12 score ($\beta = 0.10$, $p = 0.045$) (adjusted $R^2 = 0.21$, F = 22.3, $p < 0.001$). Viral anxiety mediated the association between intolerance of uncertainty and adherence to physical distancing but not the influence of perceived benefits and personal injunctive norms on adherence to physical distancing.

Conclusion: We observed that viral anxiety of healthcare workers mediated the association between intolerance of uncertainty and adherence to physical distancing. During this pandemic, exploring adherence to physical distancing and its predicting factors will be helpful for the safety of healthcare workers and the patients for whom they care.

Keywords: physical distancing, COVID-19, anxiety, uncertainty, stress

INTRODUCTION

Since the onset of the COVID-19 pandemic in 2020 (1), people in all countries have suffered from distress related to the virus. As of March 28, 2022, there have been 481,213,782 confirmed COVID-19 cases and 6,150,003 recorded COVID deaths worldwide[1], and 12,003,054 confirmed COVID-19 cases and 15,186 recorded COVID deaths in South Korea[2]. During the pandemic, frontline healthcare workers have suffered from psychological distress such as depression, anxiety, insomnia, fear of mortality, and post-traumatic stress disorder (2). Healthcare workers are facing the fear of infecting or transferring the virus to their family, friends, and colleagues, heavier workloads, perceived stigmatization, and increased scrutiny, and are coping by avoiding crowds and colleagues. To protect themselves and others, they must be fully vaccinated and follow the physical distancing guidelines (3); however, there were few reports on the adherence to physical distancing among healthcare workers (4).

Psychological Distress of Physical Distancing

Physical distancing has been one of most effective measures for preventing transmission of the COVID-19 virus (5, 6). However, it has imposed large costs on society. In this context, the Korean government announced the living with COVID-19 ("living-with-corona") policy and began to prepare residents for a return to the "new normal." Although physical distancing is beneficial, it is also known to cause psychological distress. Social isolation has been associated with increased fear, anxiety symptoms, loneliness, and depressed mood (7), perhaps due to a long period of isolation or the economic burden it carries with it. Social isolation is different from social distancing; however, social distancing seems to be related to social isolation, therefore the term "physical distancing" is now used to reduce feelings of social isolation that are associated with the term "social distancing" (8). Adherence to physical distancing is important in disease prevention and control, despite the negative impact on psychological distress. Previous studies have shown that a sense of personal responsibility and control over one's own behavior is related with adherence to physical distancing (9). Familial support has also been reported to play an important role in improving adherence (10), while decreased psychosocial well-being and lack of social support were related to non-adherence (11).

Viral Anxiety, Depression, Intolerance of Uncertainty, and Adherence to Physical Distancing

Throughout the COVID-19 pandemic, viral anxiety has been reported to be associated with adherence to or compliance with physical distancing. Anxiety may influence people's physical activity and time spent outdoors (12); thus, it has been reported

that people who feel anxiety tend to adhere to physical distancing (13–15). "Sodisphobia," or viral anxiety, is defined as experiencing excessive anxiety of being infected with viruses while in public (15). Although viral anxiety is thought to influence adherence to physical distancing, lower levels of anxiety and depression have also been reported to be associated with perceived compliance with physical distancing (16). Depression has been reported to be a predictor for physical distancing fears (17), while lower levels of depression have been reported to be associated with better adherence to measures of physical distancing (18). In general, high levels of depression have been associated with poor compliance to recommendations (19), and patients' depression is related to their non-adherence to medical treatment (20). Therefore, we can speculate that depressive symptoms of healthcare workers may be related to reduced adherence to physical distancing.

Intolerance of uncertainty, or the inability to successfully process and respond to information in uncertain contexts (21, 22), was reported to be associated with symptoms of anxiety (23, 24). Generally, intolerance of uncertainty is considered to be specific risk factor or cognitive vulnerability in the development and maintenance of anxiety disorders (25). Conceptually, intolerance of uncertainty is associated with generalized anxiety disorder (26) and obsessive-compulsive disorder (27). Difficulty tolerating uncertainty can manifest as cognitive and behavioral attempts to reduce uncertainty and enhance control (21). In the COVID-19 era, healthcare workers may find it difficult to tolerate the uncertainty associated with the spread of COVID-19. This may cause them to enhance their adherence to physical distancing to ensure the safety of their patients and themselves. Therefore, we can speculate that intolerance of uncertainty and viral anxiety may influence adherence to physical distancing. Depression also may be related with intolerance of uncertainty. Intolerance of uncertainty is associated with the etiology of depression (28). Further, it was reported that eliminating uncertainty from COVID-19 may reduce depressive symptoms among the general population (29). However, it is unclear whether healthcare workers' intolerance of uncertainty regarding COVID-19 contributes to depression or vice versa. Depression has previously been associated with decreased adherence to physical distancing, so it is essential to explore whether healthcare workers' intolerance of uncertainty influences depression to understand their level of adherence to physical distancing.

Aims of the Study

In this study, we first aimed to explore the reliability and validity of the questionnaires on adherence to physical distancing and health beliefs model proposed by Gouin et al. (30) among healthcare workers. Most healthcare workers adhered to the physical distancing policy during this COVID-19 pandemic, a meaningful and valuable behavior for their own safety and the safety of their patients, although it caused them stress and emotional distress. Therefore, the validated Korean version of the scale will be useful to assess adherence of healthcare workers to physical distancing policy during the COVID-19 outbreak.

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[1] Available online at: https://covid19.who.int/ (accessed on March 28, 2022).
[2] Available online at: http://ncov.mohw.go.kr/en/ (accessed on March 28, 2022).

Second, we aimed to examine the relationships among adherence to physical distancing, viral anxiety, depression, and intolerance of uncertainty in healthcare workers during the COVID-19 pandemic. We hypothesized that intolerance of uncertainty of healthcare workers may be associated with their adherence to physical distancing. Furthermore, we also explored whether viral anxiety of healthcare workers mediated the influence of intolerance of uncertainty on adherence to physical distancing.

METHODS

Participants and Procedure

This online survey was conducted among healthcare workers at the ASAN Medical Center, University of Ulsan College of Medicine, Seoul, Korea on November 29, 2021. ASAN Medical Center is the largest tertiary hospital in South Korea, where a total of 9,216 workers (1,759 medical doctors, 4,526 nursing professionals, and 2,931 other healthcare workers) are employed. Nearly all of them are Korean nationals. We recruited participants via an advertisement posted on the hospital's intranet, which stated the study's objective, enrollment procedure, and reward for participation. The participants completed the survey voluntarily, and a gift-coupon worth approximately five US dollars was provided as a reward for participation. The study protocol was approved by the Institutional Review Board (IRB) of the ASAN Medical Center (2021-1682), and the requirement to obtain written informed consent was waived by IRB. The sample size was estimated to be 300 in total, based on the calculation that there would be 10 samples per cell, with a total of 10 cells. (31) The cells were derived based on two groups of jobs (nursing professionals and others) and five groups based on age (20, 30, 40, 50, and 60s). After all, a total of 330 healthcare workers participated in this study on one day. The survey form was developed according to the Checklist for Reporting Results of Internet e-Surveys (CHERRIES) guidelines (32), and the usability and technical functionality were tested by investigators (SC). We collected the participants' ages, sexes, years of employment, and marital statuses. Responses to questions related to COVID-19 such as "Have you experienced taking care of confirmed COVID-19 patients?", "Did you experience being quarantined due to infection with COVID-19?", "Did you experience being infected with COVID-19?", or "Did you get vaccinated?" were gathered. Past psychiatric history was assessed with the question "Have you experienced or been treated for depression, anxiety, or insomnia?", and current psychiatric distress was assessed with the question "Do you think you are currently depressed or anxious, or do you feel you need help to improve your mood?".

Measures

Questionnaires on Adherence to Physical Distancing, Health Beliefs, and Perceived Social Norms

Adherence to Physical Distancing

Adherence to physical distancing was assessed using a questionnaire (**Supplementary File 1**) developed by Gouin et al. (30). It consists of seven items which can be rated on 5-point Likert scale, with higher score indicating greater adherence to physical distancing. This questionnaire was originally developed in English, and we used translated Korean version of the scale in this study (**Supplementary File 2**). We translated the questionnaire using a back translation method. Two bilingual experts translated the English version of the scale into two Korean versions. Then, these two translated Korean versions were synthesized into one. The synthesized version was back translated into English by two other bilingual experts, which were combined into one. Experts who translated it into Korean version compared the back-translated version and the original version to check for any discrepancy in meaning.

Health Beliefs and Perceived Social Norms

To assess psychosocial factors influencing adherence to physical distancing, participants completed a series of items assessing health beliefs about COVID-19 as well as perceived social norms related to physical distancing. Health beliefs includes three items for perceived susceptibility of being infected, three items for perceived severity of viral infection, three items of perceived benefit of physical distancing, and four items of barriers of following physical distancing, and one item of self-efficacy. Perceived social norms subscale contains single items assessing descriptive social norms, personal injunctive norms or moral norms, and social injunctive norms. These items were originally developed by Gouin et al. (30), and we translated into Korean language with permission from the original developer, and reversely translated it into English to check accuracy.

Stress and Anxiety to Viral Epidemics-6 Items (SAVE-6)

The SAVE-6 scale is a self-rating scale for measuring one's viral anxiety (33), and was derived from the SAVE-9 scale for measuring healthcare workers' work-related stress and anxiety response in relation to viral epidemics (34). The SAVE-9 consists of nine items which can be clustered into two factors; the SAVE-6 labeled "anxiety about the epidemic" (items 1, 2, 3, 4, 5, and 8), and the SAVE-3 labeled "work-related stress associated with the epidemic" (items 6, 7, and 9). All nine items can be rated using a 5-point Likert scale ranging from 0 (*never*) to 4 (*always*). In this study, we used the original Korean version of the SAVE-6 scale rather than SAVE-9, because we tried to explore the effect of viral anxiety of healthcare workers on adherence to physical distancing. The Cronbach's alpha among this sample was 0.805.

Patient Health Questionnaire-9 Items (PHQ-9)

The PHQ-9 is a self-report questionnaire that measures severity of depression (35). It consists of nine items, rated from 0 (*not at all*) to 3 (*nearly every day*). In this study, we used the Korean version of the PHQ-9 (36). The Cronbach' alpha was.883 in this sample.

Intolerance of Uncertainty-12 Items (IUS-12)

The IUS-12 is a shortened version of the original IUS (37). It is a self-rating questionnaire that measures one's intolerance of uncertainty. It consists of 12 items which are rated according to the respondent's level of agreement (1 to 7). Higher total scores

reflect greater intolerance of uncertainty. In this study, we applied the Korean version of the IUS-12 (38), and Cronbach's alpha among this sample was 0.842.

Statistical Analysis

First, we explored the reliability and validity of the Korean version of the questionnaires on adherence to physical distancing, health beliefs, and perceived social norms among the healthcare worker sample. We checked the correlation matrix and determinant value to identify the multicollinearity among items. We also checked the adequacy of the matrix correlations for the Exploratory Factor Analysis (EFA) based on Kaiser-Meyer-Olkin (KMO) value and Bartlett's test of sphericity. Before running the EFA, we performed parallel analysis and scree plot to identify the number of factors to retain for subsequent rotation. In EFA, principal component analysis (PCA) was utilized. We warranted oblique rotation to assess the correlations between extracted factors. As all the correlations between factors were significant except one, we retained this oblique (oblimin) rotation method. In this study, we explore the appropriate model of questionnaire on adherence to physical distancing using seven items and health beliefs using 13 items (three items for perceived susceptibility of being infected, three items for perceived severity of viral infection, three items for perceived benefits of physical distancing, and 4 items for barriers to following physical distancing). The single self-efficacy item was excluded in this model, as single items could not be included for the factor analysis. In addition, since the three items in the social norms subcategory measure different types of social norms as a single measurement, we did not include those in the final model. The reliability (internal consistency) was examined using the Cronbach's alpha and McDonald's omega. The convergent validity was examined based on a Pearson's correlation analysis with other rating scales.

Second, we explored the association of Adherence to Physical Distancing Scale with other rating scales. Demographic characteristics and rating scales scores are summarized as mean ± standard deviation. The level of significance for the analyses were defined as two-tailed at values of $p < 0.05$. Continuous variables were analyzed using a student's t-test, and categorical variables were analyzed using a Chi-square test. A linear regression analysis was performed to reveal the predicting variables for adherence to physical distancing. The bootstrap method with 2,000 resamples was implemented to examine the mediation effect. We used SPSS version 21.0, AMOS version 27 for Windows (IBM Corp., Armonk, NY, USA), and JASP version 0.14.1 to perform the statistical analysis.

RESULTS

A total of 330 healthcare workers participated in this survey. All except one agreed to allow their responses to be used for the study purposes. Hence, 329 responses were analyzed after excluding the response of the worker who did not agree for their response to be used in the study (**Table 1**).

TABLE 1 | Clinical characteristics of participants (N = 329).

Variables	N (%) Mean ± SD
Sex (female)	267 (81.4%)
Age	35.8 ± 14.3
Years of employment	9.7 ± 7.7
Job	
Nursing professionals	194 (59.0%)
Doctors	23 (7.0%)
Other healthcare workers	112 (34.0%)
Marital status	
Single	157 (47.7%)
Married, without kids	51 (15.5%)
Married, with kids	121 (36.8%)
Are you a shift worker? (Yes)	73 (22.3%)
Questions on COVID-19	
Did you experience being quarantined due to infection with COVID-19? (Yes)	45 (13.7%)
Did you experience being infected with COVID-19? (Yes)	2 (0.6%)
Did you get vaccinated? (Yes)	327 (99.4%)
Psychiatric history	
Did you have experience or been treated for depression, anxiety, or insomnia? (Yes)	46 (13.9%)
Do you think you are currently depressed or anxious, or do you need help to improve your mood? (Yes)	24 (7.3%)

Study 1: Reliability and Validity of the Korean Version of Questionnaires on Adherence to Physical Distancing and Health Beliefs

The normality assumption for items in both the adherence to physical distancing and health beliefs questionnaires were checked based on the skewness and kurtosis within the range of ± 2 (**Table 2**). Correlation matrices shows the absence of very high correlation (≥0.90) among items of both scales. These correlations suggest lack of multicollinearity problems. Determinant values (0.0402 for the adherence to physical distancing, and 0.0002 for the health beliefs) are above the suggested cut-off (>0.00001) and support the absence of multicollinearity among items. Data suitability and sampling adequacy for factor analysis were assessed based on the KMO measure (0.820 and 0.768, respectively) and Bartlett's test of sphericity ($p < 0.001$). Parallel analysis which suggested four factors in the health beliefs and two factors in the adherence to physical distancing. Next, a scree plot and EFA with oblimin rotation advised the four factors model of health beliefs (factor I - perceived susceptibility, factor II - perceived severity, factor III - perceived benefits, and factor IV - perceived barriers), and two factors model of adherence to physical distancing [factor I - adherence to physical distancing part I (items 1, 2, 3, 4, and 5), and factor II - adherence to physical distancing part II (items 6 and 7)]. Factor loading of items in each scale are presented in **Table 2**. The two extracted factors of adherence to physical distancing questionnaire explained 70.8% variance (factor I

TABLE 2 | Factor structure of the Korean version of the questionnaires on adherence to physical distancing and health beliefs (N = 329).

Items	Response scale (%)					Descriptive Statistics		CITC	CID	Factor loading (EFA)
	0	1	2	3	4	M	SD			
Health beliefs										
Susceptibility item 1	8.5%	33.4%	44.1%	13.1%	0.9%	2.64	0.85	0.747	0.817	0.851
Susceptibility item 2	3.3%	33.1%	48.0%	14.3%	1.2%	2.77	0.78	0.854	0.724	0.919
Susceptibility item 3	1.5%	21.9%	39.5%	33.4%	3.6%	3.16	0.86	0.659	0.899	0.795
Severity item 1	1.8%	30.1%	43.2%	21.9%	3.0%	2.94	0.84	0.779	0.834	0.945
Severity item 2	1.2%	22.2%	48.0%	25.2%	3.3%	3.07	0.81	0.826	0.793	0.860
Severity item 3	1.2%	14.9%	44.7%	33.7%	5.5%	3.27	0.83	0.725	0.881	0.769
Benefit item 1	5.8%	26.4%	30.7%	31.9%	5.2%	3.04	1.01	0.803	0.878	0.902
Benefit item 2	5.2%	19.1%	25.2%	37.4%	13.1%	3.34	1.09	0.815	0.868	0.926
Benefit item 3	6.4%	22.2%	31.0%	33.4%	7.0%	3.13	1.04	0.829	0.855	0.912
Barrier item 1	48.0%	20.7%	24.9%	6.1%	0.3%	1.90	1.00	0.341	0.886	0.555
Barrier item 2	6.7%	20.7%	31.6%	32.5%	8.5%	3.16	1.06	0.740	0.708	0.869
Barrier item 3	3.6%	17.0%	28.3%	35.0%	16.1%	3.43	1.06	0.719	0.719	0.878
Barrier item 4	7.3%	26.1%	39.5%	21.0%	6.1%	2.92	1.00	0.758	0.703	0.885
Adherence to physical distancing										
Distancing item 1	5.8%	11.6%	18.8%	40.7%	23.1%	3.64	1.13	0.774	0.821	0.818
Distancing item 2	3.3%	9.4%	20.4%	41.0%	25.8%	3.77	1.04	0.780	0.819	0.891
Distancing item 3	2.1%	8.5%	16.7%	35.0%	37.7%	3.98	1.04	0.711	0.835	0.838
Distancing item 4	3.6%	9.4%	11.6%	27.4%	48.0%	4.07	1.14	0.550	0.874	0.818
Distancing item 5	7.0%	11.9%	28.6%	38.3%	14.3%	3.41	1.09	0.376	0.642	0.675
Distancing item 6	0.6%	1.5%	3.3%	11.9%	82.7%	4.75	0.65	0.422	0.642	0.906
Distancing item 7	0.9%	0.9%	2.4%	9.1%	86.6%	4.80	0.61	0.774	0.821	0.902

CID, Cronbach's alpha if item deleted; CI, confidence interval.

explained 52.2%, and factor 2 explained 18.6% variance). The four extracted factors of health beliefs questionnaire explained 77.6% variance (factor I explained 8.2%, factor II explained 14.1%, factor III explained 24.2%, and factor IV explained 31.1% variance, **Supplementary Table 1**).

The questionnaire on adherence to physical distancing showed good reliability, when we tested for all items (Cronbach's alpha = 0.844, McDonald's Omega = 0.868). Cronbach's alpha of each factor was good (0.868 for distancing factor I and 0.781 for distancing factor II). The Cronbach's alphas if the dropped items were measured were 0.703–0.899 (**Table 2**). The convergent validity based on the Pearson's correlation analysis is presented in **Table 3**. The health beliefs questionnaire also showed the good reliability for items excluding self-efficacy (Cronbach's alpha = 0.756, McDonald's Omega = 0.717). Each factor also showed a good reliability (0.868 for perceived susceptibility, 0.885 for perceived severity, 0.907 for perceived benefit, and 0.812 for perceived barrier).

Study 2: Viral Anxiety, Depression, Intolerance of Uncertainty, and Adherence to Physical Distancing

Table 3 shows that the adherence to physical distancing score was significantly correlated with perceived severity (r = 0.21, p <

0.01), perceived benefits (r = 0.29, p < 0.01), personal injunctive norms (r = 0.41, p < 0.01), SAVE-6 score (r = 0.23, p < 0.01), and IUS-12 score (r = 0.14, p < 0.05).

We used the linear regression analysis to explore which variables predicted the adherence to physical distancing among healthcare workers. The results of the analysis showed that the variables that were significantly correlated with adherence to physical distancing were perceived severity, perceived benefit, personal injunctive norms, SAVE-6, and IUS-12 scores; these were included in the final model. However, we excluded perceived severity in the final model since we believed that there could be multicollinearity issue with viral anxiety (SAVE-6). Furthermore, the results also revealed that adherence to physical distancing among healthcare workers was predicted by perceived benefits of physical distancing (β = 0.12, p = 0.03), personal injunctive norms (β = 0.33, p < 0.001), SAVE-6 score (β = 0.13, p = 0.01), and IUS-12 score (β = 0.11, p = 0.04; adjusted R² = 0.20, F = 14.8, p < 0.001; **Table 4**).

Mediation analysis (**Table 5, Figure 1**) showed that perceived benefits of physical distancing, personal injunctive norms, and intolerance of uncertainty directly influenced adherence to physical distancing. The viral anxiety of healthcare workers mediated the association between intolerance of uncertainty and adherence to physical distancing but not the influence of perceived benefits and personal injunctive norms on adherence to physical distancing.

TABLE 3 | Correlation coefficients of each variable in all participants.

Variables	Age	1	2	3	4	5	6	7	8	9
1. Adherence to physical distancing	0.06									
2. Perceived susceptibility	0.02	0.09								
3. Perceived severity	0.002	0.21**	0.58**							
4. Perceived benefit	0.13*	0.29**	0.11*	0.13*						
5. Perceived barrier	−0.04	−0.01	0.13*	0.16**	−0.20**					
6. Descriptive social norms	0.11*	0.04	−0.21**	−0.08	0.15**	−0.04				
7. Personal injunctive norms	−0.03	0.41**	−0.01	0.13*	0.48**	−0.23**	0.21**			
8. SAVE-6	0.001	0.23**	0.45**	0.45**	0.11*	0.17**	−0.16**	0.09		
9. PHQ-9	−0.05	0.06	0.27**	0.26**	−0.06	0.24**	−0.14**	−0.04	0.03	
10. IUS-12	−0.10	0.14*	0.18**	0.13*	−0.07	0.15**	−0.11*	0.03	0.03	0.36**

SAVE-9, Stress and Anxiety to Viral Epidemics-9 items; PHQ-9, Patient Health Questionnaire-9 items; IUS-12, Intolerance of Uncertainty-12 items.
*p < 0.05, **p < 0.01.

DISCUSSION

In this study, first, we observed that the Korean version of questionnaires on adherence to physical distancing and health beliefs was valid and reliable. Second, adherence to physical distancing among healthcare workers was predicted by the perceived benefits of physical distancing, personal injunctive norms, viral anxiety, and intolerance of uncertainty. Adherence to physical distancing was directly influenced by its perceived benefit, personal injunctive norms, and intolerance of uncertainty. Viral anxiety of healthcare workers mediated the association between intolerance of uncertainty and adherence to physical distancing.

Reliability and Validity of the Korean Version of the Adherence to Physical Distancing and Health Beliefs Questionnaires

In this study, we conducted a factor analysis using 13 items of health beliefs and seven items of adherence to physical distancing questionnaires, excluding the self-efficacy item in the health beliefs subcategory. Three items of perceived social norms questionnaire also were not tested. These three items are thought to reflect different types of social norms, and we would expect that they do not load on the same factors. The four factors model of health beliefs and two factors model of adherence to physical distancing questionnaires showed a good validity among healthcare workers. However, the factor loading value of item 1 of the perceived barriers to physical distancing ("How costly or expensive is the application of these recommendations for you?") was relatively low (0.342) among this sample. In this sample, 48.0% of participants responded "not at all" to this item (**Table 2**) unlike the responses to other items. We can speculate that these results come from the fact that healthcare workers who are working in hospitals suffer fewer financial problems from physical distancing policy compared to other people working in other businesses or workplaces which were financially influenced by the lockdown. Another

TABLE 4 | Linear regression analysis to explore the predicting factors for adherence to physical distancing among healthcare workers.

Dependent variables	Included parameters	Beta	P-value
Adherence to physical distancing	Age	0.04	0.39
	Sex	−0.003	0.96
	Perceived benefit	0.12	0.03
	Personal injunctive norms	0.33	< 0.001
	SAVE-6	0.13	0.01
	IUS-12	0.11	0.04

SAVE-6, Stress and Anxiety to Viral Epidemics - 6 items; IUS-12, Intolerance of Uncertainty Scale-12 items.

possible explanation is that healthcare workers would observe physical distancing regardless of its cost because of their sense of duty.

The reliability tests results showed that the Korean version of questionnaires on adherence to physical distancing and health beliefs can be applied to healthcare workers. It also showed good convergent validity with pre-existing rating scale for viral anxiety. Components of the questionnaires were significantly positively correlated with high level of viral anxiety (SAVE-6 score, **Table 3**), though some components of the scale were not significantly correlated with depression (PHQ-9 score). We speculate that high levels of viral anxiety may influence the adherence to physical distancing to prevent from the viral infection.

Adherence to Physical Distancing, Perceived Benefits, and Personal Injunctive Norms

In this study, we observed that perceived benefits of physical distancing, personal injunctive norms, intolerance of uncertainty, and viral anxiety were associated with adherence to physical distancing. Previous studies also showed that the perceived benefits of physical distancing are a significant predictor for the adherence to physical distancing among the general population

TABLE 5 | The results of mediation analysis.

Effect	Standardized estimate	S.E.	Z–value	P	95% CI
Direct effect:					
Perceived benefit → Adherence to physical distancing	0.13	0.10	2.33	0.02	0.04 to 0.41
Personal injunctive norms → Adherence to physical distancing	0.32	0.33	5.74	< 0.01	1.28 to 2.61
IUS-12 → Adherence to physical distancing	0.10	0.05	2.03	0.04	0.003 to 0.18
Indirect effect:					
Perceived benefit → SAVE-6 → Adherence to physical distancing	0.01	0.01	0.98	0.33	−0.01 to 0.04
Personal injunctive norms → SAVE-6 → Adherence to physical distancing	0.02	0.06	1.74	0.08	−0.01 to 0.24
IUS-12 → SAVE-6 → Adherence to physical distancing	0.03	0.01	2.27	0.02	0.004 to 0.06
Component					
Perceived benefit → SAVE-6	0.06	0.09	1.06	0.29	−0.08 to 0.27
SAVE-6 → Adherence to physical distancing	0.13	0.06	2.58	0.01	0.04 to 0.27
Personal injunctive norms → SAVE-6	0.14	0.31	2.36	0.02	0.12 to 1.34
IUS-12 → SAVE-6	0.25	0.04	4.81	< 0.001	0.12 to 0.28
Total effect:					
Perceived benefit → Adherence to physical distancing	0.14	0.10	2.45	0.01	0.05 to 0.43
Personal injunctive norms → Adherence to physical distancing	0.34	0.34	6.05	< 0.001	1.39 to 2.73
IUS-12 → Adherence to physical distancing	0.14	0.05	2.75	0.006	0.04 to 0.21

S.E., standard error; CI, confidence interval.
SAVE-6, Stress and Anxiety to Viral Epidemics-6 items, US-12, Intolerance of Uncertainty-12 items.

(30). Based on the health beliefs model (39), if individuals think that a negative health outcome will be severe, they can perceive the benefits of behavior which can reduce the higher likelihood of negative outcome, and the perceived benefits of behavior can predict behavior (40). Evolutionarily, collective threats will be cleared if groups make clear and strict rules to be adhered to (41). The perceived benefits of physical distancing can be enhanced by enhancing knowledge of physical distancing to reduce the spread of COVID-19. Among the general population in Australia, knowledge of the restrictions was reported to predict intention to adhere to physical distancing (42). Of course, we can consider that healthcare workers may better understand the benefits of physical distancing, and about 70% of participants were nursing professionals or medical doctors in this study. We observed that viral anxiety did not mediate the influence of perceived benefits of physical distancing on adherence to physical distancing. This may be because viral anxiety does not influence physical distancing behavior of healthcare workers who already know the benefit of physical distancing.

Injunctive norms refer to an individual's perceptions of what behaviors are acceptable or unacceptable by others, and descriptive norms refer to individuals' perceptions of which behaviors are typically performed based on observations of others (43). Injunctive norms indicate those cases in which individuals behave because they believe it is the right thing to do (unconditional preference), or because they expect others to behave and believe that others think that individuals should do so as well (conditional preference) (44).

In this study, personal injunctive norms of healthcare workers directly influence adherence to physical distancing. It was reported that personal injunctive norms were one of the strongest predictors of adherence to physical distancing (45, 46) or preventive behaviors that have consequences for the welfare of others (47). This result shows us that interventions appealing to responsibility toward society may enhance adhering to physical distancing in this pandemic. However, we also observed that viral anxiety did not mediate the influence of personal injunctive norms on adherence to physical distancing. Like the lack of mediation effect of viral anxiety on the relationship between perceived benefits from and adherence to physical distancing, it also might come from the fact that viral anxiety does not influence physical distancing behavior of healthcare workers who already were following social norms for their, their family's, and neighbors' safety.

Adherence to Physical Distancing, Intolerance of Uncertainty, and Viral Anxiety

We observed that intolerance of uncertainty directly influenced adherence to physical distancing. Intolerance of uncertainty may be associated with the tendency to react negatively to uncertain situations. In the COVID-19 era, healthcare workers may find it difficult to tolerate the uncertainty associated with the spread of COVID-19. This may cause them to enhance their adherence to physical distancing in order to ensure the safety of their patients and themselves. In addition, viral anxiety, measured with a rating scale specific to the viral epidemic, mediated the influence of the intolerance of uncertainty on adherence to physical distancing in this study. The viral anxiety of healthcare workers might play a role in enhancing their adherence to physical distancing.

FIGURE 1 | Mediation model showing the pathway from the effect of perceived benefits, personal injunctive norms, and intolerance of uncertainty (independent variables) on adherence to physical distancing (outcome) through viral anxiety (mediator). *$p < 0.05$, **$p < 0.01$.
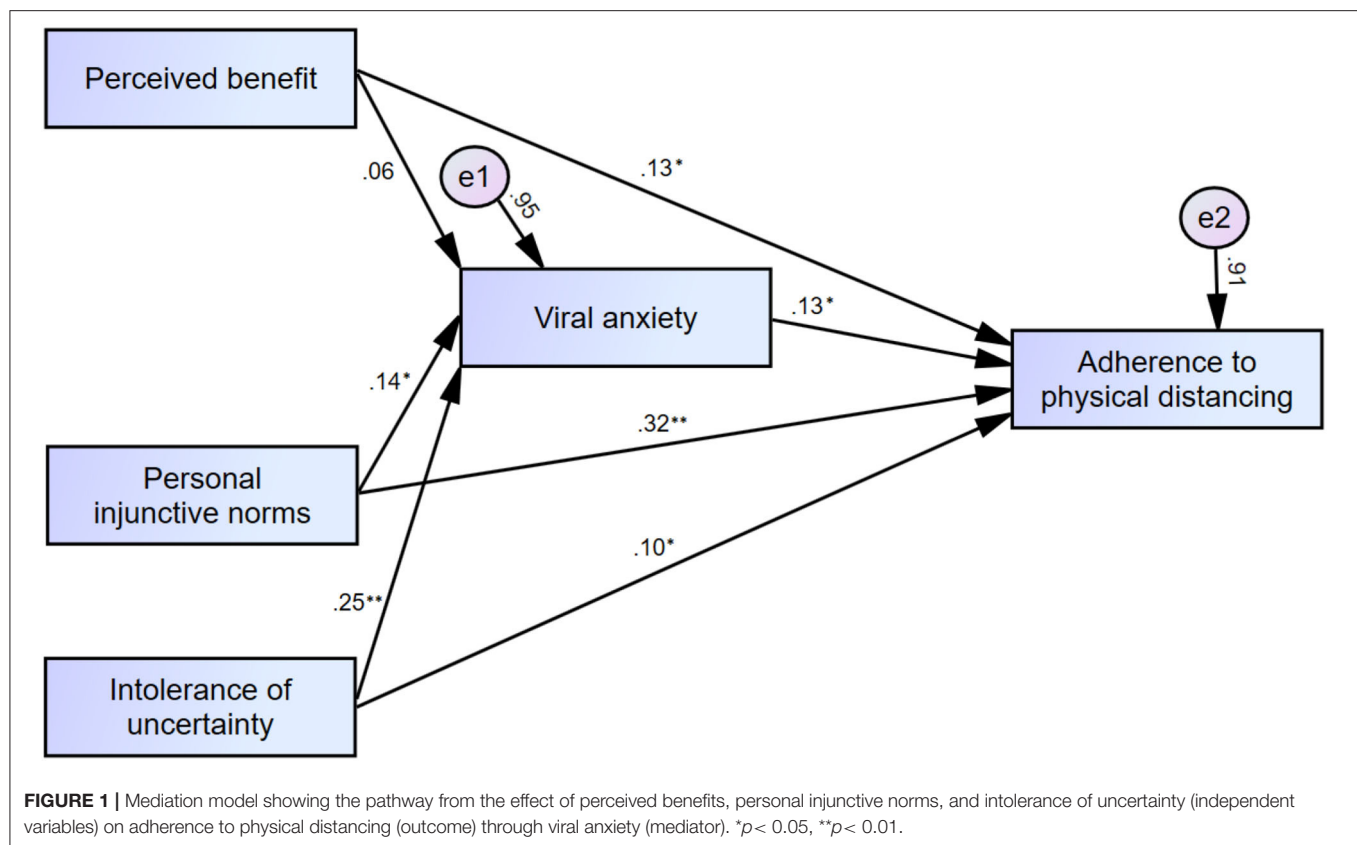
Healthcare workers usually worry about transmitting the virus from hospital to their home or from outside of the hospital to inside of the hospital. Especially female nursing professionals or juniors can have higher levels of viral anxiety (2). If they have difficulty tolerating the uncertainty and they feel a higher level of viral anxiety, they will adhere to physical distancing more.

The effect of intolerance of uncertainty is complex. Among university students, intolerance of uncertainty was reported to mediate the relationship between fear of COVID-19 and procrastination (48). This shows that people escape from the risky places when they sense harm. Conversely, physical distancing can reduce one's anxiety level. In a study, perceived compliance with physical distancing was associated with lower levels of anxiety symptoms (16). Viral anxiety might also induce adherence to physical distancing, and well adapted physical distancing may reduce anxiety symptoms. To tease out the directionality of this relationship, longitudinal studies are needed.

In this study, depression was not associated with adherence to physical distancing. In the correlation analysis, depressive symptoms measured with the PHQ-9 were significantly associated with perceived susceptibility, perceived severity, perceived barriers, and viral anxiety, but adherence to physical distancing was not significantly correlated with depression. In general, depression was considered to be associated with low adherence to or compliance with medical advice (49). Based on the theme, we can expect that healthcare workers' depression could be related to lower adherence to physical distancing. There

may be a few reasons for the lack of significant correlation between depression and adherence to physical distancing in this study. First, healthcare workers will adhere to physical distancing during the COVID-19 pandemic regardless of whether they feel depressed or stressed, as they believe that adhering to physical distancing is their duty or that it contributes to the safety of themselves and the patients they care for (50). Another possible explanation is that they have already adapted well to the stress or depressed mood associated with having to work continuously throughout the COVID-19 pandemic, and they adhere to physical distancing regardless of their state of depression.

There are limitations in this study. First, the responses collected via a self-report web-based questionnaire may be biased. Due to the pandemic situation, we decided to collect participants' responses via online survey rather than the face-to-face interview to prevent the transmission of the virus. Second, the survey was conducted only in one hospital located in Seoul, and it cannot be generalized to other sites. Third, we were unable to classify workers as patient-facing, contact, or frontline healthcare workers. In addition, the participants are considered to be clinically vulnerable or living with family or friends who would be considered as clinically vulnerable. This may have also influenced the results.

In conclusion, we observed that the Korean version of adherence to physical distancing and health beliefs questionnaires were applicable to healthcare workers and had good reliability and validity. In addition, we observed that adherence to physical distancing was directly influenced

by the perceived benefits of physical distancing, personal injunctive norms, and intolerance of uncertainty. Viral anxiety of healthcare workers mediated the association between intolerance of uncertainty and adherence to physical distancing. In the era of the "living with coronavirus" policy in Korea, it is important to manage healthcare workers' intolerance of uncertainty and enhance their perception regarding the benefits of physical distancing to encourage better adherence to physical distancing policy, which can prevent virus transmission during the pandemic for the safety of healthcare workers and patients whom they take care of.

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 study protocol was approved by the Institutional Review Board (IRB) of the Asan Medical Center (2021-1682) and the requirement to obtain written informed consent was waived by IRB. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SC and WS: conceptualization. SC, TL, and YH: data curation. SC, OA, J-PG, and WS: formal analysis. SC and TL: investigations. SC, J-PG, and YH: methodology. SC: project administration. YH, OA, and TL: visualization. SC, TL, OA, WS, YH, and J-PG: writing—original draft. All authors: 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/fpsyt. 2022.839656/full#supplementary-material

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"The worst thing that has happened to me": Healthcare and social services professionals confronting death during the COVID-19 crisis

Carlos Hernández-Fernández* and Carmen Meneses-Falcón

Department of Sociology and Social Work, Universidad Pontificia Comillas, Madrid, Spain

Objectives: This study analyzes the subjective emotional impact COVID-19 deaths have had on healthcare, social services, and funeral services professionals, it explores the different implications, and analyzes the different reactions of health and social care professionals and funeral professionals to the volume of deaths.

Methods: This work is based on a qualitative, phenomenological, and interpretative approach through in-depth interviews with 42 informants, including 36 social and healthcare professionals, as well as 6 family members of those who died from COVID-19 in Madrid. The interviews were processed through a qualitative, interpretative, categorical analysis.

Results: Healthcare professionals were overexposed to a significant number of deaths under dramatic circumstances. Many of these professionals had difficulties processing their experiences and expressed the need for psychological help. The fact that certain professionals had previous exposure to high mortality rates was not a protective factor. Some coping differences were seen between healthcare professionals and professionals dedicated to the care of the deceased (undertakers or firemen), particularly in the degree to which they personalized the care they provided.

Conclusion: The overexposure to death with the circumstances that existed during the state of emergency had a significant emotional impact on the professionals, which can lead to mental health problems in the near term.

KEYWORDS

death, COVID-19, social services and healthcare professionals, burnout, death anxiety

Introduction

Worldwide over 2,500,000 people died from COVID-19 between the end of 2019 and March 2020 (1). The number of infected and deaths was especially high in Italy and Spain.

In Spain, 152,230 deaths from illnesses occurred between the months of March and May 2020, of which 45,684 were caused by the COVID-19 virus (2), a 44.8% increase in deaths compared to 2019.

Hospitals were overflowing and had to convert operating rooms into ICUs and common spaces, like gyms and waiting rooms, into treatment areas.

Protocols were activated for hospitals and senior residences, prohibiting visitors and preventing family members from accompanying their loved ones. Healthcare and social service workers were the only companions and witnesses to the deaths of their patients.

The systems for managing the deceased broke down and funeral homes were overflowing (3). Improvised morgues were created, and military and fire service personnel were mobilized to transport bodies.

Front-line professionals had to respond in extraordinary circumstances never previously experienced and lived intimately with an inordinate number of deaths. These professionals were the last ones to see patients alive (4) which means they had to provide emotional support (5) and accompany patients through death to the extent possible.

Some healthcare and social services workers who were not used to witnessing deaths, either because of their specialty or usual patient type, were newly exposed to death and dying in a dramatic way.

The death anxiety described by Tomer et al. (6) is frequent, for example, in palliative care professionals accustomed to witnessing the death of patients, now appears in many other health care professionals, generating burnout, stress and emotional fatigue (7). It is also possible to find medium and long term effects such as those described in reviews on the intervention of professionals in humanitarian catastrophes (8, 9).

COVID-19 is an infectious disease, with which the professionals must co-exist. These professionals, were exposed to death at a much higher rate, which lead to a fear of death both that of their own and of their family members (10). On top of this, they suffered immense stress caused by fear of deterioration and death of their patients (11).

This study aims to (a) analyze the subjective emotional impact that COVID-19 deaths have had on healthcare, social service and funeral service professionals, (b) explore the different implications for one type of professional versus another, and (c) to analyze the different reactions of health and social care professionals and funeral professionals to the volume of deaths.

This research is particularly relevant as it was carried out just after the most critical months of the pandemic in one of the hardest hit cities. The study highlights the impact of the deaths that occurred during the COVID pandemic on professionals and their possible consequences. It also aims to highlight the need for prevention plans for future events.

Methods

Design

With the aim of uncovering inherently subjective aspects such as the meanings, perceptions, and emotions experienced in critical situations like the pandemic, a qualitative methodology was used for this work (12). Specifically, phenomenological and interpretative interview techniques were used. In some of the interviews, where the aim was to inquire about lived experience, a phenomenological approach was applied (13). In other cases, in which the intention was to collect a diversity of experiences, meanings and emotions, a more thematic and interpretative approach was applied. The approach of the interview depended, therefore, on the type of informant and his or her role in relation to the topic discussed in the study. Table 1 specifies the type of information on the front page for each respondent and whether or not this information is related to their direct experience.

The experience of the participants who had to face, in one way or another, situations of death during the state of emergency is explored in depth, collecting their feelings, perceptions, and thoughts, and observing how they gave meaning to what they experienced. The interview offers a contextualized view of the experience, allowing one to historically and socially frame personal experiences and thus understand the social processes that may underlie subjective evaluations or interpretations (14).

Recruitment and sampling

The study was carried out in Madrid, a city with one of the highest demands for emergency services and healthcare provision between March 2020 and May 2020 (15). To ensure a diversity of perspectives was acquired, 42 informants of different types were interviewed incorporating: (a) nine hospital employees including doctors, nurses, social workers, psychologists and chaplains; (b) eleven senior residence employees including management, psychologists, social workers, chaplains and orderlies; (c) two emergency services professionals, one a doctor and the other a nurse; (d) nine funeral services professionals across all functions including management, office administration, sales, customer service, transport, chaplains, crematorium technicians, and undertakers; (e) two firefighters; (f) six relatives of the deceased; (g) two emergency social worker and (h) one priest of improvised morgue (Table 1). In the case of the professionals, informants were selected who had different roles and worked in distinct types of institutions. The aim of this selection was to have three types of informants: i. Professionals who worked with the deceased, ii. Professionals who worked with the deceased and/or their relatives and iii. Relatives of the deceased who had contact with the professionals. All participants were contacted

TABLE 1   Data sheet of the subjects interviewed and categories.

Interview with professionals	Role	Reflected categories	Principal contributions
Hospital employers			
IP01	Medical Director	A,C,E,F,G,H,K, L,M,N,O,Q	Overview of the experience of professionals in the hospital. Testimony of their own experience. Information on protocols and decisions.
IP02	Psychologist	A,C,E,G,H,M,N, O,P	Testimony of their own experience in accompanying the dying and in the relationship with family members.
IP03	Patient Experience Department Representative	A,C,H,I,J,L,M,N, O,Q	Testimony of their own experience in accompanying patients and informing family members about the death of their loved ones.
IP04	Nurse	A,B,C,G,H,J,K,L,M,N,Ñ,O,P,Q	Testimony of their personal experience in relation to the death of patients
IP05	Nurse	A,B,C,D,E,G,H, I,J,K,L,N,Ñ,P,Q, R	Testimony of their personal experience in relation to the death of patients
IP06	Doctor	A,B,C,G,H,K,L, M,N,Ñ,O,R,	Testimony of their personal experience in relation to the death of patients
IP07	Doctor	A,B,C,D,E,F,G, H,K,J,L,M,O,Ñ, O,P,Q,R	Testimony of their own experience with facing the death of patients and reactions of family members
IP08	Social worker	A,E,F,L,	His role was not directly related to deaths, but to coordinating patient care and facilitating contact with families.
IP09	Chaplain	A,H,I,J,L	Testimony of their own experience with facing the death of patients and reactions of family members
Senior residence employees			
IP10	Director and Owner	A,G,H,I,J,K,L, M,N,O	Overview of the experience of professionals in residences. Testimony of their own experience. Information on protocols and decision-making in nursing homes.
IP11	Orderly	A,E,G,H,I,J,L, M,N,O,Q	Testimony of their personal experience in relation to the death of patients
IP12	Social Worker	A,E,G,H,I,J,L, M,O,	Testimony of their own experience with facing the death of patients and reactions of family members
IP13	Psychologist	A,C,E,G,H,I,J,L, M,O,P,Q	Testimony of their personal experience in relation to the death of patients
IP14	Communication Director	A,C,E,G,H,I,J ,K,L,M,N,O,R,P,Q	General overview of the experiences of professionals working in residences. Testimony of their own experience. Information on protocols in residences.
IP15	Social Worker and Sales Manager	A,C,E,G,H,I,K,J,L, M,N,O,R,P,Q	Testimony of their own experience as well as the experiences of colleagues.
IP16	Orderly Coordinator	A,C,E,H,I,L,J, M,N,P,Q	Testimony of their personal experience in relation to the death of patients
IP17	Orderly	A,C,E,H,I,J,L, M,N,P,Q	Testimony of their personal experience in relation to the death of patients
IP18	Director of Residence	A,B,C,H,G,N,Ñ, P,Q,R	General overview of the experiences of professionals working in residences. Testimony of their personal experience.
IP19	Orderly	A,C,E,F,H,I,L, M,N,Ñ,P,R	Testimony of their personal experience in relation to the death of patients
IP20	Chaplain	A,C,E,G,H,N,O	Testimony of their personal experience in relation to the death of patients
Funeral services professionals			
IP21	General Secretary and Secretary of the Board of Directors	A,C,H,L,N,Ñ,O, Q,R	Contextualization of work in a funeral home. Overview of the experience of professionals who work in funeral homes. Testimony of their own experience.
IP22	Sales Director	B,C,H,I,K,L,N,Ñ, O,Q,R	Testimonio de la propia experiencia en relación con la muerte, la información a familiares y al tratamiento de cadáveres.
IP23	Hearse Driver and Mortician	C,H,K,L,N,O,Q	Testimony of their own experience in relation to death and the treatment of corpses.
IP24	Customer Service Representative	B,C,H,I,L,N,Ñ,Q	Testimonio de la propia experiencia en relación con la muerte y la información a familiares

(Continued)

TABLE 1 Continued

Interview with professionals	Role	Reflected categories	Principal contributions
IP25	Public Relations Representative	B,C,H,I,L,N,Ñ,Q	Testimonio de la propia experiencia en relación con la muerte y la información a familiares
IP26	Chaplain	A,H,I,K,O,Q	Testimony of one's own experience in relation to death and rituals.
IP27	Public Relations Representative and Crematorium Technician	B,C,F,H,I,K,L,N, Ñ,O,P,Q,R	Testimonio de la propia experiencia ante la muerte y relación e información a familiares en crematorios.
IP28	Undertaker	A,B,C,H,I,K,L, N,Ñ,O,Q	Testimonio de la propia experiencia ante la muerte y relación e información a familiares en entierros.
IP29	Public Relations Representative	A,B,C,H,I,K,L, N,Ñ,O,Q	Testimonio de la propia experiencia ante la muerte y relación e información a familiares.
Emergency services professionals			
IP30	Doctor	A,C,D,G,H,K,J, L,M,N,Ñ,P	Testimony of their own experience in relation to deaths occurring at home.
IP31	Nurse	A,C,D,G,H,J,K, L,M,N,Ñ,P	Testimony of their own experience in relation to deaths occurring at home.
Emergency social workers			
IP32	Volunteer Social Worker		Testimony of own experience in communicating with families.
IP33	Volunteer Social Worker	A,H,H,Ñ,Q,P	Testimony of own experience in communicating with families.
Others (collection of corpses)			
IP34	Firefighter	B,C,G,H,I,L,M, N,Ñ,O,Q,R	Testimony of their own experience in relation to death and the treatment of corpses.
IP35	Firefighter	B,C,G,H,L,M,N, Ñ,O,Q,R	Testimony of their own experience in relation to death and the treatment of corpses.
IP36	Priest Improvised Morgue	A,E,F,H,N,P,	Testimony of their own experience in relation to death in a completely new environment.
Interview with familiars			
IF01	Daughter of Deceased	B,H,J,N,O	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them.
IF02	Daughter of Deceased	C,F,H,J,L,N,	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them.
IF03	Daughter of Deceased	B,C,G,H,J,L,M,N,	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them.
IF04	Daughter of Deceased	A,E,F,G,H,J,K,L,N,Ñ,	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them. Narrative about the relationship with funeral professionals.
IF05	Granddaughter of Deceased	A,E,F,G,H,J,L,N	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them.
IF06	Wife of Deceased	A,B,F,H,J,M,N,	Narrative on the perception of the work and mood of healthcare professionals working in hospitals and communications with them. Narrative on the perception of the work and mood of funeral services professionals.

by telephone, the project was explained, and their collaboration was requested. The interviews were carried out progressively, following the theoretical sampling model of Glaser and Strauss (16), utilizing the constant comparison between each type of informant, and seeking distinctive aspects in newly selected informants, or to augment central analysis categories that required greater depth; finally, the research questions and objectives guided the inquiry process and the search for new observations and interviewees. When information received was repeated over and over, the information required to fulfill the objectives was considered to have reached a saturation point. Interviews were conducted between July and November

2020. One of them was conducted in writing and seven by videoconference due to pandemic restrictions. The rest were conducted in person, and all were recorded. The interviews were approached as a conversation, following Kvale (17), around three dimensions: (a) the impact of being overexposed to death, (b) their experience with the deaths compared to previous stages of their lives, and (c) how they assimilated and processed the experience.

All of the interviews were conducted in Spanish and this article was written in Spanish, then later translated.

Ethical considerations

Considering the sensitivity of topics involved in this research, compliance with the appropriate ethical requirements was maintained, under the supervision of the university Ethics Committee, who issued a report of approval. All participants were informed of the objectives of the research study, the sources of financing and the planned use of the results. Informed consent was solicited, and informants were notified that their participation was voluntary. Permission for audio recording was also requested. Confidentiality was guaranteed through a confidentiality agreement.

Data analysis

Data Analysis. After the verbatim transcription of all the interviews, the analysis began with the support of the Nvivo 12 plus program, which facilitated categorization and codification. The analysis was carried out in three phases: exploration and discovery phase, categorization and codification, and interpretation (18). The participants' discourses were examined *via* a categorical analysis that considered both content and discourse analysis (19). First, the language used was explored, taking into account the words and phrases used and the sentiment associated with them (20). Secondly, the analysis focused in on the meanings associated with death and the farewell to close relatives. The development of the analytical categories and the codification of the interviews were central to this stage (Tables 1, 2) (21). The last step of analysis was the interpretation and association of meanings with the circumstances and contexts in which they took place. The main strategies of rigor and quality criteria associated with qualitative research were applied (22). Reflexibility was used in the data collection process, as well as content saturation and key categories; to prevent biases in the first author's interpretations, the second author reviewed the results and analysis for dependability and confirmability (23).

The results are presented by addressing six themes: The psychological cost on professionals, the different reactions and coping strategies, the professionals' personal relationship with death, the emotional impact of decision-making, the difficulty in processing the experience and repercussions on mental health, and the family members' perceptions about professionals.

Findings

Between March 2020 and May of 2020, during the state of emergency decreed by Spain, healthcare professionals in Madrid confronted demands for their services and an accumulation of deaths at levels never previously experienced.

Health care professionals were subjected to levels of emotional and/or physical stress and exhaustion that are proving difficult to process months later and some of them expressed a need for psychological help. Humanizing and personalizing care during the pandemic, as well as the need to make decisions about resource management and life support were significant sources of emotional stress for healthcare and social services workers. Professionals working to manage and process cadavers report greater physical rather than emotional exhaustion. The challenging work of the professionals in these circumstances was recognized and highly valued by relatives of the deceased. All verbatin, which support the results, are shown in Table 3.

1. **The psychological cost on professionals.** *"I have worked in this profession for 25 years and the truth is I have never experienced anything similar."*

During the interviews, the professional caregivers (healthcare professionals, psychologists, social workers, etc.) in recounting their experiences during this stage of the pandemic and in relation to deaths, expressed a notable degree of distress and showed significant emotional exhaustion both verbally and non-verbally (VP1).

The professionals whose work involved direct contact with bodies of the deceased (funeral services professionals and fire-fighters), but who did not have direct contact with living patients or their relatives, referred more often to the volume of work and the extraordinary nature of the situation, but showed a greater emotional distance from the deceased and less psychological exhaustion (VP2).

The funeral services personnel that directly served family members of the deceased, did express a greater psychological toll, at levels similar to caregiving professionals, as compared to other funeral services colleagues (drivers, technicians, and undertakers), who had no direct family interaction (VP3).

The workers that had had contact with patients or their families, could not suppress their emotions during the interviews, and said they had cried daily during the months of confinement (VP4). They often stated that this is the worst experience of their professional lives (VP5) and some compared the situation to what transpires in disasters, wars and third world countries (VP6).

2. **Humanizing care and coping strategies.** *"Patients must be touched when they are dying, you must be with them."*

TABLE 2 Categories.

Indicator	Category	Description
A	Accompanying	Narratives on how to accompany dying patients and families.
B	Mutual support	Experiences on supportive relationships between professionals.
C	Assimilation	Statements expressed about the way of assimilating what happened and the evolution of this process at the time of the interviews.
D	Self-protection	Explicit manifestations of self-protection strategies by professionals.
E	Death awareness	Expressions about how their lived experience connects with their awareness of their own death.
F	Contact	Narratives and accounts of experiences of physical contact between professionals and patients in the moments before death.
G	Life and death decisions	Stories and reflections on decision-making about the administration of therapeutic resources and medical triage.
H	Emotions	Expressions of emotions and feelings experienced before death and illness, both in family members and professionals.
I	Professional effort	Narratives about professional overexertion. Refers to hours worked, physical or mental effort, hours of sleep, etc...
J	Moment of death	Narratives explaining the moment of death and the circumstances surrounding it.
K	War or disaster situations	Comparisons made in the interviews with situations of war or humanitarian disasters.
L	Informing family members	The professionals tell how they informed relatives about details related to the death of their loved one or about the treatment of the corpse. Family members talk about receiving the news.
M	Unexpected death	Verbalizations about sudden and unexpected deaths and the reactions of the bereaved.
N	Organization of corpses	Comments on the organization of cadavers in an environment of chaos and its impact on the work of professionals.
Ñ	Care demands	Comments on workload and care demands
O	Healthcare and mortuary protocols	Refers to the protocols established by the authorities that prevented or allowed the farewells, or to sit vigil with the corpse, as well as the occasions in which they were not complied with.
P	Relationship to death	Instances that highlight the relationship of the interviewees with death.
Q	Number of deceased	Verbalizations about the disproportionate volume of deaths and their impact on professionals.
R	Job title and function	Clarifications on the organization and functions of professionals.

Despite the high number of deaths that occur in a typical nursing home or hospital, many healthcare and social services professionals indicated that they have never become accustomed to the phenomenon of death and were particularly impacted by the unique circumstances created by the pandemic, where patients died alone and without adequate care due to a lack of resources (VP7 and VP8). They recounted the dramatic way in which some of the deaths occurred, and the anxiety they still feel when reliving them (VP9).

The act of personalizing each patient and providing more humanizing care influenced professionals' emotional experience, causing greater psychological harm. Some professionals guarded against connecting personally with patients to protect themselves (VP10), as actions such as learning a patient's name or having to write it on the shroud after death could deliver an emotional shock (VP11).

While some professionals protected themselves by not personalizing patients and despite the tremendous workloads they had to manage, in some cases the professional-patient relationship became more intense than in periods prior to the pandemic, especially with the absence of family members. In these cases, the deaths could be even more painful for the professionals (VP12). This effect was magnified for senior home personnel given their close relationships with the residents, who could come to consider the professionals part of their family (VP13).

The professionals that historically worked with the deceased, but not with living patients or families, generally seemed more accustomed to the phenomenon of death, although they also recognized that the circumstances of the pandemic were anomalous, and they had more intense experiences in their work than before the pandemic (VP14).

For these professionals the difference from the pre-pandemic era resided not only in the volume of work, but also in the fact that they were managing a situation in which they themselves could become victims (VP15). Above all, the impact of the situation was especially notable in their concern for what might happen to their families (VP16), rather than the significant number of corpses seen in residences and hospitals, described as "Dantean" scenes (VP17). In verbalizing their

TABLE 3 Verbatin of the interviews illustrating the results obtained, classified into responses from professionals and responses from family members: Madrid. Spain 2021.

Verbatim transcriptions

Professionals

VP1	*It was a brutal emotional load. And physically I don't know, there were many times I didn't know where we found the strength to continue on.* (IP12)
VP2	*There is always a case that hits you a little harder. Well, at least that is what I say. Then you shed two tears, you immediately start thinking about something else and it's over.* (IP27)
VP3	*Yes, it psychologically scars, scars, (…), and it especially scars psychologically because it is a family's pain that they are passing on to you and you empathize with them, even if from a distance.* (IP24)
VP4	*Look, the truth is that I used to leave shifts crying every day, in the car, I would get in the car, until I got to the car I was cheering people up, but when I got in the car I would start crying like a baby until I got home.* (IP30)
VP5	*For me this has been the worst thing I have ever experienced in my job. It has been terrible. When we had the first positive case and they started to raise the alarm, that was terrifying.* (IP12)
VP6	*We are not accustomed to this in Madrid, or at least I am not, to people dying without you being able to offer them everything you have. I have gone to other places in summer, I have been working in other places as a doctor, places where diabetics die because they don't have a fridge, and when you are there, you accept it for what it is, but you never think that it could happen in Spain.* (IP06)
VP7	*Look, what I have processed a lot is the agony of dying alone. The agony of not being able to say goodbye in the final moments you are alive…* (IP14)
VP8	*So, it was a feeling of seeing patients dying and not being able to help them, and well, it has been and was horrible, horrible, horrible.* (IP07)
VP9	*One especially odd thing that happened to me was when we were very calm, I went into a room one night and stumbled upon a cadaver on the ground, and this room was already occupied by another person and so, I entered into this room and I got angry, like a rage came over me for a few seconds, I mean, what do I do with anger in this context? It was, like, a very rare thing and very disjointed, and this is how the anxiety came and this has happened to many healthcare workers.* (IP04)
VP10	*I know that it sounds very hard and very cold, and perhaps what I am going to say is appalling. But you were protecting yourself, saying: "This is not a person. It does not concern me, I do not care, I attend to them, I save their life if I can, I treat them, I do everything I can, but if they die, I don't want to know."* (IP05)
VP11	*That wasn't the worst for me, the worst that I experienced personally was when a patient died you activated the protocol (…) then we had to write the name with permanent (marker) on the sheet… that was the worst part for me because I did not learn the name of my patients. I am very… in normal conditions I didn't take bed 1 and 2, I took patient so-and-so by name, but no, in this case I couldn't. Today it was Francisco María, and tomorrow it was Pascual. Well…for what? (silence)* (IP05)
VP12	*And then one of the other things that happened is that everyone, doctors included, well, of course, you have a much closer bond with the patient who tells you their stories, and, so you knew much more about the patients than you might in the usual pace of life in the hospital when, perhaps, they are there for less time, or a family member is there with them. The people speak to you about their grandchildren, they tell you about such and such, (…) So every death that occurs…well, of course, they did not discharge number 103, Leandro has died, Leandro whose wife was admitted first, whose wife got out but not him. So, he has a story. Maybe the right thing would be not that you get used to it, but that it leaves less of an impression than at the beginning because there have been so many, but no.* (IP01)
VP13	*And saying goodbye to them and telling them that you are here, that you have been here, because at the end, they, I am not going to say that they love you more than they love their family, (…) but if we are with them all day long, taking care of them all day long, showering them, bathing them, helping them eat, helping them walk…well, ultimately they end up loving you as if you are a member of their family.* (IP11)
VP14	*We are used to putting on our armor and being up and running every day, and this has really made us take off the armor…to say, "Shit. This isn't normal."* (IP22)
VP15	*We are used to responding to what happens to someone else, but in this case, it is happening to someone else, but at the same time it could happen to you, it therefore causes a mix of emotions.* (IP21)
VP16	*You know, I was more worried about what was going on at home, than the impact picking up the bodies would have on me. Because as far as it is a job, you do it and that's it. And for that reason, it has had practically no impact on me. What impacted me was concern for my father, that the next day I could very well see him under one of the shrouds.* (IP25)
VP17	*And then, well, Dantean scenes. (…) A colleague said, "They have them (the bodies) on top of the tables." It is like, where else are they going to put them? There is no other way to do it. Often, they were on the floor…* (IP34)
VP18	*It was like, 'Shit, this seems like 'The Walking Dead' or I don't know,' it was like a very weird movie, you would arrive to pick them up…but of course, we went, it was like we were delivery drivers for, I don't know, Amazon, you know?... we went to a place, we did the pick-up and later we took them to the centers where we were supposed to take them.* (IP34)
VP19	*Well, any one of the people there could have been my father (…) It was dreadful, because at the time I was living with my father, and my father turned 62 yesterday. It made me terrified. I would arrive, grab the plate, and go into my bedroom.* (IP05)
VP20	*It has made us think and begin to prepare our affairs in case you die. So, I'm telling you things like that, or regarding leaving things arranged in your life, this, and*

(Continued)

TABLE 3 Continued

	Verbatim transcriptions
	Professionals
	that, and so on, ehhh... The fear of infecting your family, the fear of infecting your father, the fear of infecting everyone around you. (IP30)
VP21	*As soon as they let me travel the first thing I did was go see my parents. And it is very clear where the things are for when my parents die, the green folder as my Mother says, the dead people's telephone, as my Mother says. (Laughing)* (IP04)
VP22	*Well, yes, it has changed, my concept of death, of living life, it is like that, people think that death is the end of life, and it is not, but it is part of life.* (IP04)
VP23	*In other words, we live totally oblivious to it, as if it will never happen. This has been a reality check in that sense because there has indeed been a 180% excess mortality rate in the community of Madrid. It is astounding. It has made us much more aware of the fact that we do indeed die.* (IP02)
VP24	*What I have learned about the topic of death is that there is a taboo about death, it is not talked about, especially in our industry, it is always hidden. So, from the (ethics) committee, yes, we have spoken about it, and I believe that we should improve the implementation in our service offerings as well, this issue of advanced directives. So, I think this should help us to begin to deal with all these issues more naturally.* (IP15)
VP25	*One must change the chip, because if not, we couldn't work here. How can you begin to empathize with all of the families, or allow yourself to start thinking that you work with death, with the pain, with the crying, at the end I believe you couldn't handle it, you would end up depressed.* (IP27)
VP26	*I have a very close relationship with my parents, and just thinking that something could happen to them, that at some point something is going to happen to them because they are already 80 years old, well, I don't handle it very well...it is that losing.... seeing that death is horrible, but, well, I don't know, I try not to think about death.* (IP07)
VP27	*A patient dies and you are left depleted, then comes a moment of pain, but you ignore it. (...) You try not to learn their name, hope that the family does not call you, and...* (IP05)
VP28	*The medical part, in terms of attending to the people, was terrible, terrible because knowing that the hospitals were overflowing, sometimes we had to make decisions which are hmmm, it is not politically correct to say it, but we have had to let people die at home who in other circumstances could have, they might have been able to continue on.* (IP31)
VP29	*Because it was people that were still very alive, because the feeling is that you can't do everything that you should have been able to do. Because the people that are admitted now have the right to a ventilator (...), but the people in March and April didn't have that.* (IP06)
VP30	*In other words, many people were dying that ethically, should not have died...* (IP07)
VP31	*It is terrible because these people need healthcare attention just as you and I might need it. What happens? Because they are elderly you deny it to them? No, there is no right to do that, because they are equal people (cries). So, why were these people denied that?* (IP12)
VP32	*And that we are the murderers. I, in a chat of school mothers, the theme came up and I had to speak up. I stayed silent. "It is a shame that there are murderers who didn't take them (dying patients in senior residences) to the hospitals."* (IP15)
VP33	*No, this is never going to be processed. It will stay here forever, no matter how much it is discussed, whether you speak to a professional, it is not going to matter, what we have experienced, is experienced, I believe. No...it is something that will stay with us...* (IP17)
VP34	*And it is that you go out for a run and all of a sudden you feel like crying, and it lasts 5 minutes. And you return home like, what just happened? Or suddenly you can't sleep again at night.* (IP04)
VP35	*This has an impact. I already had a time when I went to a psychologist, a psychologist who was a friend of the family and she had told me "You seem to be a strong person...but it affects you..."* (IP19)
VP36	*We spoke about what we had experienced, how it seemed like so much more time had passed, (...), that we didn't really know how to act with the family or what to say to them, that we were not prepared for that, what we were experiencing with our own families and such.* (IP32)
VP37	*I believe that they (members of the department) have managed through it very well, uh, at a personal level. The Red Cross also came, two psychologists came here, to do a little therapy with us for the emotional effects that we might have, perhaps, negative (effects) from this and the truth is that, not that there has been resistance, but rather that we have listened and so on, and the feeling for me, because it coincided with three or four of my shifts is that...it is not that they haven't done their job it is that it wasn't very necessary. There was no need. (...) They (members of the department) have managed well, those who had problems with taking it home with them were more afraid but well, quite well, yes...* (IP34)
Family members	
VF01	*And after a little while SAMUR (emergency services) came and I tried to tell them to do this, with the defibrillator and such, and the man looked at me and said, "My queen"—I will not forget these words—"My queen, he has left you." This man was a real sweetheart, really. He was huge, big, with glasses, (...) and he told me, "He has left you; he has left you."* (IF06)
VF02	*I started to really cry. The doctor began to cry, his tears were falling.* (IF04)
VF03	*What I understand about the toll the work takes, (...) and that they told me "Okay, okay, we understand you, but we can't keep up." I got angry and I told them "I don't care, it is your job," I told them, and later I regretted it a ton. They did what they could, but it made me so angry...but hey, it is what it is...* (IF05)

thoughts, they used comparisons that allowed them to narrate the situation with an outsider perspective, even with a touch of levity (VP18).

3. **Professionals' personal relationship with death. *"But nothing is more certain, nor more denied than death."***

During the most intense months, healthcare and social services professionals were afraid of the virus and of death, and they were especially afraid for their families (VP19).

In many cases this fear, and the overexposure to dying forced them to reconsider their relationship with death and think about it in different ways. Some thought about the need to prepare for their own death (VP20), to address related issues with their family members (VP21), or to enjoy life more (VP22).

Several professionals commented that, after this experience, society as a whole and professionals particularly have become more conscious about the reality of death and have begun to see it as something that exists closer to home (VP23). They also highlighted how there is an increasing need to have more proactive conversations around related issues in senior residences and hospitals (VP24).

However, other workers, both in healthcare and funeral homes, signaled that they prefer not to think about death. For them this is a personal coping mechanism (VP25), to avoid having to confront the possibility of family members' deaths in the future (VP26), or as a method of self-protection to avoid suffering when their patients die (VP27).

4. **Decision-making and emotional exhaustion. *"So, you attended to one and the other could die."***

One of the major sources of stress, helplessness and frustration was the need to constantly choose who to prioritize for treatment (VP28) or which patients should be admitted to the ICU and which should not. These decisions made healthcare workers feel that they were letting people die who could have survived (VP29), which provoked serious concerns around ethics and crises of conscience (VP30). This frustration was especially intense in senior residences, where the professionals saw how residents were denied treatment (VP31), frustration that was compounded by a sense of being accused by the public of being personally responsible for residents' deaths (VP32).

5. **Difficulty in processing the experience and repercussions on mental health *"No, this will never be fully processed. It will stay with you forever."***

When healthcare and social services professionals were asked about their current state of mind, many commented on their difficulty with processing what they had experienced (VP33), they described symptoms associated with possible post-traumatic stress (VP34), and they highlighted the need for psychological help to overcome the trauma that the situation is causing them (VP35). They emphasized that during the most difficult months of the pandemic, mutual support among colleagues had been fundamental to coping with the situation. (VP36). In the case of firefighters and funeral services professionals, conversations among peers were described as useful but they did not express a need for psychological support (VP37).

6. **Family members' perceptions about professionals. *"The doctor began to cry, his tears were falling."***

It is worth mentioning that relatives of the deceased commented that even in the most dramatic moments, the social and health care professionals acted with sensitivity and humanity despite the demands for their services and the exceptional nature of the situation. (VF01). These family members were witnesses to the tears and helplessness of many healthcare providers and to their emotional state (VF02), and it is something that was valued positively. They acknowledged that at certain times it was difficult to understand the professionals' reactions, or the lack of information being provided, but afterwards family members exhibited empathy and gratitude for the professionals (VF03).

Discussion

The number of deaths that healthcare and social services professionals, as well as funeral services professionals, have had to deal with during the state of emergency has been inordinate and unexpected (3). It might be presumed that healthcare and social services professionals, who routinely witness deaths in their work, may be accustomed to deaths and are therefore more sensitized (24), and that these professionals' continuous contact with death allows them to create strategies to facilitate future contact with death (25). However, the results of this study indicate that, when faced with the COVID-19 crisis, professionals were not able to get used to the unique circumstances, and the emotional impact caused by the deaths was elevated, including in those professionals who work in high-mortality environments like ICUs, emergency rooms, palliative care, and senior residences.

As this study has shown and according to Chocarro (26), depersonalizing the patient, avoiding conversations, or avoiding learning patients' names are coping strategies used by some professionals. However, it has been found that this has not always been possible or effective, since, as indicated by Ferrán and Barrientos-Trigo (5), during the pandemic, professionals had to supplement, to the extent possible, the emotional support required by a dying patient that would otherwise fall to family members, or that might be alleviated by the support of other patients, especially in senior residences. In a situation of scarce resources, with very difficult working conditions similar to those in developing countries, or generated by disasters or wars, healthcare professionals have had to use their imagination to accompany and care for the sick as described by Torre (27). This

assumption of emotional care for patients has contributed to later separation anxiety among personnel (28) and difficulty in coping with death. On the other hand, the pressure to provide care was so high and the deaths that resulted occurred in such a dramatic way that any coping strategy could prove to be insufficient. It follows that many professionals are now in psychological treatment or say that they need it (29). Studies show that health professionals, who have worked during the first months of the epidemic, have experienced psychological symptoms such as stress, anxiety and depression, compassion fatigue and post-traumatic stress (30).

Without claiming to be a clinical assessment, it is found that, following the reviews carried out by Sakuma et al. (9) and Brooks et al. (8) the psychological and emotional effects that are noted in this study can be similar to those described in disaster situations and with humanitarian relief, such as emotional distress or compassion fatigue, among others.

One should not forget that the healthcare and social services professionals have been socialized through the same processes as the population they serve, and therefore dismiss the idea of death in the same way that the rest of the population does (26). Studies conducted before the pandemic (31) indicate that some healthcare workers demonstrate negative attitudes toward the concept of death and that this is one of the situations that regularly generates the most stress, among nursing staff for example (26). This research exposes the existence of these negative attitudes, which have been exacerbated by the impact of the deaths during the crisis. The professionals have narrated their difficulty in coming to terms with these deaths, even more so in an environment in which they considered that the deaths could have been avoided. For many healthcare professionals, death is not only something that isn't accepted, but also something that they prefer to avoid in their everyday thinking (32) in and during this crisis they have had to confront it daily. During the hardest months of the pandemic, death anxiety increases markedly among professionals (33).

The psychological distress for these workers is also caused by their perception of the risk of infection to themselves and their families, as previously indicated by Simione and Gnagnerella (34). So not only do they suffer with the deaths of their patients, but many of them, as this study indicates, connect the deaths of their patients with a fear of losing their loved ones.

Most of the research about psychological distress for healthcare and social services workers during the COVID-19 crisis does not refer explicitly to the relationship the healthcare professionals have with death, as evidenced by Bohlken et al. (35) and Spoorthy et al. (36) in their review of the literature. However, the present study considers that the professionals' prior experience with death is a determining factor for understanding their fears, emotions, and their need for psychological support.

With respect to social workers, we find few studies that speak of their relationship with death. Some, like that of Quinn-Lee

et al. (37) carried out with palliative care social workers, affirm that exposure to death at work decreases the anxiety it generates. As has been suggested with respect to health care workers, this study indicates that such standardization is not applicable in times of pandemic crisis. On the other hand, Martínez-López et al. (38) point out that social workers in Spain have suffered high levels of anxiety about death during the pandemic, especially in relation to fearing the death of others and the process of death.

In the case of funeral services workers Van Overmeire and Bilsen (39) indicate that the COVID-19 crisis also generates a risk to their mental health, due to the number of funerals, the high demands of their job, and overexposure to death in the course of their work. This risk was not evident in the present study. Although the data indicate that the demands and workload were frequently mentioned factors for funeral services professionals, there was not similar evidence in the data for an overexposure to death. The same author indicated in a later study that compassion fatigue and burnout among funeral home personnel is lower than among healthcare professionals (40). Rodríguez-Rey et al. (41) also state that the psychological impact on protective services professionals has been lower than on health professionals. Previous studies also indicated that there is no relationship between exposure to death and mental health in these groups (42).

Limitations

This study faced notable limitations due to the circumstances of the pandemic: (a) access to a wide range of healthcare professionals was difficult due to their ongoing workload as well as their state of mind; (b) the interviews were designed to be conducted in person, however some had to be conducted virtually making nonverbal communication and observations of nonverbal expressions difficult; (c) some professionals, especially social workers, were very reluctant to participate for fear of revealing particular professional situations experienced in their workplaces and (d) the great diversity of roles of the selected informants results in a heterogeneous sample.

Implications

This study reveals the need to establish mental health surveillance measures for all frontline professionals who have worked with patients who have died during the most difficult months of the pandemic.

Supportive resources such as support groups and spaces for emotional healing should be strengthened.

It is necessary to expand the curricula of healthcare and social services professional training to include subjects that support development of coping skills for dealing with death,

both in periods of crisis and in normal care provision, as well as expanding the bioethical view of death. It is furthermore advisable to promote initiatives whereby professionals and patients can talk about death to further normalize it.

This study opens the way for other research in the mental health field to consider the experience of death as an indicator of mental health and to study the real impact of this crisis, in the medium and long term, on healthcare and social services professionals as well as other professionals, such as emergency and funeral services personnel.

Conclusions

Overexposure to death, the circumstances of death and decision-making related to dying patients, have all had a significant emotional impact on healthcare and social services professionals, many of whom express the need for psychological help. The emotional impact and anxiety caused by the number of deaths during the pandemic were not influenced by a practitioner's previous experiences of having worked in environments or residences where there is a high mortality rate, because what happened in the pandemic was unlike anything previously experienced by these professionals. The level of emotional involvement and suffering was lower in professionals dedicated to the collection and burial or cremation of those who had passed, as they were able to maintain distance and limit the degree to which they personalized and identified with the deceased.

Data availability statement

The data supporting this article will be made available by the authors only on request and on a case-by-case basis, for confidentiality reasons.

Ethics statement

The studies involving human participants were reviewed and approved by Comité de Ética de la Universidad Pontificia Comillas de Madrid. The patients/participants provided their written informed consent to participate in this study.

Conflict of interest

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

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The psychological impact of COVID-19 pandemic on healthcare workers

Fei Tong[1†], Lemeng Zhang[1†], Liping Huang[2], Hongxia Yang[2,3], Minni Wen[1], Ling Jiang[1], Ran Zou[1], Feng Liu[1], Wanglian Peng[1], Xufen Huang[1], Desong Yang[1], Hui Yang[1], Lili Yi[1] and Xiaohong Liu[1]*

[1]Department of Clinical Spiritual Care, Hunan Cancer Hospital/The Affiliated Cancer Hospital of Xiangya School of Medicine, Central South University, Changsha, China, [2]Medical Services Section, Xinhua People's Hospital, Pingdingshan, China, [3]Medical Oncology Department, Xinhua People's Hospital, Pingdingshan, China

Background: As unprecedented and prolonged crisis, healthcare workers (HCWs) are at high risk of developing psychological disorders. We investigated the psychological impact of COVID-19 pandemic on HCWs.

Methods: This cross-sectional study randomly recruited 439 HCWs in Hunan Cancer Hospital via a web-based sampling method from June 1st 2021 to March 31st 2022. Anxiety and depression levels were measured using Hospital Anxiety and Depression Scale (HADS). The Post Traumatic Stress Disorder (PTSD) Checklist for DSM-5 (PCL-5) was used to assess the presence and severity of PTSD. Fear was measured by modified scale of SARS. Data were collected based on these questionnaires. Differences in fear, anxiety, depression and PTSD among HCWs with different clinical characteristics were analyzed using a multivariate analysis of variance. The Cronbach's alpha scores in our samples were calculated to evaluate the internal consistency of HADS, fear scale and PCL-5.

Results: The prevalence of anxiety, depression, and PTSD in HCWs was 15.7, 9.6, and 12.8%, respectively. Females and nurses were with higher fear level ($P < 0.05$) and higher PTSD levels ($P < 0.05$). Further analysis of female HCWs revealed that PTSD levels in the 35−59 years-old age group were higher than that in other groups; while married female HCWs were with increased fear than single HCWs. The internal consistency was good, with Cronbach's $\alpha = 0.88$, 0.80 and 0.84 for HADS, fear scale, and PCL, respectively.

Conclusion: Gender, marital status, and age are related to different level of psychological disorders in HCWs. Clinical supportive care should be implemented for specific group of HCWs.

KEYWORDS

COVID-19, anxiety, depression, healthcare workers, post-traumatic stress disorder (PSTD), fear

Introduction

The coronavirus disease 2019 (COVID-19) is a serious threat to global public health and economic stability (1). First emerged in December 2019 (2) and with rapid spread worldwide, COVID-19 was declared as a global pandemic (3). As an unprecedented and prolonged long-lasting crisis, healthcare workers (HCWs) on the front line are at high risk of developing psychological disorders (4).

The psychological impact of COVID-19 included fear, anxiety, depression, burnout, and fatigue (5). Owing to the risk of virus exposure, high workload demand, and distressing work shifts, HCWs are at high risk to develop psychological disorders (6). An umbrella review of systematic reviews and meta-analyses have revealed that the COVID-19 pandemic exerts profound impacts on the mental health states of HCWs and leads to high levels of anxiety, depression, post-traumatic stress disorder (PTSD), sleep disorders, and burnout (7). A another meta-analysis reported that among 159,194 healthcare providers in Asia, the pooled prevalence of depression, anxiety, stress, fear, and burnout was 37.5, 39.7, 36.4, 71.3, and 68.3%, respectively. The risk of developing depression and anxiety was increased in females and nurses (8). In Italy, the prevalence of depression, anxiety, and insomnia among HCWs was 50.4, 44.6, and 34.0%, respectively, and most participants were female, nurses, married, and working in tertiary hospitals (9). Symptoms of depression (50.4%), insomnia (34.0%), anxiety (44.6%), and distress (71.5%) have also been reported among HCWs in China (10). A high prevalence of PTSD (20.8%) among HCWs was reported at Central Hospital of Wuhan after the first outbreak of COVID-19 (11). These psychological disorders caused by the COVID-19 pandemic can result in adverse consequences, such as suicide and high turnover intention. The high turnover intention leads to staffing shortages and increases pressure on HCWs, which may increase burnout, adverse incidents, and patient harm, leading to future problems for the resilience of healthcare system (12). Given the ongoing and unpredictable pandemic, protecting HCWs against psychological disorders is crucial to maintain the availability of healthcare services (13). Focusing on and minimizing the psychological impacts of this pandemic on HCWs remain a challenge for healthcare systems worldwide.

HCWs usually differ in their perceived levels of anxiety and depression due to various factors, including gender, marital status, specialty and service provided, and duration of employment (14). It has been reported that younger age, longer quarantine, and lack of practical support were risk factors for psychological distress (15). The fear of being infected, struggling with difficult emotions, witnessing hasty end-of-life decisions, and inability to care for family were modifiable determinants of symptoms of psychological disorders (16). Therefore, the exploration of risk factors for psychological disorders is important.

As a susceptible population, cancer patients are often accompanied by clue symptoms such as fever, cough and dyspnea. Additionally, delayed treatment and hypochondriac tendency are more likely to cause psychological crisis in cancer patients, which may also affect HCWs in cancer center. There are a large number of researches on the psychological disorders in HCWs in general hospital, however, few study focus on the psychological disorders of HCWs and their related factors in cancer center during the COVID-19 pandemic. To this end, we evaluated the prevalence of psychological disorders among HCWs in Hunan Cancer Hospital and investigated the potential risk factors contributing to psychological disorders. Our findings provide important evidences to guide the promotion of psychological health among HCWs.

Methods

Study design and participants

This cross-sectional, survey-based study was carried out to evaluate the impact of COVID-19 on psychological disorders among HCWs. HCWs, including physicians, surgeons, and nurses, were randomly recruited from existing personal and professional contacts via a web-based sampling method from June 1st 2021 to March 31st 2022. Participants provided consent by virtually agreeing to participate as part of the sampling process. Owing to pandemic prevention and control measures, the questionnaire was completed online. A screening form was used to ensure that participants met our inclusion criteria, and an electronic informed consent was included at the beginning of the online questionnaire. The consent form included information about the purpose of the study as well as the principal investigator's contact information. At the end of the online questionnaire, participants were invited to share the link with others who met the inclusion criteria. Participants with mental illness, or hearing, speech, or cognitive impairment that may prevent them from completing the questionnaire on their own were excluded. This study was approved by the ethics committee of Hunan Cancer Hospital.

Data collection

Participants' clinical information, including age, gender, marital status, duration of employment, and service provided were collected based on the online questionnaire. The questionnaire was prepared by the qualitative research team and was analyzed by each investigator. This study was conducted by physicians, psychologists and medical staff who had received systematic scientific research training.

Psychological outcomes

Anxiety and depression assessment

Anxiety and depression levels were determined using the Chinese 14-item Hospital Anxiety and Depression Scale (HADS) (17). The questions in these subscales asked participants to recall their mental presentation under each scenario by answering always, usually, sometimes, rarely, or never. Subscales were assessed separately, with cumulative scores of 0–7, 8–10, 11 or higher indicating normal, borderline abnormal (borderline case), and abnormal, respectively.

Fear measurement

An 18-item scale was used to measure fear related to COVID-19. The scale was based on a previous scale used to assess fear among HCWs during the SARS (18). The items included fear of becoming infected, fear of caring for COVID-19 patients, fear of infecting others, and fear of death. Participants responded to the 18 items on a 4-point Likert scale, with 0, 1, 2, and 3 indicating definitely false, somewhat false, somewhat true, and definitely true, respectively.

Evaluation of PTSD

A total of 20 items are included, which correspond to the diagnostic criteria set by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). The PTSD Checklist for DSM-5 (PCL-5) was used to assess the presence and severity (19). Participants reported their symptoms based on the 20 items using a 5-point intensity scale ranging from 0 (nothing) to 4 (extremely). A higher cumulative score for each item indicates a higher degree of PTSD symptoms.

Statistical analysis

All statistical analyses were performed using Stata version 13.1 (Stata Corp., College Station, TX, USA). Fear, anxiety, depression and PTSD levels were expressed as mean $\pm$ standard deviation (SD). Differences in the aforementioned levels between HCWs with different clinical characteristics were analyzed using a multivariate analysis of variance (MANOVA). The Cronbach's alpha scores in our samples were calculated to evaluate the internal consistency of HADS, fear scale, and PCL-5. A two-tailed $P < 0.05$ was considered statistically significant.

Results

Demographic characteristics of the participants

A total of 439 HCWs were included in this study. The demographic characteristics of the participants are reported

in Table 1. Total 439 HCWs were enrolled. Among them, 280 (63.9%) were nurses, 83 (36.1%) were clinicians. Most participants were female (360 [82.0%]) and were married (293 [66.7%]). 184 (41.9%) were <35 years-old; 215 (49.0%) were aged 35 to 59. Duration of employment and service provided and other demographic Characteristics of participants were also listed in Table 1.

Reliability

The internal consistency (Cronbach's α) of was good, with $\alpha = 0.88$ for HADS, $\alpha = 0.80$ for fear scale, and $\alpha = 0.84$ for PCL.

The prevalence of psychological disorders of HCWs

Based on the questionnaire survey, the prevalence of anxiety, depression, and PTSD in the HCWs were 15.7, 9.6, and 12.8%, respectively. The prevalence of borderline abnormal anxiety and depression were 27.1 and 21.0%. The prevalence of anxiety, depression, and PTSD has been listed in Table 2.

TABLE 1 Demographic characteristics of participants.

Characteristics	No. (%)
Gender	
Female	360 (82.0%)
Male	79 (18.0%)
Age (years-old)	
≤35	184 (41.9%)
35–59	215 (49.0%)
≥60	40 (9.1%)
Marital status	
Married	293 (66.7%)
Single	146 (33.3%)
Occupation	
Nurses	280 (63.9%)
Clinicians	83 (36.1%)
Duration of employment	
<5 years	135 (30.8%)
6–10 years	140 (31.9%)
11–20 years	95 (21.6%)
More than 20 years	69 (15.7%)
Service provided	
Outpatient	51 (11.6%)
Inpatient	295 (67.2%)
Inpatient and outpatient	93 (21.2%)

Association clinical characteristics between fear, anxiety, depression, PTSD

The risk factors for fear, anxiety, depression, PTSD, and hope levels were investigated. The results revealed that fear level was significantly associated with gender ($P = 0.002$) and occupation ($P = 0.013$); while PTSD levels were significantly associated with gender ($P = 0.012$) and occupation ($P = 0.035$). Females and nurses were more inclined to develop fear and PTSD. Among HCWs, females and nurses were risk factors for fear and PTSD. While Age, marital status, duration of employment, and service provided were not related to psychological disorders. Association between fear, anxiety, depression, PTSD and clinical characteristics of HCWs has been listed in Table 3.

TABLE 2 The prevalence of anxiety, depression, and PTSD.

	Prevalence (%)
Anxiety level	
Abnormal	15.7
Borderline abnormal (borderline)	27.1
Normal	56.9
Depression level	
Abnormal	9.6
Borderline abnormal (borderline)	21.0
Normal	69.4
PTSD level	
Abnormal	12.8
Normal	87.2

Association between fear, anxiety, depression, PTSD in female HCWs

We further analyzed the risk factors for the aforementioned levels in female HCWs. The results revealed that the fear levels in married HCWs were significantly higher than those in single HCWs ($P = 0.039$). And the PTSD levels of HCWs in the 35–59 age group were remarkably higher than in other groups ($P = 0.042$). Among female HCWs, married status was a risk factor for fear, and age was a risk factor for PTSD. Association between fear, anxiety, depression, PTSD and clinical characteristics of female HCWs has been listed in Table 4.

TABLE 3 Association between fear, anxiety, depression, PTSD and clinical characteristics of HCWs.

	Fear		Anxiety		Depression		PTSD	
	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Gender		0.002		0.569		0.936		0.012
Male	21.08 ± 10.40		6.61 ± 3.50		5.59 ± 3.81		12.32 ± 9.62	
Female	25.65 ± 10.90		6.89 ± 3.66		5.55 ± 3.50		16.54 ± 12.81	
Age (years-old)		0.473		0.125		0.431		0.062
≤35	24.43 ± 11.37		6.52 ± 3.49		5.40 ± 3.37		14.50 ± 11.66	
35–59	25.23 ± 10.60		7.09 ± 3.73		5.68 ± 3.69		16.88 ± 12.92	
≥60	23.73 ± 11.02		6.59 ± 3.42		5.55 ± 3.43		13.87 ± 10.98	
Marital status		0.106		0.073		0.923		0.796
Married	25.44 ± 10.62		7.05 ± 3.70		5.57 ± 3.62		15.93 ± 12.51	
Single	23.46 ± 11.64		6.32 ± 3.41		5.53 ± 3.38		15.57 ± 12.25	
Occupation		0.013		0.527		0.824		0.035
Nurse	25.81 ± 10.72		6.92 ± 3.60		5.53 ± 3.40		16.66 ± 13.05	
Clinician	22.86 ± 11.19		6.67 ± 3.72		5.62 ± 3.85		14.01 ± 10.75	
Duration of employment		0.632		0.465		0.734		0.098
≤5 years	24.32 ± 10.24		6.70 ± 3.49		5.33 ± 3.49		14.26 ± 10.99	
6–10years	23.96 ± 12.07		6.86 ± 3.21		5.66 ± 3.64		15.54 ± 11.17	
11–20years	24.15 ± 12.21		7.01 ± 3.48		5.54 ± 3.36		15.88 ± 10.95	
≥20 years	23.78 ± 11.54		6.88 ± 3.72		5.68 ± 3.79		16.01 ± 11.76	
Service provided		0.526		0.523		0.428		0.268
Outpatient	24.11 ± 10.98		6.84 ± 3.41		5.71 ± 3.76		14.58 ± 10.54	
Inpatient	23.54 ± 11.47		6.52 ± 3.43		5.69 ± 3.88		14.88 ± 10.42	
Inpatient and outpatient	22.86 ± 11.19		6.98 ± 3.71		5.65 ± 3.81		14.98 ± 10.66	

TABLE 4 Association between fear, anxiety, depression, PTSD, and clinical characteristics of female HCWs.

Characteristics	Number	Fear		Anxiety		Depression		PTSD	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Age (years-old)			0.459		0.105		0.391		0.042
≤35	154	25.18 ± 11.28		6.54 ± 3.42		5.38 ± 3.38		14.24 ± 11.79	
35–59	170	26.08 ± 10.55		7.20 ± 3.86		5.78 ± 3.54		17.87 ± 13.57	
≥60	36	25.84 ± 11.85		6.97 ± 3.68		5.55 ± 3.45		14.83 ± 11.02	
Marital Status			0.039		0.086		0.638		0.532
Married	252	27.02 ± 10.46		6.34 ± 3.39		5.61 ± 3.57		16.83 ± 13.02	
Single	108	23.14 ± 11.70		7.12 ± 3.76		5.41 ± 3.32		15.86 ± 12.36	
Occupation			0.375		0.566		0.992		0.341
Nurse	291	25.92 ± 10.77		6.94 ± 3.59		5.55 ± 3.39		16.87 ± 12.03	
Clinician	69	24.55 ± 11.49		6.65 ± 3.98		5.55 ± 3.95		15.15 ± 11.86	
Duration of employment			0.562		0.352		0.452		0.442
≤5 years	96	24.55 ± 11.49		6.12 ± 3.45		5.62 ± 3.77		16.01 ± 12.98	
6–10years	104	24.55 ± 11.49		5.98 ± 3.66		5.35 ± 3.18		16.54 ± 12.66	
11–20years	75	24.55 ± 11.49		6.52 ± 3.18		5.58 ± 3.44		16.99 ± 13.15	
≥20 years	85	24.55 ± 11.49		6.01 ± 3.55		5.52 ± 3.49		16.78 ± 12.98	
Service provided			0.482		0.158		0.658		0.754
Outpatient	41	24.55 ± 11.49		6.05 ± 3.44		5.49 ± 3.33		16.55 ± 12.98	
Inpatient	244	24.55 ± 11.49		6.61 ± 3.87		5.79 ± 3.15		16.66 ± 13.14	
Inpatient and outpatient	75	24.55 ± 11.49		6.48 ± 3.12		5.54 ± 3.17		16.97 ± 13.55	

Discussion

The high infection risk, rapid spread, and prolonged uncertainty of COVID-19 have aggravated the physical and mental burden on all HCWs (20). Our data present concerns regarding the psychological disorders of HCWs during the COVID-19 pandemic.

During the pandemic, HCWs have been at the forefront of the global fight against the virus; therefore, they face unprecedented scenarios, often beyond their ordinary levels of experience and training. Moreover, HCWs are in direct contact with the patient and more exposed to high stress environment and workplace violence, which increases psychological stresses and occupational burnout of HCWs (21, 22). Owing to prolonged uncertainty, social isolation, and evolving professional demands, the pandemic poses unprecedented threats. Therefore, this pandemic can be regarded as a disaster in which the number of victims and medical needs exceed the capabilities and capacities of the existing healthcare system (23). HCWs constitute the most important groups who are involved in caring disaster victims, suggesting they should be involved in all phases of disaster risk management, such as risk assessment, pre-disaster planning, response during crises, and risk mitigation throughout reconstruction.

It has been reported that clinicians are at a high risk of long-term psychological disorders during the pandemic

(24, 25). Another meta-analysis of 38 studies with 53,784 HCWs indicated that the pooled prevalence of mental health problems such as PTSD, anxiety, depression, and distress in HCWs during the pandemic was 49, 40, 37, and 37%, respectively (26). Sahebi et al. conducted an umbrella review and meta-analysis and demonstrated that there is a high prevalence of PTSD (13.52%) among HCWs during the pandemic (27). In this cross-sectional study, we investigated the psychological disorders of HCWs. Overall, 15.7, 9.6, and 12.8% of HCWs reported symptoms of anxiety, depression, and PTSD, respectively. The prevalence of psychological disorders is relatively low compared with other studies. The potential explanation includes the control of COVID-19 in China, the emphasis of mental health and social support. And another important aspect is that clinical spiritual care has been routinely used for HCWs in our study. Identification of spiritual needs, understanding the specific needs, developing the individual spiritual care plan, which might contribute to relatively lower prevalence of psychological disorders (28). While release negative emotions, avoid overwork, maintain proper physical exercise, take advantage of social support system, might be useful to maintain psychological health (29). To better approach the practical and daily dimensions of spiritual care and to better address and consider the individual specific spiritual needs might be special important during COVID-19 pandemic.

HCWs may be at a higher risk of psychological disorders than the general population. Within the healthcare workforce, nurses and clinicians usually differ in their perceived levels of anxiety and depression due to various factors including gender, marital status, specialty and service provided, and duration of employment (30). Nurses are prone to varying degrees of psychological disorders during the pandemic (31, 32). A previous meta-analysis of 30 studies with a combined total of 33,062 HCWs revealed that females and nurses were with higher rates of affective symptoms than males during the pandemic (33). Another study also reported a high prevalence of symptoms of anxiety, depression, and PTSD in HCWs while nurses were with the highest prevalence (16). Accumulating studies have demonstrated that anxiety, depression, and stress were prevalent among nurses, and it was essential to develop psychological interventions that could improve the mental health of nurses during the pandemic (34, 35). Consistent with these findings, we also found that females and nurses were risk factors for fear and PTSD in HCWs during the pandemic. Moreover, we found that among female HCWs, married status was a risk factor for fear and age was a risk factor for PTSD. Being more afraid of infecting their families or unable to care for their families may partially explain the psychological burdens of married and female HCWs. Thus, there is a need for occupational health surveillance and workplace health promotions programs, especially in the long-term for prevention, early diagnosis and promotion of mental health of HCWs (36).

For disaster risk management, more interventions or appropriate social supports should be implemented to specific groups. For instance, the COVID-19 pandemic may be related the exacerbation of psychological problems especially depression in high-risk population such as pregnant women and the postpartum period (37). Moreover, human resource supply is one of the most vital factors in the production and delivery of services (38). Staffing shortages threaten healthcare systems, which may be unable to meet the current and next global challenges and can further increase HCWs' workloads and lead to burnout (12). Given the essential role of HCWs, especially during a pandemic, interventions such as efforts to recruit new staff, reduce workloads, offer financial support are required. Also, to help HCWs especially nurses to tackle and endure burnout in the pandemic, it is recommended to include the promotion of resilience in the design of interventions to reduce burnout as resilience is a protective criterion for home burnout (39). HCWs should maintain proper physical exercise, release negative emotions, and seek psychological counseling if necessary. Furthermore, there is a positive correlation between the organizational commitment and the quality of working life of HCWs (40). More emphasis should be placed on the optimization of work environment to strengthen the commitment to the organization, making training programs to increase disaster response expertise, and establishment of a fair payment system

to improve working enthusiasm of HCWs. The present study has several limitations. First, psychological outcomes evaluation was based on online questionnaire. In future studies, the use of clinical interviews for comprehensive evaluation of the problem is encouraged. Second, this study did not confirm prospectively the function of clinical spiritual care in HCWs. Futher study should be designed to explore the function of clinical spiritual care. Lastly, this study adopted a cross-sectional design. A longitudinal study is required to evaluate the prevalence of psychological burden with the progression of COVID-19.

Conclusion

In conclusion, gender, marital status and age are related to different level of psychological disorders in HCWs. Female and nurse HCWs are prone to developing psychological disorders. Clinical supportive care should be implemented to improve the psychological health levels for specific group of HCWs during the unpredictable long lasting pandemic.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Hunan cancer hospital. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

FT, LZ, and XL carried out the conception and design of the research. LH, HoY, RZ, WP, and HuY participated in the acquisition of data. XH, LY, MW, LJ, and FL carried out the analysis and interpretation of data. XL participated in the design of the study, prepare and revise the manuscript. All authors read and approved the final manuscript.

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Conflict of interest

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

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The impact of the COVID-19 pandemic on job satisfaction among professionally active nurses in five European countries

Dawid Makowicz[1]*, Katarzyna Lisowicz[1], Krzysztof Bryniarski[2], Renata Dziubaszewska[1], Natalia Makowicz[1] and Beata Dobrowolska[3]

[1]Department of Nursing, Carpathian State College, Krosno, Poland, [2]Institute of Cardiology, Jagiellonian University, Kraków, Poland, [3]Department of Holistic Care and Management in Nursing, Medical University, Lublin, Poland

The COVID-19 pandemic has negatively affected the work of many medical professionals, including the group of nurses. This study aimed at assessing the impact of the COVID-19 pandemic on job satisfaction of nursing staff in five European countries. The study was conducted using the Job Satisfaction Scale (SSP) and original questions on the job satisfaction. The cross-sectional online study was conducted with a sample of 1,012 professionally active nurses working in Poland, Germany, Italy, Great Britain and Sweden, who assessed their job satisfaction before (retrospectively) and during the pandemic. The results showed a significant decrease in job satisfaction due to the need to perform it during the pandemic caused by the SARS-CoV-2 virus. In 8 out of 10 examined parameters of job satisfaction, a statistically significant decrease in job satisfaction was observed at the level of $p < 0.05$. Among the examined factors influencing job satisfaction, the highest decrease was recorded based on the assessment of working conditions (1,480). A high level of satisfaction with the work of nurses has a significant impact on providing better patient care as well as reducing the risk of professional burnout of nurses.

KEYWORDS

COVID-19, nursing, Europe, job satisfaction, pandemic

Introduction

Humanity has struggled with different pandemics over the centuries. The most known, that have claimed the largest number of lives are plague, cholera and influenza (1). When a new type of pathogen belonging to already recognized group of coronaviruses was discovered in China, people were not aware of the effects of the new disease on the whole world could be. COVID-19 pandemic influenced human functioning globally: it reorganized professional work, people had to adapt to the prevailing restrictions and limit the possibility of contact with loved ones (2). The people who had to take care of patients infected with the SARS-CoV-2 virus from the early

days of pandemic were nurses, whose work and personal life was completely changed. Due to the high risk of cross infection among the nursing staff, it was mandated that all professional activities and duties were to be performed using additional personal protective equipment, which included, although not limited to: filtering half masks, safety glasses, visors, overalls, medical gloves, and protective footwear or shoe protectors. Continuous work over several hours in such equipment within the dirty zone made it impossible to meet basic life needs (3). Fearing of the loved ones and to protect them for possible infection, some of the nursing staff decided to stay in hotels. Some were forced to temporarily leave their homes, due to being redeployed to work in single-named hospitals, even hundreds of kilometers away from their place of residence (4). Additional matter experienced by the medical staff was stigmatization, rejection and aggression from the surrounding society, often not only aimed at them directly, yet at their families too (4). The COVID-19 pandemic has caused enormous physical, as well as mental health burdens. It left its mark not only on the patients, but also on the people who cared for them. Nursing staff who encountered the disease and death of people infected with the SARS-CoV-2 virus on a daily basis often reported fear, mood disorders, anxiety, feelings of loneliness and sleep disorders (5–8). Research shows that lack of a negative test result for SARS-CoV-2 in a patient under care contributed to depression, anxiety and reduced professional job satisfaction (9). Nursing staff were concerned about their and their family's health. They were fully aware that they could be a potential source of infection for their family members (10). As the analyses reveal, the COVID-19 pandemic has significantly contributed to not only willingness, yet actual resignation among the nursing teams (11). Recent studies are limited to the respond from one specific country and therefore, it is difficult to compare the phenomenon of declining satisfaction among the nursing staff with their professional work in different countries, due to the use of different methodologies for conducting research (12–14). The decrease in job satisfaction can have a significant impact on the level of care provided to patients, as high-quality nursing care usually correlates with high level of job satisfaction. Low job satisfaction contributes to the omission of certain activities in patient care, which may cause adverse events and a general decline in the quality of services provided by nursing staff (15, 16). This survey is of an international nature, it aimed to compare the changes taking place in job satisfaction in different European countries during the COVID-19 pandemic among the nursing teams.

Materials and methods

Aim of the research

Aim of this research was to assess the impact of the COVID-19 pandemic on job satisfaction of nursing staff in five European countries.

Research questions

1. In what aspects of nursing job satisfaction have been observed changes during the COVID-19 pandemic?
2. What determinants influenced the change in the level of job satisfaction of nursing staff during the COVID-19 pandemic?

Study design

Cross sectional online study among 1,012 nurses from five European countries.

Research instruments

The quantitative study was conducted using a survey consisting of 5 questions from the Job Satisfaction Scale (SSP) and 5 original questions; in all 10 queries, answers were given on a seven-point scale, where: 1 meant "I strongly disagree," 4 "it is difficult to say whether I agree or disagree," and 7 "I strongly agree" (17). Satisfaction of the professional work of male and female nurses before the COVID-19 pandemic and during the pandemic was assessed. The study assessed the average level of job satisfaction among nursing staff. Obtaining a higher level of answers indicated a higher level of satisfaction among the respondents. The scale was subjected to a reliability analysis (Alpha Cronbach), where the results were obtained- −0.915 (analysis before the COVID-19 pandemic) and 0.877 (analysis during the COVID-19 pandemic), which confirmed the reliability of the scale (18). The questions in the study also concerned the hospital wards where the respondents worked, the type of shift pattern performed, the average number of patients infected with the SARS-CoV-2 virus during one duty with which the respondents worked, the means of direct protection that they had, the opportunity to use in the ward during their work, and the possibility of taking a shower and disinfecting the body before leaving the ward following the completion of the shift. Additionally, respondents were asked about sociodemographic issues: country of origin, gender, age, place of residence and education. The survey was conducted in Polish for Polish-speaking respondents, for the remaining respondents, it was conducted in the English.

Data collection

The material was collected from January to March 2022. The study was conducted using the Internet through the association of nurses' websites for nurses working in Poland, Germany, Great Britain, Sweden and Italy. The website selection criterion was to have at least 1,000 members. The members of the internet groups were actively working nursing staff in

hospital departments of various specializations. Five websites were selected to survey all 5 countries and all have met above criterion. After the approval of the administrators of individual websites, a post was placed along with a survey and detailed information on the purpose and course of the study. The survey was completed by 1,067 respondents. From the collected material, questionnaires that were not completed and those in which inconsistencies appeared were removed. Eventually, the material in the form of 1,012 correctly completed surveys was subjected to analysis.

Participants and setting

The study was addressed to nurses who, during the COVID-19 pandemic, worked or are working in the ward where patients infected with SARS-CoV-2 were treated or are being treated. The study 3 used the convenience sampling method. Each participant in the study had to meet the criterion of being a registered nurse and working regularly with the so-called COVID patient (for at least 30 days). It was assumed that the research will be conducted in 5 European countries located in different regions of Europe. Out of 46 European countries, Great Britain, Italy, Germany and Poland were selected due to the high incidence and mortality rates from COVID-19 (19),[1] and Sweden, which, compared to other European countries, has opted for a policy of less stringent countermeasures, including mainly recommendations and guidelines instead of bans and orders (20). In each country, the number of nurses covered by the study was to oscillate around 200 respondents. Two hundred and fourteen (21%) nurses that were surveyed came from Poland, 208 (20.6%) from Great Britain, 202 (20%) from Germany, 196 (19.4%) from Italy, and 192 (19%) from Sweden.

Ethical issues

At the beginning of the survey, information was provided about the aim of the study, the voluntary participation and the application of the obtained research results. Participants were informed that completing the online questionnaire will be considered and understood as giving consent to participate in the study. Respondents were also informed that they can withdraw at any point of the time during the data collection process. The survey was anonymous and did not violate the privacy of respondents. The study is in accordance with the requirements of the Declaration of Helsinki and the recommendations of the ICMJE. The Bioethics Committee agreed to carry them out (EC-0254/5/01/2022). In order to comply with the GDPR rules, the respondents consented to the processing of data included in the survey, the questions were

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1   https://www.worldometers.info/coronavirus/ (accessed January 15, 2022).

designed to ensure that the respondents could not be identified. After data collection, the material was downloaded into an Excel file and stored on password protected computer.

Statistical analysis

The basic test that was used in statistical analyses was the Chi-square test for the independence of variables. It was mainly used for questions built on nominal scales. To determine the strength of the compound, coefficients based on the aforementioned Chi-square and Kramer V-tests were used. The dependent variable was measured on a quantitative scale, and independent on a qualitative scale, while when the conditions for the use of parametric tests were not met, non-parametric tests for the assessment of differences in U Mann Whitney and Kruskal Wallis were used. Correlations between ordinal or quantitative variables (during unfulfilled conditions for the use of parametric tests) were made using Spearman's rho coefficient. Comparisons of dependent trials (before and after) were made using the T-test for dependent trials, which with equal groups is resistant to assumptions related to the use of parametric tests. The analysis was performed using the IBM SPSS 26.0 package together with the Exact Tests module—thorough tests. Any dependencies/correlations/differences are statistically significant with $p \leq 0.05$.

Results

Characteristics of study participants and the conditions of professional work performed

The study group was dominated by women, constituting 89.7% of respondents (Table 1). The largest percentage of nurses (39%) was in the age range of 31–40 years. The mean age of nurses was 34 years (SD = 8.6). The majority of respondents lived in the city (70.4%) and 96.6% of respondents had a university degree. The place of work of the respondents was very diverse, the most people performed work in the infectious disease ward (11.7%). The respondents were dominated by people who worked in a two-shift system for 12 h (73.8%). The average number of patients infected with SARS-CoV-2 during one duty with which the nursing staff worked was 12 people, while the dominant number was 15 people.

The largest percentage of nurses working with COVID-19 patients had the opportunity to use medical gloves (100%) and filtering half masks (89.4%), while the smallest number of people had access to protective glasses (37.4%). At the end of duty (work), 69.2% of the respondents had the opportunity to bathe and disinfect their bodies within the ward before leaving (Table 1).

TABLE 1 Sociodemographic data.

Variable	Subgroup	*N*	%
Sex	Woman	908	89.7%
	Man	104	10.3%
Age	21–30 years	383	37.9%
	31–40 years	395	39.0%
	41–50 years	167	16.5%
	Over 50 years	67	6.6%
Domicile	City	712	70.4%
	Village	300	29.6%
Education	Higher education	978	96.6%
	Secondary education	34	3.4%
Hospital ward	Department of infectious diseases	118	11.7%
	Pulmonology department	116	11.5%
	Intensive care unit	110	10.9%
	Internal medicine department	109	10.8%
	Rehabilitation department	91	8.9%
	Other departments	468	46.2%
Protection measures available	Medical gloves	1,012	100%
	Filtering half masks	905	89.4%
	Visors	851	84.1%
	Medical coverall	823	81.3%
	Shoe covers	762	75.3%
	Protective footwear	393	38.8%
	Safety glasses	378	37.4%
Possibility of bathing and disinfecting the body within the ward before leaving it	Yes	700	69.2%
	No	312	30.8%

Assessment of job satisfaction

Working conditions, the number of nursing staff to the number of patients, the social prestige of the profession

In most of the issues assessed (9/10), a decrease in professional work satisfaction was observed, while in 7/10 of the issues it was shown that the decrease was statistically significant at the level of $p < 0.001$ (Table 2). The greatest decrease in job satisfaction occurred due to the perception of the assessed working conditions (1.480) and the inappropriate ratio of nursing staff on duty to the number of patients on the ward (1.166). The only aspect assessed that increased during the

pandemic was the sense of performing an important profession for the general public (0.379) (Table 2).

In Poland, among nurses, the greatest increase in the feeling that the profession is important to the general public was observed (0.897), while a significantly reduced response rate was noticed, compared to other countries indicating that the number of staff to the number of patients on a given ward is insufficient (0.206) (Table 3). This particular measure was also assessed in Poland prior pandemic and it was reported as much lower in contrast to other countries (3.06). In the United Kingdom, nurses were less likely to choose the nursing profession if there were given opportunity again, and it was noted as the highest level (1.192). Among the Italian respondents, the largest decrease in the overall assessment of working conditions was noted (2.959). The lowest decrease in satisfaction with the working conditions was observed by the Swedish respondents in contrast to the other countries surveyed (0.750). Interestingly, only Swedish data indicate an increase at the level of perceived professional prestige (0.104). In Germany, no significant deviations from the average scores were observed (Table 3).

Assessment of job satisfaction in individual countries

The conducted study showed that the highest decrease in job satisfaction by nursing staff was observed in Italy (1.0980), while the lowest decrease in satisfaction was recorded in Sweden (0.2958)—Table 4. In each of the countries, a statistically significant decrease ($p < 0.05$) was observed in each of the assessed job satisfaction factors (Table 4).

Assessment of the impact of gender on the perception of job satisfaction

Studies have shown the impact of gender on the job satisfaction during the COVID-19 pandemic in terms of perceiving the work as ideal ($p = 0.005$), assessment of working conditions ($p < 0.001$), satisfaction with previous achievements at work ($p = 0.004$) and assessment of nursing staff ration to patient ($p = 0.015$; Table 5). Globally, women in the study obtained a significant decrease in job satisfaction than men, the result was statistically significant ($p = 0.011$; Table 5).

Assessment of the impact of age on the perception of job satisfaction

The decrease in the level of job satisfaction during the COVID-19 pandemic also depended on the age of respondents. The data were collected from assessing work as an ideal, job satisfaction, satisfaction with the professional goals achieved so far, re-choosing the same profession, satisfaction with pay, the importance of the profession for the general public and the

TABLE 2 Impact of the pandemic on professional job satisfaction among the nursing staff.

Results for dependent variables		Average	N	SD	Differences in dependent variables		p
					Average	SD	
All countries							
1	(Before COVID-19) In many ways, my work is close to perfect.	5.30	1,012	1.25	0.674	1.10	<0.001
	(During COVID-19 course) In many ways, my work is close to perfect.	4.62	1,012	1.43			
2	(Before COVID-19) I have great working conditions	5.51	1,012	1.11	1.480	1.18	<0.001
	(During COVID-19 course) I have great working conditions	4.03	1,012	1.45			
3	(Before COVID-19) I'm satisfied with the work	5.53	1,012	1.08	0.698	1.17	<0.001
	(During COVID-19 course) I'm satisfied with the work	4.83	1,012	1.38			
4	(Before COVID-19) So far, at work, I have managed to achieve what I wanted	5.25	1,012	1.15	0.559	0.91	<0.001
	(During COVID-19 course) So far, at work, I have managed to achieve what I wanted	4.69	1,012	1.22			
5	(Before COVID-19) If I had to decide again, I would choose the same job	5.64	1,012	1.17	0.603	0.98	<0.001
	(During COVID-19 course) If I had to decide again, I would choose the same job	5.04	1,012	1.21			
6	(Before COVID-19) I am satisfied with the remuneration I receive for my work	5.19	1,012	1.39	0.024	1.24	0.669
	(During COVID-19 course) I am satisfied with the remuneration I receive for my work	5.17	1,012	1.54			
7	(Before COVID-19) I have a very good relationship with my colleagues	5.80	1,012	1.08	0.103	0.92	0.012
	(During COVID-19 course) I have a very good relationship with my colleagues	5.70	1,012	1.05			
8	(Before COVID-19) I feel that my profession is important to the general public	5.39	1,012	1.12	−0.379	1.06	< 0.001
	(During COVID-19 course) I feel that my profession is important to the general public	5.76	1,012	0.97			
9	(Before COVID-19) My profession is associated with professional prestige	5.51	1,012	1.18	0.555	1.55	< 0.001
	(During COVID-19 course) My profession is associated with professional prestige	4.96	1,012	1.68			
10	(Before COVID-19) There is an adequate number of nursing staff on duty per patient	4.80	1,012	1.54	1.166	1.26	<0.001
	(During COVID-19 course) There is an adequate number of nursing staff on duty per patient	3.63	1,012	1.62			

SD, Standard deviation. Fragments of tables marked in color show the statistical significance of specific results.

TABLE 3 Impact of the pandemic on professional job satisfaction among the nursing staff in the surveyed European countries.

Results for dependent variables		Average	N	SD	Differences in dependent variables		p
					Average	SD	
Poland							
8	(Before COVID-19) I feel that my profession is important to the general public	4.63	214	1.04	−0.897	0.51	<0.001
	(During COVID-19 pandemic) I feel that my profession is important to the general public	5.52	214	1.04			
10	(Before COVID-19) there is an adequate number of nursing staff on duty per patient	3.06	214	1.60	0.206	1.47	0.151
	(During COVID-19 pandemic) there is an adequate number of nursing staff on duty per patient	2.85	214	1.72			
United Kingdom							
5	(Before COVID-19) If I had to decide again, I would choose the same job	6.25	208	0.97	1.192	1.11	<0.001
	(During COVID-19 pandemic) If I had to decide again, I would choose the same job	5.06	208	1.20			
Italy							
2	(Before COVID-19) I have great working conditions	5.46	196	0.78	2.959	1.03	<0.001
	(During COVID-19 pandemic) I have great working conditions	2.50	196	0.73			
3	(Before COVID-19) I'm satisfied with the work	5.29	196	0.74	1.918	1.19	<0.001
	(During COVID-19 pandemic) I'm satisfied with the work	3.37	196	0.89			
9	(Before COVID-19) my profession is associated with professional prestige	5.28	196	0.79	2.459	1.25	<0.001
	(During COVID-19 pandemic) my profession is associated with professional prestige	2.82	196	0.93			
10	(Before COVID-19) there is an adequate number of nursing staff on duty per patient	3.92	196	0.68	2.194	1.05	<0.001
	(During COVID-19 pandemic) there is an adequate number of nursing staff on duty per patient	1.72	196	0.84			
Sweden							
2	(Before COVID-19) I have great working conditions	5.63	192	0.63	0.750	0.82	<0.001
	(During COVID-19 pandemic) I have great working conditions	4.88	192	0.93			
9	(Before COVID-19) my profession is associated with professional prestige	5.73	192	0.70	−0.104	0.96	0.294
	(During COVID-19 pandemic) my profession is associated with professional prestige	5.83	192	0.90			

SD, Standard deviation. Fragments of tables marked in color show the statistical significance of specific results.

TABLE 4 The impact of the COVID-19 pandemic on job satisfaction of nursing staff in individual countries.

Country by mortality rate		In many ways, my work is close to perfect.	I have great working conditions	I'm satisfied with the work	So far, at work, I have managed to achieve what I wanted	If I had to decide again, I would choose the same job	I am satisfied with the remuneration I receive for my work	I have a very good relationship with my colleagues	I feel that my profession is important to the general public	My profession is associated with professional prestige	There is an adequate number of nursing staff on duty per patient	Satisfaction level
Sweden	Average	−0.4479	−0.7500	−0.2083	−0.4271	−0.3750	−0.3125	−0.0521	0.1563	0.1042	−0.6458	−0.2958
	N	192	192	192	192	192	192	192	192	192	192	192
	SD	0.69	0.82	0.80	0.67	0.63	0.65	0.67	0.92	0.96	0.59	0.37
Poland	Average	−0.6168	−1.3925	−0.5888	−0.3738	−0.2710	−0.4766	−0.0280	0.8972	−0.4299	−0.2056	−0.3486
	N	214	214	214	214	214	214	214	214	214	214	214
	SD	1.04	0.90	0.87	0.68	0.92	1.64	0.60	0.51	1.54	1.47	0.61
Germany	Average	−0.3465	−1.2277	−0.2376	−0.6436	−0.2673	−0.2574	−0.2970	−0.1386	−0.0990	−1.3564	−0.4871
	N	202	202	202	202	202	202	202	202	202	202	202
	SD	0.72	0.82	0.61	0.86	0.83	0.84	0.62	0.88	0.93	0.79	0.40
United Kingdom	Average	−0.5577	−1.0962	−0.5577	−0.6538	−1.1923	0.2692	−0.1538	0.0865	0.0577	−1.4808	−0.5279
	N	208	208	208	208	208	208	208	208	208	208	208
	SD	1.27	0.95	1.34	1.11	1.11	1.26	1.45	1.20	1.30	1.14	0.82
Italy	Average	−1.4184	−2.9592	−1.9184	−0.7041	−0.9082	0.6837	0.0204	0.8776	−2.4592	−2.1939	−1.0980
	N	196	196	196	196	196	196	196	196	196	196	196
	SD	1.29	1.03	1.19	1.08	0.97	1.16	0.93	1.22	1.25	1.05	0.40
Total	Average	−0.6739	−1.4802	−0.6976	−0.5593	−0.6028	−0.0237	−0.1028	0.3794	−0.5553	−1.1660	−0.5482
	N	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
	SD	1.10	1.18	1.17	0.91	0.98	1.24	0.92	1.06	1.55	1.26	0.62
H Kruskal-Wallis		49.586	193.884	121.803	8.812	73.417	74.717	13.575	105.365	173.959	170.554	139.703
P		<0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001
p (Monte Carlo)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001

SD, Standard deviation. Fragments of tables marked in color show the statistical significance of specific results.

TABLE 5 Change in satisfaction with professional work during the COVID-19 pandemic and the gender of the surveyed group.

SEX		In many ways, my work is close to perfect.	I have great working conditions	I'm satisfied with the work	So far, at work, I have managed to achieve what I wanted	If I had to decide again, I would choose the same job	I am satisfied with the remuneration I receive for my work	I have a very good relationship with my colleagues	I feel that my profession is important to the general public	My profession is associated with professional prestige	There is an adequate number of nursing staff on duty per patient	Satisfaction level
Woman	Average	−0.7093	−1.5441	−0.7137	−0.5925	−0.6256	−0.0088	−0.0837	0.3767	−0.5815	−1.2004	−0.5683
	N	908	908	908	908	908	908	908	908	908	908	908
	SD	1.12	1.20	1.21	0.92	1.00	1.27	0.95	1.07	1.57	1.27	0.63
Man	Average	−0.3654	−0.9231	−0.5577	−0.2692	−0.4038	−0.1538	−0.2692	0.4038	−0.3269	−0.8654	−0.3731
	N	104	104	104	104	104	104	104	104	104	104	104
	SD	0.84	0.78	0.72	0.74	0.82	1.01	0.48	1.01	1.27	1.17	0.53
Total	Average	−0.6739	−1.4802	−0.6976	−0.5593	−0.6028	−0.0237	−0.1028	0.3794	−0.5553	−1.1660	−0.5482
	N	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
	SD	1.10	1.18	1.17	0.91	0.98	1.24	0.92	1.06	1.55	1.26	0.62
U Mann-Whitney		9,163.5	8,395.5	11,296.5	9,138.5	10,295.0	11,076.5	10,118.0	11,691.0	10,993.0	9,469.5	9,281.5
P		0.005	<0.001	0.594	0.004	0.107	0.447	0.057	0.905	0.403	0.015	0.011
p (Monte Carlo)		0.004	<0.001	0.601	0.005	0.105	0.439	0.054	0.900	0.406	0.013	0.010

SD, Standard deviation. Fragments of tables marked in color show the statistical significance of specific results.

TABLE 6 Change in satisfaction with professional work during the COVID-19 pandemic and the age of the surveyed group.

Age of male and female nurses		(In many ways, my work is close to perfect.)	I have great working conditions	I'm satisfied with the work	(So far, at work, I've been able to achieve what I wanted)	If I had to decide again, I would choose the same job	I am satisfied with the remuneration I receive for my work	I have a very good relationship with my colleagues	I feel that my profession is important to the general public	My profession is associated with professional prestige	There is an adequate number of nursing staff on duty per patient	Satisfaction level
21–30 years	**Average**	**−0.4219**	**−1.3438**	**−0.5052**	**−0.4427**	**−0.5469**	**0.1510**	**−0.1094**	**0.5208**	**−0.3385**	**−1.0104**	**−0.4047**
	N	383	383	383	383	383	383	383	383	383	383	383
	SD	1.04	1.21	1.12	0.84	1.05	1.24	0.92	0.93	1.60	1.43	0.65
31–40 years	**Average**	**−0.7665**	**−1.5482**	**−0.7970**	**−0.6345**	**−0.5736**	**0.0660**	**0.0355**	**0.4975**	**−0.6294**	**−1.2640**	**−0.5614**
	N	395	395	395	395	395	395	395	395	395	395	395
	SD	1.05	1.18	1.19	0.90	0.88	1.12	0.83	0.94	1.55	1.13	0.48
41–50 years	**Average**	**−0.9167**	**−1.6190**	**−0.7143**	**−0.5238**	**−0.6071**	**−0.3929**	**−0.2619**	**0.0119**	**−0.7024**	**−1.2143**	**−0.6940**
	N	167	167	167	167	167	167	167	167	167	167	167
	SD	1.18	1.18	1.09	0.96	0.90	1.38	0.893	1.26	1.42	1.17	0.72
Over 50 years	**Average**	**−0.9697**	**−1.5152**	**−1.1818**	**−0.8788**	**−1.0909**	**−0.6364**	**−0.4848**	**−0.2121**	**−1.0000**	**−1.3636**	**−0.9333**
	N	67	67	67	67	67	67	67	67	67	67	67
	SD	1.31	0.87	1.44	1.08	1.28	1.27	1.27	1.53	1.41	1.08	0.73
Total	Average	−0.6739	−1.4802	−0.6976	−0.5593	−0.6028	−0.0237	−0.1028	0.3794	−0.5553	−1.1660	−0.5482
	N	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
	SD	1.10	1.18	1.17	0.91	0.98	1.24	0.92	1.06	1.55	1.26	0.62
H Kruskal-Wallis		18.425	7.187	10.068	9.025	9.050	15.284	5.505	18.124	9.969	5.127	24.861
p		<0.001	0.066	0.018	0.029	0.029	0.002	0.138	<0.001	0.019	0.163	<0.001
p (Monte Carlo)		<0.001	0.06	0.018	0.027	0.025	0.001	0.133	<0.001	0.018	0.161	<0.001

SD, Standard deviation. Fragments of tables marked in color show the statistical significance of specific results.

assessment of professional prestige. In the 21–30 age range, there was a decrease at 0.4047, 31–40 years at 0.5614, 41–50 years at 0.6940, and over 50 years at 0.9333 (Table 6). As the age of the respondents increased, the overall level of satisfaction with their professional work decreased due to the emergence of the coronavirus pandemic ($p < 0.001$). During the pandemic, job satisfaction decrease was mostly reported among the oldest group of surveyed male and female nurses, and to the least extent in the youngest professional group (Table 6).

Discussion

Satisfaction with the performed professional work is one of the most important factors that affect the efficiency of the work of medical staff, ensuring the highest possible core provided to the patient. In addition, it specifically prevents the phenomenon of burnout among health care workers (9). The current study showed a significant decrease in satisfaction with their professional work among nurses caused by work during the COVID-19 pandemic. The decrease in job satisfaction, in most of the surveyed aspects, was statistically significant. Said and El-Shafei conducted a study in which they found that nursing staff working in single-name wards during the pandemic showed significantly lower levels of job satisfaction than staff who worked in general wards and had no contact with COVID-19 patients (13). Similar analyses were presented by Savitsky et al. (21). The research conducted among physicians showed the adverse impact of the pandemic on job satisfaction, the authors also observed a large increase in burnout caused by the need to work during the pandemic (22). Sharif et al. proved that the excessive workload resulting from the current pandemic significantly reduces the perceived level of satisfaction within the medical profession (23). The researchers emphasize that the fear of getting ill and infecting the family with the SARS-CoV-2 virus has a significant impact on lowering the level of job satisfaction (24). The study abd-Ellatif et al. shows that 41.2% of respondents had a low level of job satisfaction due to fear of infection during the pandemic (25). According to the conducted research in a group of nurses working on wards where staff do not care for people suffering from COVID-19, 10% of respondents are seriously considering changing their profession, while on wards, where such patients are hospitalized, as many as 24.8% declare their willingness to change their occupation (13). In particular, De los Santos et al. and Labrague et al. underlined that the situation related to the need to work in new aggravating conditions led to very low job satisfaction among the nursing staff and effectively encouraged the decision to change professions (26, 27). The main reason for the decline in job satisfaction among nursing staff Soto-Rubio et al. report correlates to an increase in the prevalence of psychosocial risks during a pandemic, with a risk of accidents at work, low work commitment and mental illness (28). Low job satisfaction has

a negative impact on the organizational commitment of health care workers, may contribute to staff shortages and is the main reason for the rotation of medical workers. Satisfied employees are more creative and dedicated to work, and engage in organizational tasks. Moreover, the conducted research showed a direct relationship between the satisfaction of health care workers and the satisfaction of patients with the care received during hospitalization (29). Employees who are more satisfied with their work, perform better in their workplaces and are more productive. The hospital management should take all efforts to ensure a high level of job satisfaction for their employees, as this will improve work efficiency, which consequently will provide better care for patients (30).

In the author's sample, the greatest decrease in professional satisfaction occurred due to the assessment of working conditions and the assessment of the ratio of nursing staff on duty to the number of patients on the ward. As shown by the research conducted by Havaei et al. there was a decrease in all aspects of working conditions surveyed among nursing staff, due to the emergence of the COVID-19 pandemic. At the same time, they underlined that the deterioration of working conditions prevented effective patient care (31). In addition, researchers noted a significant impact on deteriorating working conditions of the nurses' health (32). Lasater et al. (33) and Yu et al. (34) described an important problem regarding shortages of nursing staff, although highlighted it was already present before the pandemic, and during its duration, it simply became even more visible and problematic. An insufficient number of nursing staff on duty increases the risk of making mistakes when working with patients, which creates a risk to patients and the deterioration of their health. Higher patient mortality is observed in facilities where the ratio of nurses to patients was lower. In addition, the shortage of nursing staff increases the risk of dissatisfaction with the work performed and more frequent and faster burnout (35). Bad working conditions largely contribute to the resignation of nursing staff from work, and therefore, staff shortages and an insufficient number of nurses on duty are observed. The deteriorating working conditions prevent the nursing staff from providing the highest levels of care (36).

Changes in job satisfaction in individual countries were also analyzed. The lowest decline in job satisfaction was recorded in Sweden, in the United Kingdom the results were very close to the average of all countries, while the largest decrease was recorded in Italy. By analyzing mortality data in European countries (19) compared to the author's study, countries with higher mortality rates had a higher decline in job satisfaction. Aydin and Fidan proved that the incidence of patients' deaths during the SARS-CoV-2 pandemic on the ward where the nursing team had been working had a significant impact ($p < 0.05$) on their life satisfaction (37). Conducted research shows that patients' deaths are perceived by nursing staff as the most stressful factor in their professional work (38). Orrù et al. presenting their

research, showed that medical staff who encountered the death of patients during the COVID-19 pandemic were much more likely to feel the negative effects of their work than staff who did not come into contact with the death of patients (39). On the other hand, Nwozichi et al. stressed that in addition to the deaths of patients, nursing staff often had to deal with the emotions and anxiety of deceased patients' loved ones, which further intensifies professional dissatisfaction (40). It would be extremely valuable to consider conducting a study involving the analysis of the relationship between job satisfaction and the direct number of deaths of patients experienced by nursing staff.

The author's research has shown that women, in most of the surveyed aspects (8/10), assessed their professional work as worse than men, due to the need to work during the COVID-19 pandemic. In 4, out of 10, parameters studied, the differences achieved were statistically significant, while globally the difference between the genders was presented at the level of statistical significance. Thai et al. also observed a significant difference between the satisfaction of women and men working in health care during the pandemic caused by the SARS-CoV-2 virus (41). Studies showing the multifaceted impact of the pandemic on the mental health of healthcare professionals revealed that in most of the parameters studied, the pandemic carried a much higher risk of complications for women: the risk of developing symptoms of depression, fear and anxiety. It should be emphasized that in no parameter studied did men report greater discomfort than women (42). The studies conducted among a group of physicians show that women are much more likely to show the negative impact of the current pandemic (22). De los Santos et al. proved that gender significantly affects the negative perception of professional work and leads to the fear of performing their profession (26). Other studies have also demonstrated that the SARS-CoV-2 pandemic has had a more negative impact on women working in healthcare than on men in each of the aspects studied (43–45). Ding et al. (46) who attempted to explain this phenomenon, noted that women were more sensitive and felt disgusted by the virus. In addition, they observed that the sex differences had already existed before and that the COVID-19 pandemic only made it more pronounced. Another factor that could have contributed to a higher decline in women's job satisfaction was a much greater increase in their domestic duties compared to men's, for example, due to the closure of childcare centers (47). The higher subjective perception of stressors in women may also be significant (48). The greater decline in satisfaction among women than in men is worrying because women constitute a much greater percentage of professionally active nursing personnel, which exacerbates the problem in this professional group (49). On the other hand, it is noteworthy that the study by Bettinsoli et al. rightly concluded that sharing their emotions and reporting mental health problems by men is considered less masculine. Therefore, there is a risk that men have also been less successful in dealing with the pandemic, however, they were not willing to expose their emotions and when answering the survey, they reported a lower decrease in job satisfaction than in reality (50).

The author's study showed that as the age of respondents increased, the level of satisfaction with their professional work decreased due to the emergence of the COVID-19 pandemic. In the oldest group of respondents, the decrease in job satisfaction was at the highest level, while in the youngest group the decrease in satisfaction was the lowest. This result is in line with results obtained by Majid et al. (51). The occurrence of this phenomenon has also been observed in groups of non-medical workers (52). The increased workload resulting from the pandemic is much more likely to increase the stress on older workers and their health. Senior nursing staff found it more difficult to adapt to the new epidemiological conditions, reducing their willingness to work (53). In the current epidemiological conditions, the pressure exerted on health care workers is constantly increasing. Compared to younger workers, middle-aged and older workers do not have as much capacity to relieve stress created in the workplace, due to family responsibilities and environmental factors (54).

Limitations

The quantitative study provided information on the frequency of occurrence of a decrease in job satisfaction during the COVID-19 pandemic among the group of nurses. It seems reasonable to extend the research to other European countries along with a detailed qualitative analysis of the features that had a statistically significant impact on the decrease in job satisfaction. Additionally, when planning the extension of the study, consideration should planned to introduce additional factors that may significantly affect the satisfaction with the work of the nursing staff. A limitation of the study is the fact, that the respondents assessed their job satisfaction prior to the pandemic, retrospectively. Moreover, the respondents, countries of origin had different measures imposed during the pandemic and had different health care systems.

Conclusions

Satisfaction with the work of nursing staff is extremely important to provide the highest possible level of care to patients. The COVID-19 pandemic has negatively affected the satisfaction of nurses with their professional work. It had the most severe impact on the perception of the change in working conditions. A greater decrease in job satisfaction was found among women and in the older group of nurses, in contrast to men and younger subjects. Demonstrating the existence of such a dependence should become an inspiration for the management in taking actions aimed at improving the current

working conditions, which are considered insufficient by nurses during the pandemic.

Data availability statement

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

Ethics statement

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

Author contributions

DM, KL, KB, RD, NM, and BD contributed to conception and design of the study and wrote sections of the manuscript. DM, KL, and NM organized the database. DM performed the statistical analysis and wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

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

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Night shifts, insomnia, anxiety, and depression among Chinese nurses during the COVID-19 pandemic remission period: A network approach

Pu Peng[1,2†], Mining Liang[1,2†], Qian Wang[1,2], Lulu Lu[1,2], Qiuxia Wu[2]* and Qiongni Chen[1,2]*

[1]Clinical Nursing Teaching and Research Section, The Second Xiangya Hospital, Central South University, Changsha, China, [2]Department of Psychiatry, National Clinical Research Center for Mental Disorders, The Second Xiangya Hospital of Central South University, Changsha, Hunan, China

Background: The outbreak of the COVID-19 pandemic imposed a heavy workload on nurses with more frequent night shifts, which led to higher levels of insomnia, depression, and anxiety among nurses. The study aimed to describe the symptom-symptom interaction of depression, anxiety, and insomnia among nurses and to evaluate the impact of night shifts on mental distress *via* a network model.

Methods: We recruited 4,188 nurses from six hospitals in December 2020. We used the Insomnia Severity Index, Patient Health Questionnaire-9, and Generalized Anxiety Disorder Scale-7 to assess insomnia, depression, and anxiety, respectively. We used the gaussian graphical model to estimate the network. Index expected influence and bridge expected influence was adapted to identify the central and bridge symptoms within the network. We assessed the impact of night shifts on mental distress and compared the network structure based on COVID-19 frontline experience.

Results: The prevalence of depression, anxiety, and insomnia was 59, 46, and 55%, respectively. Nurses with night shifts were at a higher risk for the three mental disorders. "Sleep maintenance" was the central symptom. "Fatigue," "Motor," "Restlessness," and "Feeling afraid" were bridge symptoms. Night shifts were strongly associated with sleep onset trouble. COVID-19 frontline experience did not affect the network structure.

Conclusion: "Sleep maintenance," "Fatigue," "Motor," and "Restlessness" were important in maintaining the symptom network of anxiety, depression, and insomnia in nurses. Further interventions should prioritize these symptoms.

KEYWORDS

COVID-19 pandemic, depression, anxiety, insomnia, network analysis

Introduction

The COVID-19 pandemic has deeply enlarged the workload and worsened the mental state of healthcare workers (1–3); approximately 40% have experienced anxiety, depression, and insomnia symptoms during the pandemic (1, 2, 4). One of the major risk factors for increased mental problems might be the heavy workload, especially frequent

night shifts. Studies consistently reported that night shifts were associated with a higher risk of burnout, sleep impairment, depression, anxiety, and low quality of life among healthcare workers (5–10).

Network analysis is an emerging and promising tool for understanding the psychopathology of mental disorders (11). It assumes that symptoms are components rather than the reflection of mental disorders (12). The network model allows relationships to be identified within symptoms to find the "central symptom" considered to have the strongest influence on the other symptoms in the network (13, 14). It also provides an opportunity to establish comorbidity at the symptom level by identifying "bridge symptoms" (15). Central and bridge symptoms are pivotal in developing and maintaining mental disorders (15, 16). Targeting these symptoms is of great clinical value.

Increasingly, studies use network analysis to describe the symptom network of anxiety and/or depression among different populations including adolescents, college students, the general population, and quarantined individuals during the pandemic (17–21). However, despite the high prevalence of psychological symptoms among nurses, there was no previous study describing the potential symptom-symptom interaction among the nursing population. Moreover, studies regarding the mental health of nurses were mainly carried out during the peak of the pandemic. Nevertheless, studies suggested the persistence of mental symptoms even long after the pandemic's initial peak (22–26). Describing the prevalence and network structure of depression, anxiety, and insomnia symptoms among nurses in the late stage of the pandemic would provide valuable insights into the long-term investigation, identification, and intervention for these symptoms in the nursing population.

Hence, we conducted the present study to assess the network structure of anxiety, depression, and insomnia symptoms in a large sample of Chinese nurses during the pandemic's remission period. We aimed to identify the central and bridge symptoms within this network. In particular, we examined the impact of night shifts and COVID-19 frontline experience on nurses' mental health.

Methods

This study was performed based on the reporting standards for psychological network analyses of cross-sectional data (27).

Study setting and participants

We conducted a secondary analysis using the data from our previous study (28). The study used a web-based questionnaire and was conducted in December 2020 in Hunan province, China, which had entered a remission period during the

COVID-19 pandemic (8 months without any new local cases). Snowball sampling was used to recruit nurses from six local hospitals. All practicing nurses willing to participate in the survey were eligible. Student nurses or nurses on sick leave or maternity leave during 2020 were excluded. After participants provided informed consent, the questionnaire was distributed *via* an online survey platform (www.wjx.cn) and WeChat. Only participants who responded to all questions could submit the questionnaire, and we used identification numbers to avoid repeat submissions. Participation was voluntary with no compensation. The questionnaire took average 5–8 min to complete. Participants who took too short (<2 min) or too long (>60 min) to complete the survey were excluded.

Measures

We collected demographic (age, gender, education level, partnership status, family income) and work-related (work duration, night shifts, title, COVID-19 frontline experience, hospital level) characteristics *via* self-designed questionnaires. Nurses aiding Wuhan or working in local isolation wards during the pandemic were identified as frontline nurses. Chinese nurses worked in three shift schedules including the day shift (8:00 am−4:00 pm), evening shift (4:00 pm−0:00 am), and night shift (0:00 am−8:00 am). Night shifts were questioned through the single item "How many night shifts do you have per month?."

To evaluate insomnia, we used the Chinese version of the Insomnia Severity Index (ISI), a validated questionnaire in both clinical and non-clinical populations (29, 30). It contains 7 items on severity of sleep disturbances and associated daytime symptoms, assessed on a five-point Likert scale, ranging from 0 ("not at all") to 4 ("very serious"). Higher ISI scores indicate greater insomnia severity. ISI scores above 7 were used to identify potential insomnia.

Depression and anxiety symptoms were assessed with the 9-item Patient Health Questionnaire (PHQ-9) and 7-item General Anxiety Disorder scale (GAD-7), respectively, which are validated and widely used in Chinese populations (31, 32). Both questionnaires use four-point Likert scales to assess symptom frequency, from 0 ("not at all") to 3 ("nearly every day"). Following previous studies (33, 34), a cutoff score of 5 was used to screen for depression and anxiety symptoms. We removed the item "trouble falling or staying asleep, or sleeping too much" (PHQ3), as it focused on sleep problems and could overlap with insomnia in the network analysis.

Statistical analysis

All statistical analyses were conducted using R (ver. 4.2.0). We described continuous variables as the median and interquartile range (IRQ; 25–75%). Categorical data were

presented as frequency and percentages. All tests were 2-tailed; $p < 0.05$ indicated statistical significance.

Network estimation

We used the "describe" function in the R package "psych" to calculate means, standard deviations (SD), kurtosis, and skewness for PHQ-9, GAD-7, and ISI items. Items with an SD 2.5 times lower than the mean for all scale items were considered to be less informative and excluded. The "goldbricker" function in the R package "network tools" was used to identify redundant items.

Following previous research, we used the R packages "bootnet" and "qgraph" to estimate and visualize the network analysis (35). To estimate the network, we used the gaussian graphical model with the default of the EBICglasso model, which was widely used in psychological network models (36). The network model defined the symptom as a "node." The "edge" between two nodes represents a unique association between two symptoms after controlling for all other variables in the network. Thicker edges indicate stronger associations (27). Red edges indicated a negative association while blue edges suggested a positive association.

To identify the network's central symptoms, we calculated the centrality indices "strength," "betweenness," "expected influence" (EI), and "closeness" via the R package "qgraph." The EI index was chosen to quantify the importance of the node (37). We used the R package "MGM" to assess node predictability in the network. Predictability suggests the extent to which a node's variance can be explained by its neighbors (19). High predictability suggests that a symptom could be controlled by changing neighboring nodes. We assessed Spearman's rank-order correlations between mean item scores and both node strength and predictability, following previous studies (38–40).

To identify possible bridge symptoms linking the three mental symptoms, we used the R package "networktool" (15). We assessed the bridge expected influence (BEI) index, with a higher EI suggesting a stronger association with symptoms in other communities. Bridge symptoms were chosen with an 80th percentile BEI threshold (41).

To evaluate the impact of night shifts on depression, anxiety, and insomnia symptoms, we added night shifts to the network and used the "flow" function in Rpackage "qgraph."

Network stability and accuracy

To test the accuracy of edge estimations, we used non-parametric bootstrapping with 1000 bootstrap samples via the "bootnet" packages. We also tested bridge and center strength stability using a case-dropping bootstrap procedure (35). The correlation stability coefficient (CS-C) represented network stability. A CS-C higher than 0.5 was considered good.

Network comparison

We compared the insomnia–depression–anxiety network based on COVID-19 frontline experience via the R package "Network Comparison tool." The global network strength (absolute sum of all edge weights) and structure (distribution of edge weights) between both networks were evaluated.

Ethical considerations

The study was approved by the ethics committee of the Second Xiangya Hospital of Central South University.

Results
Descriptive statistics

In total, 4,237 nurses participated in the survey and 4,188 validated responses were included in the final analysis (Table 1). The median age was 30 (26–35), and the median for years practicing was 8 (4–13). One-fifth of the participants worked as frontline nurses during the pandemic's peak. Most participants were women (98%), had a bachelor's degree (69%), had a junior title (61%), and were married (68%). Approximately half experienced depression (59.6%), anxiety (47%), and insomnia (55.5%) symptoms. 2917 (70%) of the nurses had at least one mental symptom. The median night shift frequency per month was 2 (1–3). 3153 nurses had at least one night shift per month. Compared with those without night shifts, nurses with night shifts were at a higher risk for depression (62 vs. 50%), anxiety (48 vs. 42%), and insomnia (57 vs. 48%) (all $p < 0.001$).

Insomnia–depression–anxiety network structure

No items were excluded for low item informativeness or redundancy. Table 2 presents the means and SDs for all items.

Figure 1 shows insomnia–depression–anxiety network, which had a density of 0.68 (156/231 edges) and a mean weight of 0.043. Supplementary Table S1 shows the correlation matrices. The nodes' mean predictability was 0.581, suggesting that 58% of a node's variance could be explained by adjacent nodes. ISI6 (noticeability) had the lowest predictability at 0.18, while GAD2 (uncontrollable worry), GAD4 (trouble relaxing), and ISI2 (sleep maintenance) had the highest predictability (0.72). We found no relationship between node predictability and mean value.

TABLE 1 Characteristics of participants.

Variable	Overall, N = 4,188[a]	Nurses without shifts, N = 1,035[a]	Nurses with shifts, N = 3,153[a]	p-value[b]
Workplace				<0.001
Tertiary hospital	1,290 (31%)	214 (21%)	1,076 (34%)	
Secondary hospital	898 (21%)	281 (27%)	617 (20%)	
Primary hospital	2,000 (48%)	540 (52%)	1,460 (46%)	
Gender				<0.001
Female	4,099 (98%)	1,027 (99%)	3,072 (97%)	
Male	89 (2%)	8 (1%)	81 (3%)	
Age, years	30 (26, 35)	36 (30, 43)	29 (25, 32)	<0.001
Practicing years	8 (4, 13)	15 (9, 23)	7 (3, 10)	<0.001
Title				<0.001
Junior title	2,536 (61%)	340 (33%)	2,196 (70%)	
Nurses in charge	1,464 (35%)	537 (52%)	927 (29%)	
Chief nurses	188 (5%)	158 (15%)	30 (1%)	
Head nurse	370 (9%)	260 (25%)	110 (4%)	<0.001
Education				0.2
Junior college or below	1,110 (27%)	254 (25%)	856 (27%)	
Bachelor degree	2,910 (69%)	733 (71%)	2,177 (69%)	
Master degree or above	168 (4%)	48 (4%)	120 (4%)	
Partnership				<0.001
Single	840 (20%)	58 (5%)	782 (25%)	
Partnered	382 (9%)	18 (2%)	364 (11%)	
Married	2,866 (68%)	920 (89%)	1,946 (62%)	
Widowed	100 (3%)	39 (4%)	61 (2%)	
Family monthly income, CNY				<0.001
< 10,000	2,063 (50%)	452 (44%)	1,611 (51%)	
10,000–30,000	1,684 (40%)	479 (46%)	1,205 (38%)	
30,000–50,000	221 (5%)	49 (5%)	172 (6%)	
>50,000	220 (5%)	55 (5%)	165 (5%)	
Frontline experience	882 (21%)	184 (18%)	698 (22%)	0.003
GAD7	4 (1, 7)	3 (0, 7)	4 (1, 7)	<0.001
PHQ9	6 (2, 9)	4 (2, 8)	6 (3, 9)	<0.001
ISI	8 (4, 11)	7 (3, 11)	8 (4, 12)	<0.001
Anxiety	1,935 (46%)	431 (42%)	1,504 (48%)	<0.001
Depression	2,457 (59%)	515 (50%)	1,942 (62%)	<0.001
Insomnia	2,287 (55%)	501 (48%)	1,786 (57%)	<0.001
At least one distress	2,917 (70%)	669 (65%)	2,248 (71%)	<0.001

[a]Median (IQR); n (%).
[b]Wilcoxon rank sum test; Pearson's Chi-squared test.

Following previous research (39), insomnia symptoms were divided into sleep disturbance (ISI1, ISI2, ISI3) and daytime dysfunction (ISI5, ISI6, ISI7) groups. ISI4 (sleep dissatisfaction) was connected to both groups. The strongest edge within the insomnia symptom network was ISI2 (sleep maintenance)–ISI3 (early wakening), which was also the strongest edge in the network according to the edge-differ test (Supplementary Figure S1). ISI2 (sleep maintenance)–ISI1 (sleep onset) was the second strongest edge. Within the depression symptom communities, the strongest edge was PHQ1 (anhedonia)–PHQ4 (fatigue), followed by PHQ1 (anhedonia)–PHQ2 (sad mood). The most robust edges within anxiety symptom communities were GAD7 (feeling afraid)–GAD5 (restlessness) and GAD3 (excessive worry)–GAD4 (trouble relaxing). The most robust transdiagnostic edge within the network was GAD5 (restlessness)–PHQ8 (motor).

TABLE 2 Descriptive statistics of the items in the insomnia-depression-anxiety network.

Items	Item content	Mean	SD	Strength	Predictability
PHQ1	Anhedonia	0.86	0.68	0.25	0.64
PHQ2	Sad mood	0.75	0.66	0.29	0.64
PHQ4	Fatigue	0.95	0.73	0.51	0.64
PHQ5	Appetite	0.70	0.72	−1.29	0.46
PHQ6	Worthless	0.61	0.71	0.37	0.60
PHQ7	Concentration	0.57	0.72	−1.07	0.49
PHQ8	Motor	0.39	0.61	0.83	0.58
PHQ9	Death	0.23	0.51	−1.09	0.45
GAD1	Nervous	0.73	0.68	0.21	0.68
GAD2	Uncontrollable worry	0.57	0.70	0.69	0.72
GAD3	Excessive worry	0.77	0.74	0.69	0.71
GAD4	Trouble relaxing	0.69	0.74	0.77	0.72
GAD5	Restlessness	0.42	0.61	0.47	0.65
GAD6	Irritability	0.79	0.74	0.17	0.65
GAD7	Feeling afraid	0.47	0.66	0.65	0.66
ISI1	Sleep onset	0.91	0.98	0.28	0.64
ISI2	Sleep maintenance	0.97	1.05	1.67	0.72
ISI3	Early wakening	0.82	0.99	−1.21	0.57
ISI4	Sleep dissatisfaction	1.98	1.03	0.83	0.57
ISI5	Daytime disfunction	1.59	1.03	−1.57	0.35
ISI6	Noticeability	0.86	1.01	−2.46	0.18
ISI7	Sleep induced distress	1.24	1.13	0.00	0.50

Central and bridge symptoms

The centrality indices strength, closeness, EI, and betweenness are presented in Supplementary Table S2. The centrality index (Figure 2A) revealed the most central symptom of the insomnia–depression–anxiety network was ISI2 (sleep maintenance), which was statistically stronger than other symptoms (Supplementary Figure S1). Other central symptoms included GAD4 (trouble relaxing), GAD2 (uncontrollable worry), and GAD7 (feeling afraid). PHQ4 (fatigue) was the most central symptom in depression communities. We found no association between node strength with the mean value.

PHQ4 (fatigue), GAD7 (feeling afraid), PHQ8 (motor), and GAD5 (restlessness) held the highest BEI (Figure 2B), suggesting they served as bridge symptoms in the insomnia–depression–anxiety network. ISI1 (sleep onset) showed a stronger connection with anxiety and depression symptom communities than other insomnia symptoms.

Network stability and accuracy

Insomnia–depression–anxiety network exhibited excellent stability and accuracy. The case-dropping procedure found the

CS-C of node and bridge expected influence was 0.75, indicating the network retained a correlation of 0.7 with the original data with 95% certainty even after omitting 75% of the raw data (Figure 3A). The bootstrapped 95% CIs were narrow, indicating the network's high accuracy (Figure 3B).

Impact of night shifts on depression, anxiety, and insomnia symptoms

We added monthly night shift frequency to the network (Figure 4). Having more night shifts was positively related to ISI1 (sleep onset), PHQ2 (sad mood), and PHQ5 (appetite). However, its associations with other symptoms were rather weak.

Network comparison test

We compared insomnia–depression–anxiety network symptoms based on COVID-19 frontline experience (Supplementary Figure S3). We observed no differences in the global strength ($p = 0.779$) or network invariance ($p = 0.479$) between the two groups.

FIGURE 1
The network of insomnia, depression, anxiety symptoms in nurses. The green, blue, and orange nodes represented insomnia, anxiety, and depression symptoms, respectively. The blue edges represented positive association, while the red represented the negative association. Thicker edges suggested stronger association.
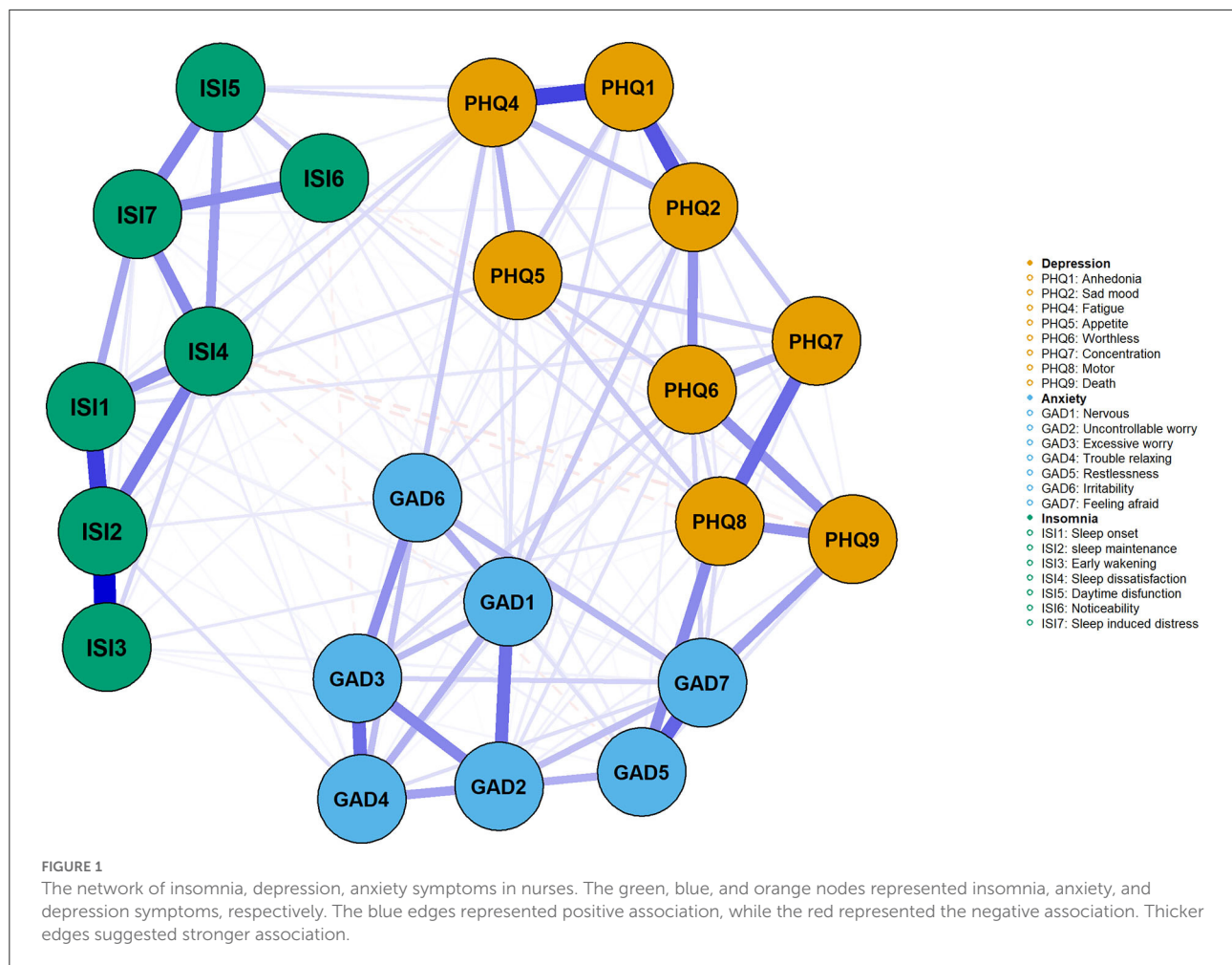
Discussion

To our knowledge, this study was the first to assess the network structure of insomnia, depression, and anxiety symptoms in the nursing population. We identified several central symptoms (i.e., impaired sleep maintenance, trouble relaxing, and uncontrollable worry) and bridge symptoms (i.e., psychomotor agitation/retardation and restlessness). Fatigue and feeling afraid were both central and bridge symptoms. Night shifts were strongly associated with late sleep onset. COVID-19 frontline experience did not affect the network structure.

To date, only a few studies have assessed the comorbid of anxiety, depression, and insomnia at an item level (40–44). Despite the different study sample, sleep maintenance problem has been repeatedly reported to play an important part in the establishment of depressive, anxiety, and insomnia symptoms network (42–44), which were in line with our studies. Our work suggested sleep maintenance problems might be the network's trigger and driver. This hypothesis was supported by a retrospective study which found that approximately 66%

of 456 insomnia patients first experienced sleep maintenance difficulties (45). Previous studies showed life stressors to have a stronger association with impaired sleep maintenance, compared with late sleep onset and early waking (46, 47). These studies might suggest that sleep maintenance problems are easily triggered by negative life events, and then induce other symptoms in the network.

We found that sleep disturbance symptoms showed higher strength than daytime dysfunction symptoms, contrasting Bai's study on mental health care workers at the pandemic's peak (39). This inconsistency might result from the different pandemic periods. Heavy workloads and serious consequences from medical errors during the day at the pandemic's peak may have led healthcare workers to focus more on daytime dysfunction than sleep disturbance in relation to insomnia. This finding highlights the need to track dynamic changes in insomnia among healthcare workers during the COVID-19 pandemic to provide targeted interventions.

Fatigue was defined as feeling tired and loss of energy (48). It emerged as both a central and bridge symptom within the
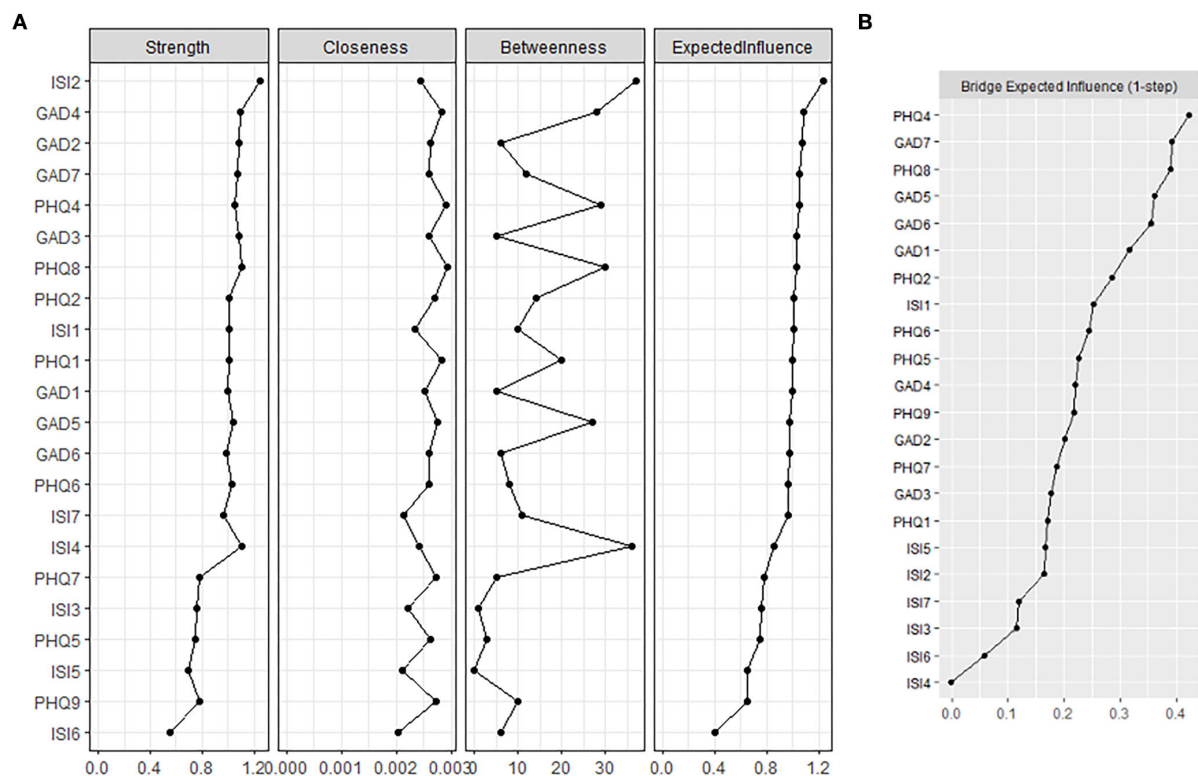
FIGURE 2
Centrality index and bridge expected influence of the nodes. **(A)** Centrality index of the nodes within the network. Higher expected influence suggested being more influential. **(B)** Bridge expected influence of the nodes. Nodes with higher bridge expected influence were considered to be the bridge symptoms which drove the comorbidity.

network, implying it is an important clinical target. Fatigue's high centrality has been consistently reported in different populations, including college students, nursing students, and the general population, in the pandemic's late stage, indicating it might be the hallmark of depressive symptoms during this period (18–20, 40). Interestingly, fatigue has traditionally been recognized as a somatic symptom of depression, and a systemic review of the network of major depressive disorder suggested a robust community of fatigue, concentration loss, and psychomotor symptoms (49). However, we found fatigue had a stronger association with mood disturbances (anhedonia, sad mood, and feeling worthless) than somatic or cognitive symptoms. Within the depression community, PHQ4 (fatigue)–PHQ1 (anhedonia) was the strongest edge, while fatigue showed no association with concentration loss or psychomotor symptoms. This might suggest that fatigue in this sample was more likely to be psychological exhaustion rather than physical tiredness. Fatigue also showed positive associations with all insomnia symptoms except for noticeability and was most strongly associated with subjective sleep dissatisfaction and daytime dysfunction. Interestingly, the association between early waking and fatigue was rather weak.

In addition to fatigue, our findings suggested psychomotor symptoms, such as psychomotor agitation/retardation and restlessness, could trigger connections within the network. The interconnection between restlessness and psychomotor agitation/retardation was the network's most robust transdiagnostic edge. Other psychomotor symptoms, such as trouble relaxing, also showed high central strength. The high bridge centrality of psychomotor symptoms has been consistently validated in studies regarding the network of anxiety and depression during the COVID-19 pandemic (18, 20, 21, 50–52). This might reflect the impact of movement restrictions related to social distancing and lockdown policies on mental health during the pandemic, which requires focused attention (20). Sleep onset had the highest BEI among insomnia symptoms, suggesting it shares a close relationship with anxiety and depression symptoms. Our results support several longitudinal studies which found that sleep onset insomnia was a stronger predictor of depression than other insomnia subtypes (53, 54). Moreover, the residua of sleep onset insomnia were found to predict major depressive disorder relapse (55).

We also evaluated the impact of COVID-19 frontline experience and night shifts on mental health symptoms. We

FIGURE 3

Accuracy and stability of the network. **(A)** The stability of central and bridge expected influence by case-dropping bootstrap. **(B)** The accuracy of the network edges by non-parametric bootstrapping.
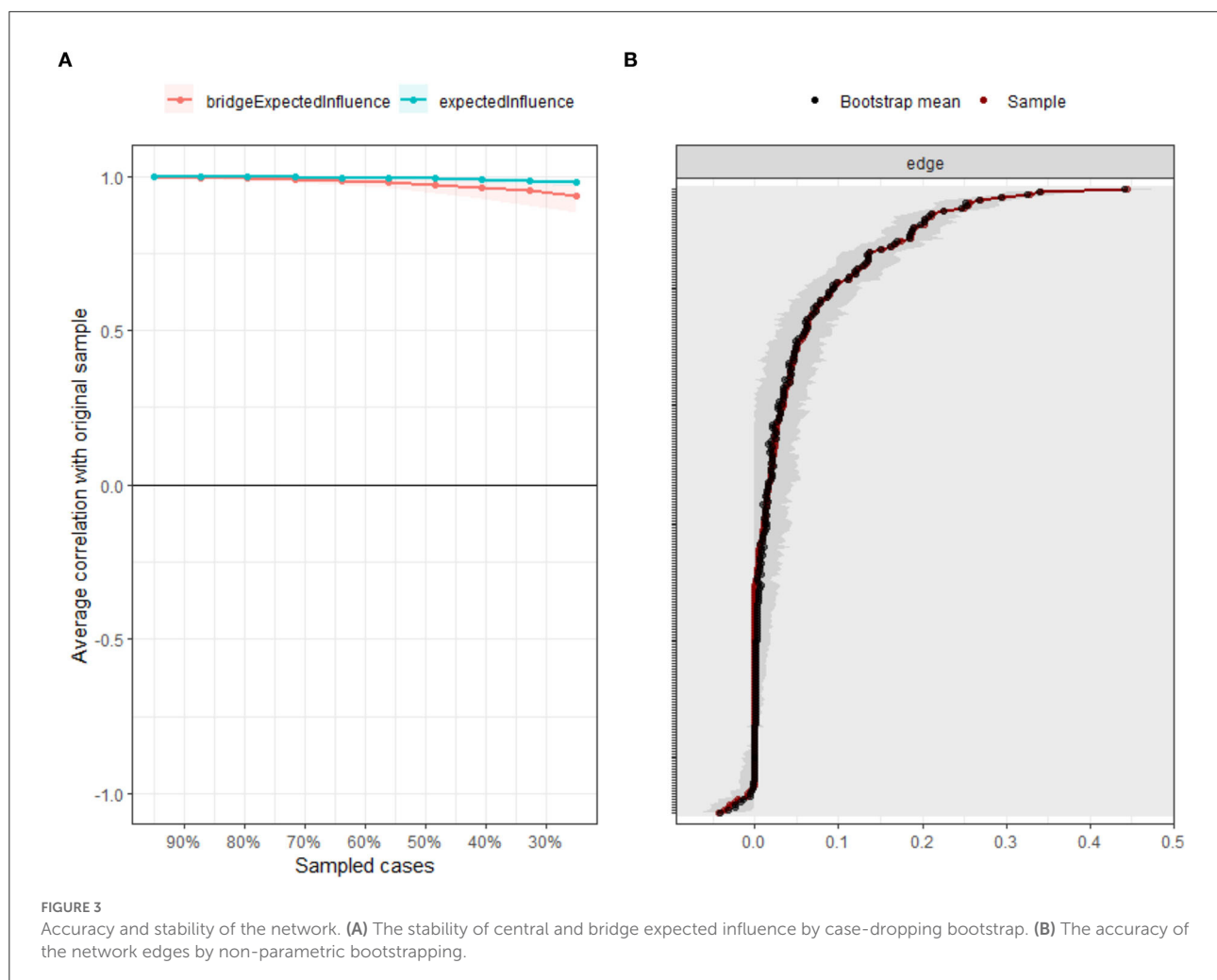
found no differences in the network between frontline and non-frontline nurses, which might have resulted from when data were collected. As the data were collected during the pandemic's remission period, the impact of direct exposure to COVID-19 patients on mental health might have disappeared. Several studies reported similar results to ours. Zhang et al. compared frontline and non-frontline nurses' mental health during the remission period. They found no difference in depression, anxiety, and insomnia prevalence between frontline and non-frontline nurses (56). Yu et al. described the network of depression and anxiety symptom network among Chinese clinicians and determined there was no difference in the symptom network between frontline and non-frontline clinicians.

Our study supported previous findings that night shifts were associated with insomnia and depression (57, 58). Particularly, night shifts were related to late sleep onset, rather than sleep maintenance or early wakening problems. Our results are in line with one previous study (59), which found significantly

longer sleep latency in shift-work nurses. Moreover, we found night shifts were related to depressed mood and appetite change. These findings suggest the need to develop an optimal shift schedule and screen and intervene for late sleep onset insomnia and depression in nurses working night shifts.

This study has several implications for clinical practice and nursing management. First, our study demonstrated the long-lasting psychological harm of the pandemic on nurses during the remission period. Depression (59.6%), anxiety (47%), and insomnia (55.5%) symptoms showed higher prevalence than in studies during the pandemic's peak (60–63), suggesting the strong need to screen and intervene for depression, anxiety, and insomnia in this period. Second, our study identified several key symptoms, such as sleep maintenance, fatigue, psychomotor agitation/retardation, restlessness, and feeling afraid. They might play an important role in triggering and maintaining the depression-anxiety-insomnia network. Hence, it's necessary for nursing managers and policymakers to provide timely screening and targeted intervention for these specific symptoms,

FIGURE 4
The impact of night shifts on insomnia, depression, and anxiety symptoms. The green, blue, and orange nodes represented insomnia, anxiety, and depression symptoms, respectively. The blue edges represented positive association, while the red represented the negative association. Thicker edges suggested stronger association.
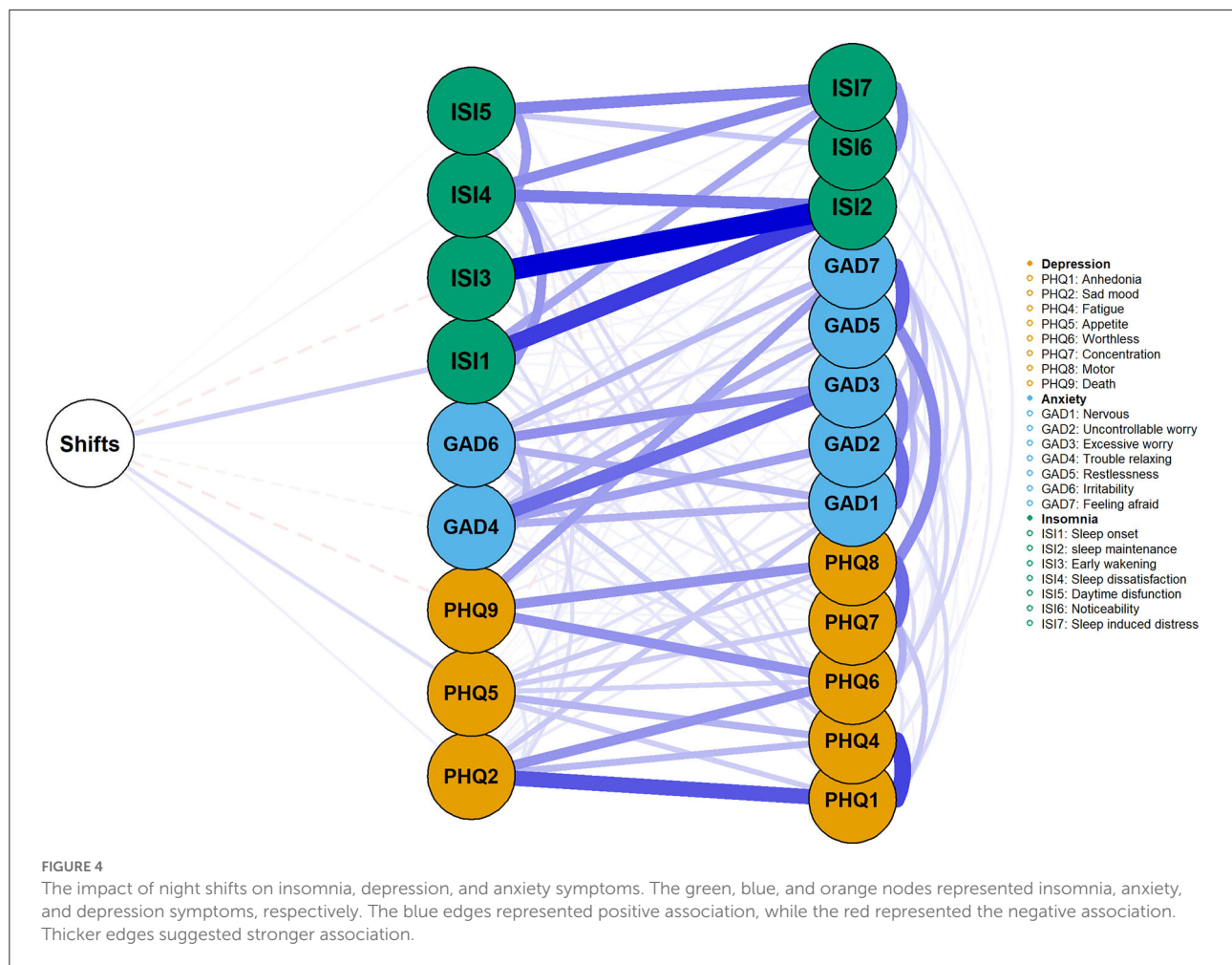
which might help early detect and reduce depression, anxiety, and insomnia in nurses. For example, a network intervention analysis revealed the effectiveness of behavior therapy on sleep maintenance (64), indicating it might be a promising treatment for insomnia among nurses. Physical activity might help reduce psychomotor symptoms and energy loss (65), which might be included in treatment interventions. Third, we found nurses with more night shifts were more prone to late sleep onset. Timely screening and prevention for late sleep onset insomnia are needed in this population. Cognitive behavioral therapy for insomnia has been demonstrated to be effective in treating insomnia and depression in shift workers (66, 67), which might help reduce insomnia in nurses working night shifts.

Our study had several limitations. First, owing to its cross-sectional design, causal relationships could not be identified. Second, as we did not collect baseline data, we could not provide dynamic trajectories for participants' mental well-being. Third, we used snowball sampling rather than random sampling, which might reduce the representativeness of our samples and lead

to potential sampling bias. However, the reported prevalence of depression and anxiety and the demographic characteristics (age, gender, married status, and night shifts) were very close to those of one national cohort of Chinese nurses ($N = 138, 279$) in a similar period (68), suggesting such bias might be very small. Fourth, our study was conducted during the remission period of the pandemic and only included Chinese nurses. The work burden was lighter due to the control of the pandemic. Further studies are in need to verify our findings in different settings such as different periods of the pandemic and hospitals in other countries. In addition, we only assessed the frequency of the night shifts. Providing a more precise description of night shifts, such as frequency of consecutive shifts, length and intensity of night shifts, and shift patterns may help to better understand the relationship between night shifts, depression, anxiety, and insomnia in the nursing population. Fifth, mental distress was assessed *via* self-report questionnaires, rather than a standard diagnostic tool. Lastly, the use of the bootstrap procedure to assess the network stability might be another limitation of our study.

Conclusion

Our study assessed the network structure of insomnia, anxiety, and depression symptoms among a large sample of nurses during the remission period of the COVID-19 pandemic. We found sleep maintenance was the central symptom, while fatigue, psychomotor agitation/retardation, restlessness, and feeling afraid were the bridge symptoms within the network. Night shifts were associated with a higher risk of depression, anxiety, and insomnia and exhibited a direct association with late sleep onset. These findings provided new insights into the symptom-symptom relationship of insomnia, depression, and anxiety and were valuable in preventing and treating the three common mental distresses in the nursing population.

Data availability statement

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

Ethics statement

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

Author contributions

PP: conceptualization, software, and writing—original draft preparation and editing. ML: methodology and writing—review and editing. QWa: data curation and writing—review and editing. LL: writing—review and editing and validation. QC: design, supervision, and project administration. QWu: writing—review and editing, conceptualization, and methodology. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1040298/full#supplementary-material

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Psychological distress facing the COVID-19 pandemic in dental interns from the Peruvian capital: A cross-sectional study under a multivariable regression model

César Cayo-Rojas[1]*, Nancy Córdova-Limaylla[1], Marysela Ladera-Castañeda[2], Gissela Briceño-Vergel[1], Carlos López-Gurreonero[3], Manuel Castro-Mena[1], Alberto Cornejo-Pinto[2], Regina Agramonte-Rosell[3] and Luis Cervantes-Ganoza[4]

[1]School of Stomatology, Universidad Privada San Juan Bautista, Lima, Peru, [2]Faculty of Dentistry and Postgraduate School, Grupo de Investigación Salud y Bienestar Global, Universidad Nacional Federico Villarreal, Lima, Peru, [3]School of Stomatology, Universidad Científica del Sur, Lima, Peru, [4]Faculty of Stomatology, Universidad Inca Garcilaso de la Vega, Lima, Peru

Aim: Psychological distress can be considered a maladaptive response to a stressful situation that occurs when external events or stressors impose demands that cannot be coped with. Therefore, the aim of the present study was to evaluate the sociodemographic factors associated with psychological distress in dental interns from the Peruvian capital facing the COVID-19 pandemic.

Materials and methods: This analytical, observational, cross-sectional study was conducted on 392 Stomatology interns from the Peruvian capital from June to July 2022. The validated COVID-19 Peritraumatic Distress Index (CPDI) scale to detect the levels of psychological distress consisted of four dimensions: negative mood, changes in behavior and cognitive skills, fatigue and hyperreactivity, and somatization. Pearson's chi-square and Fisher's exact test were used for bivariable analysis. In addition, a logit model was used to assess the influence of variables: sex (X1), age group (X2), marital status (X3), monthly economic income (X4), working area in the capital city (X5), and living with people vulnerable to COVID-19 (X6), with the psychological distress levels, considering a significance $p < 0.05$.

Results: The prevalence of psychological distress in dental interns was severe in 6.4% [95% confidence interval (CI): 3.9–8.8%] and mild in 37.8% (95% CI: 33.0–42.6%). According to bivariable analysis, the levels of psychological distress by COVID-19 were not significantly associated with sex ($p = 0.190$), age group ($p = 0.418$), marital status ($p = 0.554$), monthly economic income ($p = 0.327$), working area in the capital city ($p = 0.993$), and living with people vulnerable to COVID-19 ($p = 0.134$). In addition, according to the logistic regression analysis, none of the variables studied was considered an influential factor ($p > 0.05$) in psychological distress presented by dental interns.

Conclusion: The 44.2% of dental interns from the Peruvian capital presented psychological distress facing the COVID-19 pandemic, without any of the possible associated variables of this study significantly affecting this behavioral disorder.

Introduction

The COVID-19 pandemic severely affected the mental health of populations in general, since in order to control the spread of disease, it was necessary to take sanitary measures such as social distancing, which resulted in isolation and loneliness. Similarly, the economic sector was affected, accentuating the material and economic shortages. It was also necessary to adapt to teleworking, virtual education, and access to medical and psychological care was restricted. In addition to all this, the infodemia by some media contributed to the prevalence of psychological disorders [1, 2].

According to a study conducted during the pandemic of more than 55,000 participants from 40 countries, multiple and wide-ranging vulnerabilities from anxiety to probable depression and suicidal tendencies through distress were recorded [3]. The Global Burden of Disease estimated that the COVID-19 pandemic has caused a 27.6% increase in cases associated with major depressive disorder and a 25.6% increase in cases associated with anxiety disorders [4]. In Peru, preliminary findings of the population-based survey on mental health during the COVID-19 pandemic, in which 58,349 people participated, showed that 28.5% of all respondents reported depressive symptomatology. Of this group, 41% of respondents reported symptoms associated with mild-to-severe depression and 12.8% reported suicidal ideation. Women and men reported depressive symptomatology in 30.8 and 23.4% of the total cases, respectively. The age group of 18-24 years had the greatest depressive affectation [5].

Psychological distress can be considered a maladaptive response to a stressful situation that occurs when external events or stressors impose demands that cannot be coped with, characterized by a predominance of physical symptoms where there is paralysis of the organism, overwhelm, and a decrease in the person's precision to grasp this phenomenon [6–8]. Psychological distress in healthcare is common and may include symptoms of burnout, depression, anxiety, rumination, and perceived stress [9–11]. In this context, in recent studies, it has been reported that students, interns, and dental professionals were more likely to develop mood disorders [12–14], for example, Mekhemar et al. [15] reported higher levels of anxiety, stress, and depression in female dentists aged 50 and 59 years old, with immunodeficiency or with a chronic disease and in those who considered the COVID-19 pandemic as a financial risk. In addition, several sociodemographic factors have been reported to be associated with psychological distress in the context of the pandemic and confinement, such as age, gender, marital status, economic income, and cohabitation with vulnerable people, among others [2, 16, 17].

To specifically assess the emotional impact of the COVID-19 pandemic, the *COVID-19 Peritraumatic Distress Index* (CPDI) [18–23] has been designed and consists of four dimensions D1: negative mood, D2: changes in behavior and cognitive skills, D3: fatigue and hyperreactivity, and D4: somatization [19].

The justification of the present study lies in the increase of psychological distress symptoms in students and professionals of health sciences such as medicine, dentistry, and nursing, among others since these are professional areas associated with high academic and clinical workload, which could lead to a decrease in physical and mental capacity, as well as the consumption of harmful substances and development of suicidal tendencies [9, 24, 25]. Therefore, the findings of the present study will help to underline the need to include emotional impact management as part of the educational curricula, as well as to develop coping strategies, interventions, and support programs in health, mainly based on stress management in students who have contact with patients, even more so in times of the COVID-19 pandemic [26, 27].

Therefore, the purpose of the present study was to evaluate the sociodemographic factors associated with psychological distress in dental interns in the Peruvian capital facing the COVID-19 pandemic.

Materials and methods

Type of study and delimitation

This analytical, prospective, observational, and cross-sectional study was carried out with dental interns from the Peruvian capital from June to July 2022. This manuscript was written according to the STrengthening the Reporting of

OBservational studies in Epidemiology (STROBE) guidelines for observational studies (28).

Sample size and selection of participants

The sample size was 392 dental interns. This was calculated with the Epidat 4.2 statistical program based on a formula for estimating a proportion with an unknown population, considering $p = 0.5$ with a significance level $\alpha = 0.05$ and a margin of error of 5%. The sampling technique was by a snowball, according to the inclusion and exclusion criteria.

Inclusion criteria

The inclusion criteria are as follows:

- Dental interns.
- Dental interns residing in the Peruvian capital.
- Dental interns who gave their informed consent and free disposition to be part of the study.
- Dental interns of both sexes with legal age.

Exclusion criteria

The exclusion criteria are as follows:

- Dental interns who did not complete the entire questionnaire.
- Dental interns who were receiving psychological/psychiatric treatment.

Variables

The associated factors considered in the study, in relation to the variable psychological distress in the face of COVID-19, were sex (X1), age group (X2) (21, 22), marital status (X3), monthly economic income (X4), working area in the capital city (X5), and living with people vulnerable to COVID-19 (X6) (3).

Instrument application

The Spanish-validated version for Peru of the COVID-19 Peritraumatic Distress Index Scale (CPDI) was used to detect psychological distress facing the COVID-19 pandemic (19). This scale consisted of 24 items distributed in four dimensions. The first dimension consisted of five items (R1–R5) that assessed negative mood. The second dimension consisted of seven items (R6–R12) that assessed changes in behavior and cognitive skills.

The third dimension consisted of seven items (R13–R19) that assessed fatigue and hyperreactivity. The fourth dimension consisted of five items (R20–R24) that assessed somatization. All questions referred to signs and symptoms that dental interns felt in the week prior to the assessment (18, 21). Each item had five ordinal (Likert-type) response alternatives "never," "occasionally," "sometimes," "often," and "most of the time" with scores from 0 to 4, respectively. Upon answering the full scale, the scores for each item were summed and a total score was obtained, which was converted into a "*COVID-19 Peritraumatic Distress Index*" *(CPD Index)* based on the total score plus four points (23).

The results of psychological distress levels facing the COVID-19 pandemic were divided into the following ranges (18):

Normal: No psychological distress present (<28 points).

Mild to moderate: Presence of minimal to moderate psychological distress (28–51 points).

Severe: Presence of marked to severe psychological distress (≥52 points).

The instrument's reproducibility test was assessed in a sample of 30 students, and the questionnaire was taken twice at two different times in an interval of 10 days (29), altering the order of the questions to avoid memory bias (test–retest). The results of Pearson's *R* correlation between both scores were very good ($R = 0.994$; CI: 0.985–0.998). The reliability was analyzed with Cronbach's alpha for each dimension, obtaining acceptable values for the first (0.712; CI: 0.664–0.755), second (0.780; CI: 0.745–0.812), third (0.896; CI: 0.879–0.911), and fourth dimensions (0.805; CI: 0.773–0.834). Internal consistency of the entire instrument was very good with a Cronbach's alpha value of 0.932 (CI: 0.922–0.941).

Procedure

The questionnaire was elaborated in the virtual platform Google Classroom® and was distributed in a self-administered manner *via* a link through the social networks WhatsApp®, Facebook®, Telegram®, and e-mails to different dental interns from seven different universities who were doing their internship in different parts of the Peruvian capital (Central Lima, East Lima, North Lima, and South Lima) with assistance from their hospital internship professors, who were contacted by telephone. Upon clicking on the invitation, the participants were automatically directed to the study aim and the informed consent page with the principal investigator's contact information. Once they agreed to participate, they were directed to the scale (CPD index) with instructions to develop it. However, they were free to decline the assessment if they did not wish to complete it during its course. Personal details such as telephone number, name, and address were not required. The survey was designed to be completed only once. Data were

collected and stored in a Microsoft® Excel 2019 spreadsheet, and these data were kept in a password-protected digital folder to which only the researchers had access.

Statistical analysis

The data were imported by STATA statistical software, version 16.0 (College Station, Texas, USA), and descriptive statistics were used to obtain the absolute and relative frequencies of categorical variables. For bivariable analysis, Pearson's chi-square test and Fisher's exact test were applied for expected values <5. Influencing factors were examined using a logistic regression model (logit model) with an odds ratio (OR). All analyses were carried out considering a significance level of 5% ($p < 0.05$).

Ethical aspects

All participants gave their virtual informed consent voluntarily. In addition, the present study respected the bioethical principles for medical research on human subjects from the Declaration of Helsinki (30) related to confidentiality, freedom, respect, and non-maleficence since the data were stored in a portable device with a password to which only the researchers had access. This research was approved by the Institutional Ethics Committee of the Universidad Privada San Juan Bautista with resolution No. 823-2022-CIEI-UPSJB.

Results

Of all dental interns, the female sex was the most predominant with 68.4%. There was also a higher percentage of dental interns between 26 and 35 years of age at 46.7%. Of the total number of dental interns, 83.4% were single. In addition, 58.7% earned <US$250 per month and 76.8% worked as interns on the outskirts of the Peruvian capital. Finally, 54.8% lived with people vulnerable to COVID-19 (Table 1).

Of the 392 dental interns surveyed, the prevalence of psychological distress was found to be severe in 6.4% (95% CI: 3.9–8.8%) and mild to moderate in 37.8% (95% CI: 33.0–42.6%). The overall prevalence of psychological distress was 44.2% (95% CI: 39.2–49.1%) (Figure 1).

According to the negative mood of dental interns, the results showed that there was a statistically significant association of sex with R3 (I feel insecure and have been buying a lot of masks, remedies, disinfectant gel, gloves, and/or other household products.) and R4 (I feel compassion for patients with COVID-19 and their families. I feel sad for them.) ($p < 0.001$ and $p = 0.018$, respectively). Age group was significantly associated with R3 and R5 (No matter what I do, I feel empty

TABLE 1 Characterization of sociodemographic variables of dental interns from the Peruvian capital.

Variable	Categories	Frequency	Percentage
Sex	Female	268	68.4
	Male	124	31.6
Age group	≤25 years	160	40.8
	26–35 years	183	46.7
	>35 years	49	12.5
Marital Status	Married or cohabiting	65	16.6
	Single	327	83.4
Monthly economic income	≤250 dollars	230	58.7
	250–500 dollars	100	25.5
	500–750 dollars	28	7.1
	>750 dollars	34	8.7
Working area in capital city	Central Lima	91	23.2
	East, North and South Lima	301	76.8
Living with people vulnerable to COVID-19	Yes	215	54.8
	No	177	45.2
Age	**Mean**	**Median**	**SD**
	28.5	27.0	6.7

SD, standard deviation.

and helpless.) ($p = 0.019$ and $p = 0.031$, respectively). Marital status was only significantly associated with R3 ($p = 0.012$), while monthly economic income was significantly associated with R2 (I cannot stop imagining that possibly my family or I might be infected and I feel terrified and anxious thinking about it.), R4, and R5 ($p = 0.003$, $p = 0.039$, and $p < 0.001$, respectively). On the other hand, the working area in the capital city was significantly associated with R4 ($p = 0.029$). Finally, living with people vulnerable to COVID-19 was significantly associated with R5 ($p = 0.045$) (Table 2).

According to the changes in behavior and cognitive skills of dental interns, it was observed a statistically significant association of sex with R7 (I am losing faith in people around me.) and R8 (I tend to believe negative news about COVID-19 and have more skeptical opinions about good news.) ($p = 0.031$ and $p = 0.005$, respectively). The age group alone was significantly associated with R7 ($p = 0.005$). Marital status was significantly associated with R9 (I keep an eye on information on COVID-19 all the time. Even if it is not necessary, I cannot avoid it.), R11 (I believe all sources with information about COVID-19 without previously evaluating them.), and R12 (I avoid watching the news about COVID-19 because of the fear it generates me.) ($p = 0.004$, $p = 0.003$ and $p = 0.045$, respectively). Monthly economic income was significantly associated with R8 and R11 ($p = 0.018$ and $p = 0.036$, respectively). On the other hand, working area in the capital city was significantly associated

FIGURE 1
Frequency of dental interns according to their levels of psychological distress.
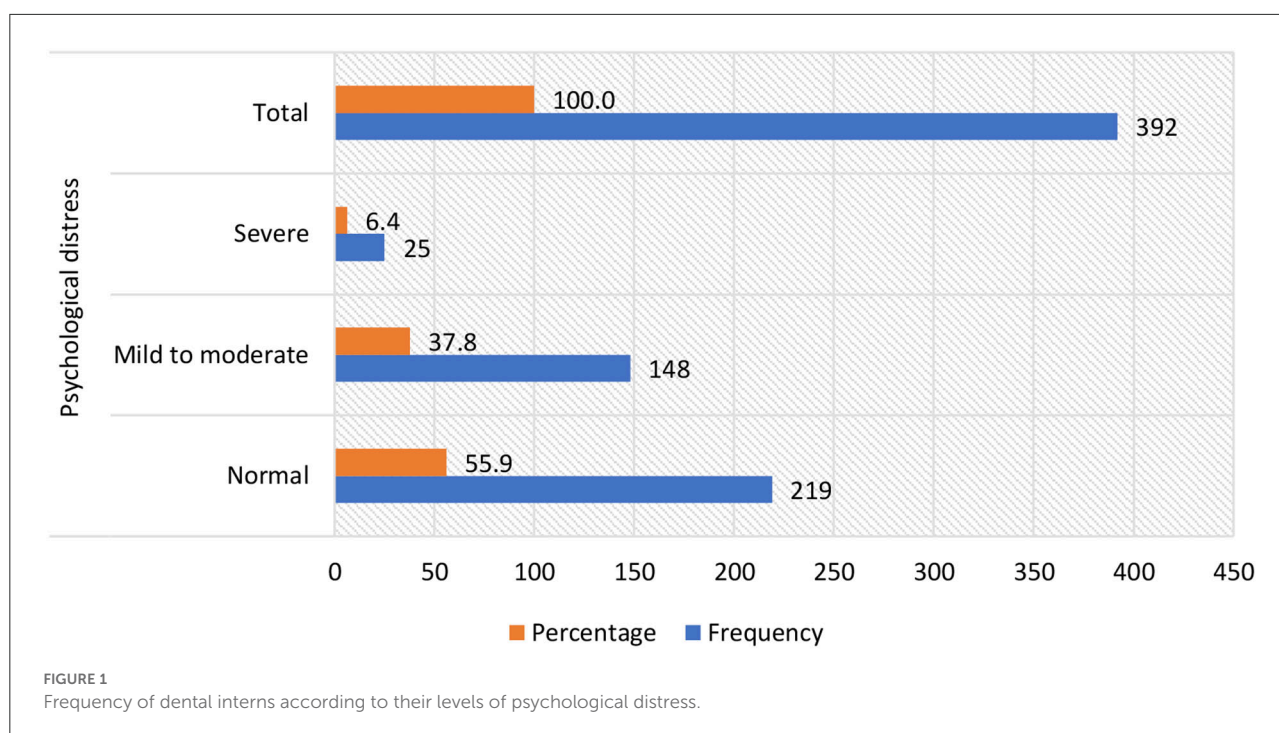
with R6 (I feel powerless and angry with people around me, authorities, and the media) ($p = 0.007$). Finally, living with people vulnerable to COVID-19 was significantly associated with R7 and R11 ($p = 0.045$ and $p = 0.033$, respectively) (Table 3).

According to fatigue and hyperreactivity of dental interns, the statistically significant association of sex was observed with R13 (I feel more irritable and have frequent conflicts with my family.) and R18 (I feel uncomfortable communicating with other people.) ($p = 0.016$ and $p = 0.008$, respectively). Age group was only significantly associated with R14 (I feel tired and sometimes even totally out of strength.), R16 (Because of anxiety, my reactions are slowing down.), R17 (It is difficult for me to make decisions.), and R18 ($p = 0.016$, $p = 0.032$, $p < 0.001$, and $p = 0.009$, respectively). Marital status was only significantly associated with R14 ($p = 0.034$). Monthly economic income was significantly associated with R17 and R19 (I am talking less with my family.) ($p = 0.038$ and $p = 0.031$, respectively). Finally, living with people vulnerable to COVID-19 was significantly associated with R18 ($p = 0.023$) (Table 4).

According to the somatization presented by dental interns, a statistically significant association of sex was observed with R20 (During this COVID-19 period, I often feel dizzy or have back pain and/or chest discomfort.) and R24 (I have constipation or frequent urination.) ($p = 0.001$ and $p = 0.012$, respectively). In addition, monthly economic income was significantly associated with R21 (During this COVID-19 period, I often have stomach pain, bloating, and other stomach discomforts.) and R22 (I cannot sleep well. I dream that I or my family are infected with

COVID-19.) ($p = 0.032$ and $p = 0.007$, respectively). Finally, living with people vulnerable to COVID-19 was significantly associated with R20 and R22 ($p = 0.026$ and $p = 0.032$, respectively) (Table 5).

According to bi-variable analysis, the levels of psychological distress of dental interns with more than 2 years of facing the COVID-19 pandemic were not significantly associated with sex ($p = 0.190$), age group ($p = 0.418$), marital status ($p = 0.554$), monthly economic income ($p = 0.327$), working area in the capital city ($p = 0.993$), and living with people vulnerable to COVID-19 ($p = 0.134$). In addition, according to the logistic regression analysis, none of the variables studied was considered an influential factor ($p > 0.05$) in the psychological distress presented by dental interns (Table 6).

Discussion

The impact of the disease caused by the SARS-CoV-2 coronavirus affected work patterns, produced temporary unemployment and lack of social interaction, affecting the mental health of populations in general and forcing them to adapt to this new lifestyle. In addition to all this, the fear of contracting the virus and the concern for the health and well-being of close relatives had to be managed (2, 31, 32). All of the above was maximized in health professionals, especially dentists, as they are exposed to known or suspected COVID-19 virus sources during clinical procedures that generate contaminated bioaerosols (24, 33, 34). Therefore, the aim of the present study

TABLE 2 Negative mood associated with sociodemographic factors of dental interns from the Peruvian capital.

Questions	Never	Occasionally	Sometimes	Often	Most of the time	Sex	Age group	Marital status	Monthly economic income	Working area in capital city	Living with people vulnerable to COVID-19
	f (%)	f (%)	f (%)	f (%)	f (%)	*p	*p	*p	*p	*p	*p
R1. I feel more anxious and nervous than usual	85 (21.7)	109 (27.8)	148 (37.8)	33 (8.4)	17 (4.3)	0.190	0.485	0.317	0.998	0.390	0.809
R2. I can't stop imagining that possibly my family or I might be infected and I feel terrified and anxious thinking about it	120 (30.6)	129 (32.9)	100 (25.5)	28 (7.1)	15 (3.8)	0.140	0.313	0.089	0.003	0.814	0.931
R3. I feel insecure and have been buying a lot of masks, remedies, disinfectant gel, gloves and/or other household products	107 (27.3)	140 (35.7)	93 (23.7)	43 (11.0)	9 (2.3)	<0.001	0.019	0.012	0.239	0.993	0.199
R4. I feel compassion for COVID-19 patients and their families. I feel sad for them	110 (28.1)	65 (16.6)	97 (24.7)	73 (18.6)	47 (12.0)	0.018	0.152	0.144	0.039	0.029	0.844
R5. No matter what I do, I feel empty and helpless	120 (30.6)	79 (20.2)	103 (26.3)	57 (14.5)	33 (8.4)	0.295	0.031	0.868	<0.001	0.742	0.045

*Based on Pearson's chi-square, significant association (p < 0.05). In cells where more than 20% of expected values were found to be <5, Fisher's exact test was considered.

TABLE 3 Changes in behavior and cognitive skills associated with sociodemographic factors of dental interns from the Peruvian capital.

Questions	Never	Occasionally	Sometimes	Often	Most of the time	Sex	Age group	Marital Status	Monthly economic income	Working area in capital city	Living with people vulnerable to COVID-19
	f (%)	f (%)	f (%)	f (%)	f (%)	*p	*p	*p	*p	*p	*p
R6. I feel powerless and angry with people around me, authorities and the media	94 (24.0)	115 (29.3)	100 (25.5)	53 (13.5)	30 (7.7)	0.578	0.109	0.527	0.062	0.007	0.598
R7. I am losing faith in people around me	139 (35.5)	101 (25.8)	97 (24.7)	33 (8.4)	22 (5.6)	0.031	0.005	0.712	0.227	0.538	0.045
R8. I tend to believe negative news about COVID-19 and have a more skeptical opinion about good news	132 (33.7)	133 (33.9)	77 (19.6)	33 (8.4)	17 (4.3)	0.005	0.370	0.960	0.018	0.388	0.379
R9. I keep an eye on information about COVID-19 all the time. Even if it is not necessary. I can't avoid it	148 (37.8)	126 (32.1)	77 (19.6)	25 (6.4)	16 (4.1)	0.995	0.243	0.004	0.144	0.152	0.846
R10. I am constantly sharing news about COVID-19 (mostly negative news)	218 (55.6)	92 (23.5)	58 (14.8)	14 (3.6)	10 (2.6)	0.092	0.126	0.822	0.616	0.578	0.511
R11. I believe all sources with information about COVID-19 without previously evaluating them	232 (59.2)	77 (19.6)	60 (15.3)	16 (4.1)	7 (1.8)	0.245	0.082	0.003	0.036	0.684	0.033
R12. I avoid watching news about COVID-19 because of the fear it generates me	152 (38.8)	102 (26.0)	76 (19.4)	39 (9.9)	23 (5.9)	0.736	0.078	0.049	0.149	0.802	0.431

*Based on Pearson's chi-square, significant association (p < 0.05). In cells where more than 20% of expected values were found to be <5, Fisher's exact test was considered.

TABLE 4 Fatigue and hyperreactivity associated with sociodemographic factors of dental interns from the Peruvian capital.

Questions	Never	Occasionally	Sometimes	Often	Most of the time	Sex	Age group	Marital status	Monthly economic income	Working area in capital city	Living with people vulnerable to COVID-19
	f (%)	f (%)	f (%)	f (%)	f (%)	*p	*p	*p	*p	*p	*p
R13. I feel more irritable and have frequent conflicts with my family	204 (52.0)	98 (25.0)	66 (16.8)	12 (3.1)	12 (3.1)	0.016	0.157	0.116	0.904	0.229	0.287
R14. I feel tired and sometimes even totally out of strength	123 (31.4)	142 (36.2)	90 (23.0)	24 (6.1)	13 (3.3)	0.061	0.016	0.034	0.160	0.347	0.655
R15. It is hard for me to concentrate	138 (35.2)	133 (33.9)	92 (23.5)	17 (4.3)	12 (3.1)	0.110	0.078	0.834	0.271	0.634	0.975
R16. Because of anxiety, my reactions are slowing down	142 (36.2)	108 (27.6)	104 (26.5)	26 (6.6)	12 (3.1)	0.160	0.032	0.629	0.099	0.824	0.903
R17. It is difficult for me to make decisions	119 (30.4)	135 (34.4)	106 (27.0)	26 (6.6)	6 (1.5)	0.232	<0.001	0.340	0.038	0.699	0.749
R18. I feel uncomfortable communicating with other people	210 (53.6)	100 (25.5)	57 (14.5)	21 (5.4)	4 (1.0)	0.008	0.009	0.640	0.052	0.984	0.023
R19. I am talking less with my family	202 (51.5)	103 (26.3)	59 (15.1)	23 (5.9)	5 (1.3)	0.169	0.232	0.671	0.031	0.305	0.125

*Based on Pearson's chi-square, significant association (p < 0.05). In cells where more than 20% of expected values were found to be <5, Fisher's exact test was considered.

was to assess the factors associated with psychological distress in dental interns from the Peruvian capital facing the COVID-19 pandemic.

Although several studies (21, 35, 36) reported, under a multivariable logistic regression model, that various factors such as sex, age, and socioeconomic status, among others, influenced psychological distress facing COVID-19, in the present study, there was no significant influence of any of the factors considered. This could be due to the fact that surveys were conducted at a time when there was a low number of infected and deceased persons (June and July 2022), which may have influenced respondents by giving them a false sense of security (37). Similarly, according to Peruvian government regulations, at the time of the survey, all participants had at least three doses of vaccine against COVID-19, which could also have contributed to feeling more confident about infection (38). In addition, it is worth mentioning that when analyzing each item of the CPD Index in each of its dimensions, associations were found with various sociodemographic factors that are relevant to highlight.

It was observed that the sex of dental interns in the Peruvian capital was associated with the feeling of insecurity and the need to buy many masks, remedies, disinfectant gel, gloves, and/or other household products. Similarly, it was associated with compassion and sadness for patients with COVID-19 and their families. It was also associated with the loss of faith in the people around them, relying on negative news about COVID-19 and doubting good news, being irritable, and having frequent conflicts with their family and discomfort when communicating with others. Finally, they were associated with dizziness, back pain or chest discomfort, constipation, or frequent urination. This could be explained according to Di Crosta et al. (39) by the fact that panic buying is influenced by negative emotions such as fear or anxiety, with women being especially more sensitive to particular situations under pressure (40, 41). In addition, trait neuroticism (being anxious and emotionally vulnerable) has been reported to be more common in women (42), as reported by other studies such as Shrestha et al. (43), Hakami et al. (44), and Ali et al. (45) who reported that women had a higher risk of developing psychological distress during the COVID-19 pandemic. Similarly, Sabrina et al. (46) and Gutiérrez et al. (47) indicated that women tend to show greater concern for the safety of their parents and relatives, and the study by Khanagar et al. (25) indicates that female students are more expressive with their emotions, while male students tend to avoid expressing their feelings. On the other hand, in relation to irritability, our findings corroborate with those reported by Zhang et al. (48) who indicated that the general irritability of women is greater than that of men. In addition, García-Sierra et al. (49) found similar results to ours, reporting that the female gender is a risk factor for somatization and psychological distress.

The findings of the present study indicated that the age group of dental interns from the capital city of Peru was

TABLE 5 Somatization associated with sociodemographic factors of dental interns from the Peruvian capital.

Questions	Never f (%)	Occasionally f (%)	Sometimes f (%)	Often f (%)	Most of the time f (%)	Sex *p	Age group *p	Marital status *p	Monthly economic income *p	Working area in capital city *p	Living with people vulnerable to COVID-19 *p
R20. During this COVID-19 period, I often feel dizzy or have back pain and/or chest discomfort	172 (43.9)	112 (28.6)	76 (19.4)	29 (7.4)	3 (0.8)	0.001	0.363	0.710	0.187	0.284	0.026
R21. During this COVID-19 period, I often have stomach pain, bloating and other stomach discomfort	183 (46.7)	103 (26.3)	78 (19.9)	22 (5.6)	6 (1.5)	0.446	0.786	0.406	0.032	0.425	0.592
R22. I can't sleep well. I dream that I or my family are infected with COVID-19	280 (71.4)	61 (15.6)	37 (9.4)	9 (2.3)	5 (1.3)	0.623	0.158	0.479	0.007	0.481	0.032
R23. I have lost my appetite	252 (64.3)	79 (20.2)	51 (13.0)	8 (2.0)	2 (0.5)	0.069	0.057	0.824	0.235	0.515	0.253
R24. I have constipation or frequent urination	189 (48.2)	95 (24.2)	70 (17.9)	26 (6.6)	12 (3.1)	0.012	0.151	0.159	0.092	0.425	0.708

*Based on Pearson's chi-square, significant association (p < 0.05). In cells where more than 20% of expected values were found to be <5, Fisher's exact test was considered.

TABLE 6 Psychological distress associated with sociodemographic factors of dental interns in the Peruvian capital.

Variables	Categories	Psychological distress							
		Bivariable analysis				Multivariable analysis			
		Normal	Mild to moderate	Severe	*p	OR	95% CI		**p
		f (%)	f (%)	f (%)			LL	UL	
X1: Sex	Female	145 (37.0)	102 (26.0)	21 (5.4)	0.190	1.39	0.88	2.19	0.154
	Male	74 (18.9)	46 (11.7)	4 (1.0)		Ref.			
X2: Age group	≤25 years	87 (22.2)	59 (15.1)	14 (3.6)	0.418	1.13	0.56	2.31	0.731
	26–35 years	104 (26.5)	72 (18.4)	7 (1.8)		1.00	0.51	1.95	0.998
	>35 years	28 (7.1)	17 (4.3)	4 (1.0)		Ref.			
X3: Marital status	Married or cohabiting	34 (8.7)	25 (6.4)	6 (1.5)	0.554	1.23	0.69	2.20	0.479
	Single	185 (47.2)	123 (31.4)	19 (4.8)		Ref.			
X4: Monthly economic income	≤250 dollars	131 (33.4)	84 (21.4)	15 (3.8)	0.327	0.78	0.36	1.69	0.528
	250–500 dollars	49 (12.5)	45 (11.5)	6 (1.5)		1.13	0.51	2.50	0.766
	500–750 dollars	21 (5.4)	6 (1.5)	1 (0.3)		0.34	0.11	1.03	0.056
	>750 dollars	18 (4.6)	13 (3.3)	3 (0.8)		Ref.			
X5: Working area in capital city	Central Lima	51 (13.0)	34 (8.7)	6 (1.5)	0.993	1.04	0.64	1.69	0.866
	East, North and South Lima	168 (42.9)	114 (29.1)	19 (4.8)		Ref.			
X6: Living with people vulnerable to COVID-19	Yes	125 (31.9)	81 (20.7)	9 (2.3)	0.134	0.84	0.55	1.27	0.400
	No	94 (24.0)	67 (17.1)	16 (4.1)		Ref.			

*Based on Pearson's chi-square. **Based on a logit model, $p < 0.05$ (significant association).

associated with the feeling of insecurity and the need to buy many masks, remedies, disinfectant gel, gloves, and/or other household products. It was also associated with the loss of faith in people around them, feelings of tiredness, and diminished strength. Moreover, it was associated with slower reactions due to the anxiety they felt and difficulty in making decisions. Finally, it was associated with discomfort when communicating with other people. This could be supported by Di Crosta et al. (39) and Arafat et al. (50) who reported that under crisis situations that threaten health or disrupt social life, such as that caused by the COVID-19 pandemic, people change their behavior leading them to buy more things than usual (panic buying or compulsive buying). This may manifest with greater intensity in young people, as they are more exposed to digital platforms that disseminate negative information. Similarly, Rens et al. (51) reported that 65% of young people experienced high levels of mental distress in this epidemiological context. Furthermore, according to the Pew Research Center, young adults aged 18–29 years exhibited higher levels of psychological distress than other age groups (52). Also, according to Cook et al. (53), young people, because of the lack of social interaction due to restrictions imposed to control the spread of SARS-CoV-2 coronavirus, were unable to create and preserve bonds of friendship that could provide them a sense of acceptance, trust, security, and support. Similarly, the COVID-19 pandemic is known to have exacerbated the mental health problems of young people in several ways by disrupting college plans, family life, or employment (54).

In the present study, it was found that the marital status of dental interns from the Peruvian capital was also associated with the feeling of insecurity and the need to buy many masks, remedies, disinfectant gel, gloves, and/or other household products. It was also associated with avoiding news about COVID-19 because of the fear it caused them and finally with the feeling of extreme tiredness. This could be supported by Ortega (55) who reported that consumer behavior depends on several factors, including cohabitation. Therefore, those who are single usually live with their parents and/or grandparents who belong to the vulnerable group, thus, in order to protect themselves, they could develop the tendency to buy more personal protection items. Also, Shrestha et al. (43) found that unmarried health professionals had an increased risk of developing a psychological disorder during the COVID-19 pandemic. In addition, the rapid propagation of false information (infodemia) through different digital media led to singles (56), being those who normally have more time to access social networks, being exposed to both real and fictitious news, generating uncertainty about the COVID-19, which is consistent with the findings of Yoshioka et al. (2) who found a significant association of psychological distress with being single or divorced/separated. Similarly, several studies report that loneliness is a risk factor for developing mental disorders under situations of constant pressure (57–60).

On the other hand, the monthly income of stomatology interns in the Peruvian capital was associated with concern for the possible contagion on themselves or their family members, sadness, and compassion for patients with COVID-19 and their families. It was also associated with the feeling of vulnerability and emptiness, with believing negative news and distrusting good news about COVID-19. Finally, it was associated with stomach pain and bloating, and disturbed sleep due to worry about being infected themselves or their family members. These findings could be explained by the fact that, during the pandemic, social attention by government agencies was reduced because healthcare had to be prioritized, affecting those with the lowest income the most (61). Possibly, this situation generated a certain type of psychological distress since they had to go out into the streets to seek sustenance under risky conditions such as coming into contact with infected people, putting their family members at risk of cross-infection. Similarly, our findings are consistent with the study by Sabrina et al. (46) who reported that 58.1% of dental students said that COVID-19 had a negative impact on their financial situation, causing them greater levels of distress. According to Viertiö et al. (58) and Ahnkist et al. (62), financial difficulties in covering household costs appear to have negative effects on mental health. They also reported that change in employment status and an uncertain financial situation was associated with increased psychological distress and fear, which is corroborated by the study of Rahman et al. (63) who found that 51% of participants surveyed had their jobs compromised by the COVID-19 pandemic, suffering from job loss, reduced working hours, and pay cuts.

In the present study, the Peruvian capital area where dental interns worked was associated with feelings of compassion and sadness for patients with COVID-19 and their families, as well as with helplessness and anger with people, authorities, and the media. This could be supported by the study findings of Chen et al. (64) who indicated that peri-urban communities are marked by limited infrastructure, material deprivation, greater insecurity, and lack of health services. This may have an impact on mental health since the infrastructure and work environments may not be a guarantee of protection against contagion as the demand in these areas is higher, being agglomerations unavoidable.

Dental interns from the Peruvian capital who lived with vulnerable persons were associated with feelings of emptiness and fragility, lack of trust in the people around them, trusting sources with information about COVID-19, discomfort when communicating with other people, and also with dizziness, back pain, chest discomfort, and not sleeping well because they were worried about infecting themselves or their family members. This can be explained by what was found in the study by Abdul et al. (65) who reported that relatives of a critically ill or vulnerable patient presented high levels of anxiety, depression, and stress, perhaps due to the fear that

these relatives with comorbidities could be severely affected in their health, complicating it to the point of death risk. This concern was heightened during times of pandemic due to the unknown nature of the disease and its treatment, which is consistent with the data on the increase in the COVID-19 impact index associated with the increase in the prevalence of major depressive disorder and anxiety (4).

The importance of the present study lies in the fact that the results obtained could contribute to the assessment of the psychological morbidity of dental interns, in order to establish lines of action and prevent adverse consequences that could lead them to develop emotional, physiological, and behavioral alterations. Similarly, these results will help to plan the necessary modifications in the educational curriculum according to the current context for the design and implementation of strategies and techniques of emotional intelligence as part of it, as well as to provide student support services for unfortunate situations in times of crisis (24).

This study had some limitations, such as not being able to evaluate the respondents in person, because hospitals still restrict access to external personnel so that they can take personalized surveys due to the pandemic. Another factor that has not been considered in this study is having been ill with COVID-19 since many of the interns are young and most of them have been asymptomatic against COVID-19 and 100% of them have had at least three doses of vaccines. It should be noted that this type of study may present potential selection biases since dental interns presented different sociodemographic characteristics, so possible confounding variables such as marital status, monthly economic income, working area of the capital city, and living with people vulnerable to COVID-19 were controlled (21, 35, 36). It should also be recognized that associations of sociodemographic factors with CPD index items found in the present study do not necessarily constitute evidence of causality. Dental interns who received psychological treatment were excluded because their distress could be attenuated by having received support and follow-up by a professional, which would not allow us to have real data about the impact of the pandemic on their emotional state. Also, the present study did not include the evaluation of the academic and clinical load of the dental interns, which could influence the levels of psychological distress, so it is recommended to take them into account for future research. Another limitation was that the snowball sampling method used did not allow for the calculation of a response rate to the invitation made to dental interns. Finally, the cross-sectional design does not allow us to assess the dynamism and sustainability over time of dental interns facing psychological distress.

It is recommended in the future to carry out studies with a longitudinal design that assess the psychological impact of COVID-19 and the level of acceptance of therapeutic support received. Furthermore, it is recommended that the same aim of the present study be pursued with students in preclinical and clinical areas since Hughes et al. (66) reported moderate levels of psychological distress due to students being faced with the abrupt variation of pedagogical learning resources adapted to a virtual environment (67). Additionally, it is suggested that relevant authorities in professional schools and universities take into account the organization of preventive plans and strategies to overcome the long-term effects of psychological distress, involving policymakers, non-governmental organizations, parents, students, and other concerned organizations.

Conclusion

In summary, considering the limitations of the present cross-sectional study, it can be concluded that 44.2% of the dental interns from the Peruvian capital presented psychological distress facing COVID-19, without any of the possible associated variables in this study significantly influencing this behavioral disorder. However, it is recommended that relevant authorities take into account the organization of preventive plans and strategies in order to manage in a timely manner the technical, economic, pedagogical, psychological, and nutritional assistance of students who undergo hospital internships, to prevent them from developing psychological distress that would seriously affect their work performance and, even worse, their mental health.

Data availability statement

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

Ethics statement

This research was approved by the Institutional Ethics Committee of the Universidad Privada San Juan Bautista with resolution No. 823-2022-CIEI-UPSJB. The patients/participants provided their virtual informed consent to participate in this study.

Author contributions

CC-R conceived the research idea. CC-R, NC-L, ML-C, and GB-V elaborated on the manuscript. MC-M and CC-R collected and tabulated the information. CL-G, NC-L,

ML-C, CC-R, and LC-G carried out the bibliographic search. CC-R and AC-P interpreted the statistical results. CC-R, NC-L, GB-V, ML-C, and RA-R helped in the development of the discussion. CC-R, LC-G, RA-R, NC-L, ML-C, and CL-G performed the critical revision of the manuscript. All authors approved the final version of the manuscript.

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Conflict of interest

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

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The other side of COVID-19: A cross-sectional study on mental health in a sample of Italian nurses during the second wave

Erika Renzi[1]*, Valentin Imeshtari[1], Dima Masud[2],
Valentina Baccolini[1], Giuseppe Migliara[1], Giulia Gasperini[3,4],
Corrado De Vito[1], Carolina Marzuillo[1], Paolo Villari[1] and
Azzurra Massimi[1]

[1]Department of Public Health and Infectious Diseases, Sapienza University of Rome, Rome, Italy,
[2]Emergency Department, Sandro Pertini Hospital, Rome, Italy, [3]Department of Translational and
Precision Medicine, Umberto I Teaching Hospital, Rome, Italy, [4]Department of Biomedicine and
Prevention, University of Rome Tor Vergata, Rome, Italy

Introduction: The COVID-19 pandemic has led to a drastic increase in the workload of healthcare professionals, particularly nurses, with serious consequences for their psychological well-being. Our study aimed to identify demographic and work-related factors, as well as clinical predictors of post-traumatic stress disorder (PTSD) and generalized anxiety disorder (GAD), in nurses employed during the COVID-19 pandemic.

Methods: We carried out a cross-sectional study between December 2020 and April 2021 on nurses employed during the COVID-19 second wave (October - December 2020). We evaluated PTSD and GAD using two validated questionnaires: i) the Impact of Event Scale – Revised (IES-R); and ii) General Anxiety Disorder −7 (GAD-7).

Results: Overall, 400 nurses, whose mean age was 34.3 years (SD $\pm$ 11.7), were included in the study. Most were female (78.5%), unmarried (58.5%) and employed in the central (61.5%) regions of Italy. A total of 56.8% of all participants had clinical predictors of PTSD, recording a median IES-R score (IQR) of 37.0 (22.0, 51.0) (range 1-84; cut-off >33 for PTSD). Furthermore, 50% of respondents reported moderate-to-severe symptoms consistent with GAD, recording a median GAD-7 score (IQR) of 9.5 (6.0,14.0) (range 0-21; cut-off >10 for GAD). Multivariable analysis showed that moderate-to-severe GAD (aOR = 4.54, 95% CI: 2.93 - 7.05), being employed in the critical care area (aOR = 1.74, 95% CI: 1.01 - 3.00) and being female (aOR= 1.88, 95% CI: 1.09 - 3.22) were significantly associated with the presence of clinical predictors of PTSD.

Discussion: The levels of PTSD symptoms and anxiety among nurses were high during the pandemic. PTSD and GAD represent a public health problem that should be addressed in the post-pandemic period. Healthcare organizations need to activate specific support and rehabilitation networks and programs for healthcare professionals employed during the COVID-19 pandemic.

KEYWORDS

nursing, mental health, COVID-19, post-traumatic stress disorder, generalized anxiety disorder

1. Introduction

Since the beginning of the COVID-19 pandemic, healthcare workers (HCWs) were in the front line, assisting patients with COVID-19; they faced an unexpected and sudden increase in healthcare demands and were exposed to a high risk of contracting the disease (1). Furthermore, because of the fear of contagion and the social-distance measures put in place to contain the pandemic, HCWs often could not or chose not to see their families and friends for long periods, so they found themselves alone and with no emotional support. Such conditions are known to have negative effects on the psychological health of HCWs (2, 3).

Psychological sequelae secondary to the outbreak of an epidemic have already been reported for Middle East respiratory syndrome (MERS) in 2012 and severe acute respiratory syndrome (SARS) in 2003, in which symptoms of post-traumatic stress disorder (PTSD), sleep disorders, social isolation, work-related stress, burnout, and generalized anxiety disorder (GAD) were reported in HCWs (4–7). In the case of the COVID-19 pandemic, the scientific literature shows that HCWs, especially nurses and women who worked in the front line and in emergency areas, experienced more severe mental health symptoms than others (3). According to a meta-review of systematic reviews, GAD and PTSD were the most prevalent COVID-19 pandemic-related mental health conditions affecting HCWs, especially nurses (8). Several more detailed studies, conducted after the first wave of the pandemic in China, reported that HCWs suffered from anxiety and stress-related symptoms, with prevalence ranging from 28.5 to 36.1% and 24 to 73.4%, respectively (9–11). In addition, some studies have reported high levels of anxiety and acute stress disorders in nurses more than a year after the start of the pandemic (12, 13).

Focusing attention on the psychological impact of COVID-19 on HCWs, particularly on the Italian nurses who were among the first in Europe to deal with the pandemic and to assist COVID-19 patients (14), is crucial to investigate if such HCWs are to be offered the right tools to face this extraordinary scenario and to preserve their mental health, both as individuals and as actors in the National Health Service. In the Italian context, relatively few studies have investigated the prevalence of GAD and PTSD in HCWs, and most of these were conducted exclusively during the first wave of COVID-19 (15, 16), focusing on local contexts (12, 17, 18). Given this, we conducted a study on a national sample of nurses employed during the second wave of the COVID-19 pandemic to investigate the long-term impact on nurses' mental health, with the specific aims of (i) determining the prevalence of symptoms of potential GAD and PTSD; (ii) identifying possible predictors of PTSD.

2. Materials and methods

2.1. Setting and participants

We conducted a cross-sectional survey, using a convenience sample of Italian nurses who worked on the front line during the second wave of the COVID-19 pandemic (October–December 2020) (19, 20). The survey followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (21) (Supplementary Material S1) and was disseminated through social-media platforms (Facebook,

Telegram, Instagram), as well as specific social-media groups for nurses. Data collection was performed between December 2020 and April 2021. Nurses were invited to take part voluntarily in an online survey accessible *via* smartphone through a Google Form link. The study was performed in accordance with the World Medical Association Declaration of Helsinki. Participants were asked for their consent and were guaranteed anonymity in the information collected. The institutional ethics board of the Umberto I Teaching Hospital/Sapienza University of Rome approved this study (protocol 0489/2021).

2.2. Questionnaire

We developed a 41-item survey based on the literature. The questionnaire comprised three sections. The first section included 12 items that aimed to collect socio-demographic and occupational data: gender, age, nationality, marital status, employment information (department, area, employment in COVID-19 area during the first wave, and geographical context), and COVID-19 personal history (previous SARS-CoV-2 infection and experience). The second section aimed to investigate anxiety disorders: in this case, Generalized Anxiety Disorder-7 (GAD-7), a questionnaire for GAD screening, was used in its validated Italian version. The scale assigns a score from 0 (not at all) to 3 (almost every day) based on the frequency of reported symptoms over the previous 14 days. The total GAD-7 score for the seven items ranges from 0 to 21. Based on the total score, it is possible to stratify the presence of symptoms of GAD (0–4: minimal anxiety; 5–9: mild anxiety; 10–14: moderate anxiety; 15–21: severe anxiety) (22). The third section assessed acute stress reactions and the increased likelihood of having PTSD using a validated questionnaire, Impact of Event Scale-Revised (IES-R), which has demonstrated good internal consistency in the Italian version (23). IES-R is a 22-item scale that is rated from 0 (not at all) to 4 (extremely) with respect to how distressing each item was during the last 7 days. For the purposes of our study, we modified the IES-R instructions by contextualizing the questionnaire to the COVID-19 experience of the 7 days prior. The total IES-R score for the 22 items ranges from 0 to 88. The scale scores are determined from three subscales, which reflect intrusion (8 items), avoidance (8 items), and hyperarousal (6 items; see Table 1 for definitions).

2.3. Statistical analysis

Descriptive statistics were obtained using the median and interquartile range, or mean and standard deviation, for continuous variables, and proportions for dichotomous and categorical variables. The COVID-19 employment area was categorized into five categories: critical care (i.e., emergency departments, intensive care units), medical wards (also including nursing homes), surgical wards, primary care (i.e., COVID-19 vaccination services, COVID-19 testing programs, contact tracing units, and home-care services for COVID-19 patients), and other (i.e., mental-health units, rehabilitation units). The age of the nurses was classified according to the average age (35 years). The presence or absence of symptoms of PTSD and GAD were assessed using validated questionnaires and were classified as either being present or absent (two variables). To

TABLE 1 Impact of Event Scale-Revised (IES-R) subscale definition.

IES-R subscale (PTSD symptoms)	Definition
Avoidance	The practice or an instance of keeping away from particular situations, environments, individuals, or things because of either (a) the anticipated negative consequence of such an encounter or (b) anxious or painful feelings associated with them (APA Dictionary). *For example: avoiding reminders of trauma; losing interest in activities*
Hyperarousal	One of three sets of criteria used to diagnose post-traumatic stress disorder and acute stress disorder. Symptoms of hyperarousal include exaggerated startle response, disturbed sleep, difficulty in concentrating or remembering, and excessive vigilance (APA Dictionary). *For example: difficulty sleeping; angry outbursts*
Intrusion (or intrusive thoughts)	Mental events that interrupt the flow of task-related thoughts in spite of efforts to avoid them (APA Dictionary). *For example: nightmares; reliving trauma*

IES-R, impact of Event Scale-Revised; PTSD, post-traumatic stress disorder.

assess GAD-7, we classified a score > 10 as "presence of moderate/ severe symptoms of GAD". PTSD was classified into two levels: IES-R scores ≥ 33 were classified as "presence of symptoms of PTSD" and scores < 33 as "absence of symptoms of PTSD". For the univariable analysis, Pearson's chi-squared test was used for dichotomous and categorical variables, while the Mann–Whitney U Test was used to compare continuous variables between females and males. A multivariable logistic-regression model was built to identify predictors of PTSD. According to the Hosmer and Lemeshow logistic-regression model building strategy, the variables examined by univariate analysis using the appropriate statistical test were included in the model when the *p*-value was less than 0.25 (see Supplementary Material S2). We also included variables described by opinion of experts and literature to provide a complete control of confounding. All variables initially tested were retained in the final model because their exclusion altered the aORs of the other variables. The only exception was the variable "years of working" which was removed due to collinearity with the variable "age". The final model consisted of the following variables: sex (female vs. male), age (≤ 35 and > 35 years), marital status (married/engaged vs. single/unmarried/separated/divorced), region of employment (northern Italy vs. center, south Italy, and Islands), nurses employed in COVID-19 wards during the first and second waves, COVID-19 employment wards/area (primary care, critical care, medical wards, surgical wards and other), COVID-19 previous infection, symptomatic COVID-19 positive member of family/friends and presence of moderate-to-severe GAD (GAD-7 score ≥ 10). Results were expressed as adjusted odds ratios (aOR), their 95% confidence intervals (CI), and *p*-value. A *p*-value < 0.05 was considered statistically significant. All analyses were performed using Stata (StataCorp LLC, 4905 Lakeway Drive, College Station, TX, United States), version 17.0.

3. Results

3.1. Characteristics of the sample

A total of 400 nurses employed in 19 of the 21 Italian Regions (19 administrative Regions and two autonomous provinces) during the second wave of the COVID-19 pandemic completed the survey. In line with the gender distribution of nurses in Italy [76.45% women (24)], most of the sample was female (78.7%), unmarried (58.5%), and employed in central Italy (61.5%), with a mean age of 34.3 ± 11.8 years. The years of professional experience for the overall sample

ranged from 0 to 43 years (mean = 16 years, SD= ± 11.9). Most respondents worked in COVID-19 units during both the first and second waves of the pandemic (195; 51.3%); the main areas of work were critical (37.0%) and primary (35.3%) care. Finally, 19% of the sample reported a previous SARS-CoV-2 infection (Table 2).

3.2. Generalized anxiety disorder

The median GAD-7 score (IQR) was 9.5 (6.0,14.0; range: 0–21). Of the four severity categories, only 63 nurses (15.8%) reported as being in a normal state, while the remaining 337 (84.2%) experienced symptoms of anxiety, from mild (*n* = 137, 34.2%) to moderate (*n* = 106, 26.5%), and up to severe GAD (*n* = 94, 23.5%). Based on the cut-off value of 10, the prevalence of symptoms of GAD was 50% (*n* = 200). There was a gender difference in score distribution, with females having a higher median than males: 10.0 (6.0,14.0) vs. 8.0 (6.0,14.0; Table 3).

3.3. Post-traumatic stress disorder

Participants recorded IES-R scores ranging from 0 to 84, with a median score (IQR) of 37.0 (22.0, 51.0). According to the predefined cut-off for assessing the presence of PTSD symptoms (IES-R scores ≥ 33), of the 227 participants (56.8%) who scored above the cut-off, 195 (85.9%) attained scores higher than 39 (Table 4). The median IES-R score (IQR) of female nurses was higher than that of male nurses: 38.0 (24.0, 52.0) vs. 30.0 (22.0, 45.0; Table 2). Similar gender differences were found for the median subscale scores (IQR): female nurses had a higher median score (IQR) for the *hyperarousal subscale* [8.0 (4.0, 12.0) vs. 6.0 (3.0, 11.0), *p*-value = 0.034] and *intrusion subscale* [16.0 (9.0, 21.0) vs. 13.0 (6.0, 9.0), *p*-value = 0.007]. The items with the highest median score were those in the *intrusion subscale* (Table 5).

3.4. Multivariable analysis

At the multivariable analysis, higher odds of PTSD symptoms were found for nurses with presence of symptoms for moderate-to-severe GAD (aOR = 4.54, 95% CI: 2.93 to 7.05). Similarly, being female (aOR= 1.88, 95% CI: 1.09 to 3.22) and employment in the critical care area (aOR = 1.74, 95% CI: 1.01 to 3.00) were associated with the

TABLE 2 General characteristics of the survey sample.

Variable	Frequency (%)	Mean (±SD)
Age		34.3 ± 11.8
Sex		
Female	315 (78.7)	
Male	85 (21.3)	
Years of working		16.1 ± 11.9
≤1 year	107 (26.8)	
2–5 years	121 (30.2)	
5–10 years	45 (11.3)	
>10 years	125 (31.2)	
Missing system	2 (0.5)	
Marital status		
Single/unmarried	214 (53.5)	
Married/engaged	166 (41.5)	
Separated/divorced	20 (5.0)	
Region of employment		
North	116 (29.0)	
Centre	246 (61.5)	
South and Island	38 (9.5)	
Employed in COVID-19 wards during first wave (March–May 2020)		
Yes	195 (51.3)	
No	205 (48.7)	
COVID-19 employment wards/area		
Critical care	148 (37.0)	
Medical wards	89 (22.2)	
Surgical wards	6 (1.5)	
Primary care	141 (35.3)	
Other	16 (4.0)	
COVID-19-positive		
Yes	76 (19.0)	
No	324 (81.0)	
COVID-19 cases among family members/friends		
Yes	83 (20.8)	
No	317 (79.2)	

SD, standard deviation.

presence of symptoms of PTSD. In contrast, age, marital status, employment in COVID-19 units continually during both the first and second waves, employment in a COVID-19 area in Northern Italy, and previous SARS-CoV-2 infection did not appear to increase the likelihood of having symptoms of PTSD (Table 6).

4. Discussion and conclusion

This study aimed to assess the prevalence of symptoms of GAD and PTSD among nurses employed during the second wave of COVID-19 in Italy and to evaluate the factors influencing PTSD in this sample.

Overall, the results of the present study confirm that the COVID-19 pandemic has had a profoundly negative effect on the mental health of Italian nurses.

Generalized anxiety disorder symptoms were reported by half the nursing population sample employed during the second wave of the pandemic. The prevalence of symptoms of anxiety appears in line with the international context. In fact, during the global pandemic, anxiety was the most prevalent mental disorder in HCWs and prevalence was significantly higher than in the general population, with a similar distribution in the pooled prevalence across all geographic areas: global 42%, (25) Africa 49% (26), South America 35% (27), Eastern Europe 30% (28), and Southeast Asia 23% (9). These results are also consistent with other studies conducted in Italy and other European

TABLE 3 Distribution of generalized anxiety disorder and post-traumatic stress disorder scores in the study sample and by gender.

Severity category (score range)	N (%)	Female	Male	p-Value
		N (%)	N (%)	
GAD-7				0.149
Total sample	400 (100)	315 (100)	85 (100)	
Normal (0–4)	63 (15.8)	51 (16.2)	12 (14.1)	
Mild (5–9)	137 (34.2)	99 (31.4)	38 (44.7)	
Moderate (10–14)	106 (26.5)	87 (27.6)	19 (22.4)	
Severe (15–21)	94 (23.5)	78 (24.8)	16 (18.8)	
IES-R				
Total sample	400 (100)	315 (100)	85 (100)	0.012
Absence of symptoms for PTSD (0–32)	173 (44.2)	126 (40.0)	47 (55.3)	
Presence of symptoms for PTSD (33–88)	227 (56.8)	189 (60.0)	38 (44.7)	

GAD-7, generalized anxiety disorder-7 questionnaire; IES-R, impact of Event Scale-Revised; PTSD, post-traumatic stress disorder.

TABLE 4 Median of generalized anxiety disorder and post-traumatic stress disorder scores in the study sample and by gender.

Scale	Total score, median	IQR	Female		Male		p-Value
			Total score, median	IQR	Total score, median	IQR	
GAD-7	9.5	6.0–14.0	10.0	6.0–14.0	8.0	6.0–14.0	0.133
IES-R	37.0	22.0–51.0	38.0	24.0–52.0	30.0	22.0–45.0	0.059

IQR, interquartile range; GAD-7, generalized anxiety disorder-7 questionnaire; IES-R, impact of Event Scale-Revised.

countries (25, 29–31). Significant differences were observed in the occurrence and severity of the condition according to gender, with female nurses reporting a higher median GAD-7 score. However, even before the pandemic, anxiety overload in the nursing profession, together with its symptomatic manifestations and their potential effect on patient safety, appeared to be a well-established phenomenon: pre-pandemic studies reported a prevalence of GAD greater than 35% in the nursing population, with a particular impact on female nurses (32–36). Therefore, to rebuild a healthcare system challenged by COVID-19, it will be necessary to increase efforts to screen and diagnose anxiety disorders in healthcare providers.

In the case of PTSD, the recorded IES-R scores suggest the presence of PTSD symptoms in almost 60% of the sample. This is markedly higher than the prevalence shown in pre-pandemic studies, which reported PTSD in 7–21% of nurses (37, 38). However, our findings are still consistent with studies carried out during other emergencies/crisis periods when HCWs, particularly nurses and frontline workers, experienced higher levels of psychological distress, anxiety, and PTSD (39). In addition, recent systematic reviews have reported a prevalence of PTSD among HCWs ranging from 21.5% to 73.5% (25, 40); in studies conducted specifically in Italy, during the current pandemic, the reported levels of PTSD symptoms ranged from 37.2% to 52.6% (16, 31). Another finding that emerged from our study was the gender difference in the distribution of mental-health conditions, with a higher prevalence of psychological symptoms of PTSD in females, which is also in line with a recent systematic review of the literature (41). Women are more likely than men to suffer from psychological disorders due to a combination of multiple biological, social, and gender-role factors. Gender differences are extensively described in the literature and in

psychopathology texts: the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the U.S. National Center for PTSD define being female as a risk factor for the development of PTSD (42–44). This difference is evident both in the median IES-R score of the sample (female nurses 38.0 vs. male nurses 30.0) and in terms of symptomatology, with a significant difference in the presence of symptoms related to intrusion and hyperarousal. With reference to intrusion symptoms, higher scores were recorded in the female sample, especially for the intrusive emotional experience (reliving negative feelings). Although this characteristic is typical of the period immediately following a traumatic event, its persistence over months seems to be a good predictor of long-term PTSD (45). This suggests that PTSD-related disorders resulting from COVID-19 could be a serious problem that needs addressing during the transition to post-pandemic conditions: interventions will be needed to support nurses to ensure a healthy workforce.

Differences in the prevalence of symptoms of PTSD could be explained by multiple factors, such as the specific temporal and epidemiological context in which the study was conducted, the characteristics of the organization (e.g., the presence of professional support for HCWs), and the context in which nurses are employed (e.g., type of COVID-19 work area) (16). In our study, nurses employed in the critical care area had a higher likelihood of a diagnosis of PTSD. This result is in line with data from the literature and previous pandemics (46–54). Nurses employed in critical care directly cared for COVID-19 patients and thus experienced patient deaths more frequently and had to make difficult decisions about the allocation of resources and equipment for the people in their care (41, 55–57). They were also exposed to greater health risks as a result of working with

TABLE 5 IES-R subscale scores in the study sample and by gender.

Impact of Event Scale-Revised (IES-R)		Median (IQR)			p-Value
Subscale	Items	Total	Female	Male	
Avoidance					
	I avoided letting myself get upset when I thought about it or was reminded of it	2.0 (1.0, 3.0)			
	I felt as if it had not happened or wasn't real	1.0 (0.0, 2.0)			
	I stayed away from reminders of it	1.0 (0.0, 2.0)			
	I tried not to think about it	2.0 (1.0, 3.0)			
	I was aware that I still had a lot of feelings about it, but I did not deal with them	2.0 (1.0, 3.0)			
	My feelings about it were kind of numb	1.0 (0.0, 2.0)			
	I tried to remove it from my memory	1.0 (0.0, 2.0)			
	I tried not to talk about it	1.0 (0.0, 2.0)			
	Median score for *Avoidance Subscale*	14.0 (9.0, 19.0)	14.0 (9.0, 19.0)	13.0 (8.0, 18.0)	0.426
Hyperarousal					
	I felt irritable and angry	2.0 (1.0, 3.0)			
	I was jumpy and easily startled	2.0 (1.0, 3.0)			
	I had trouble falling asleep.	2.0 (0.0, 3.0)			
	I had trouble concentrating	1.0 (0.0, 2.0)			
	Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart	0.0 (0.0, 1.0)			
	I felt watchful and on-guard	2.0 (1.0, 3.0)			
	Median score for *Hyperarousal Subscale*	8.0 (4.0, 11.00)	8.0 (4.0, 12.0)	6.0 (3.0, 11.00)	0.034
Intrusion					
	Any reminder brought back feelings about it	2.0 (1.0, 3.0)			
	I had trouble staying asleep	2.0 (0.0, 3.0)			
	Other things kept making me think about it	2.0 (1.0, 3.0)			
	I thought about it when I did not mean to	2.0 (1.0, 3.0)			
	Pictures about it popped into my mind	2.0 (1.0, 3.0)			
	I found myself acting or feeling like I was back at that time	2.0 (1.0, 3.0)			
	I had waves of strong feelings about it	1.0 (0.0, 2.0)			
	I had dreams about it	2.0 (1.0, 3.0)			
	Median score for *Intrusion Subscale*	15.0 (8.0, 20.0)	16.0 (9.0, 21.0)	13.0 (6.0, 19.0)	0.007

*Item response anchors are 0, not at all; 1, a little bit; 2, moderately; 3, quite a bit; 4, extremely; IQR, interquartile range.

infected patients who required constant nursing care (58). In addition, female nurses, and nurses of both sexes with moderate-to-severe symptoms of GAD, reported more severe clinical predictors of PTSD. The literature supports these findings: in particular, a systematic review with a meta-analysis found a positive correlation between being female, anxiety, and PTSD during the pandemic (40), especially in nurses employed on the front line of care for COVID-19 patients (59). On the other hand, our model did not report associations for some predictors of PTSD described in the pandemic literature. Thus, marital status, being of young age, having worked continuously in COVID-19 units (first and second waves), and having been infected with COVID-19 were not found to be predictors of PTSD for the nurses examined, although they emerged as variables of interest in other studies (39, 60).

Some limitations of this study must be addressed. First, the selection of the sample was carried out by a snowball sampling procedure *via* social media using an online survey link. This has some limitations, as the method does not guarantee that the sample is representative of the larger population, especially due to the possibility that nurses with risk factors were more likely to participate and complete the survey. On the other hand, the selection method is easy to perform and allows the recruitment of a larger number of relevant individuals, and we therefore feel it is suitable for an exploratory analysis. Second, the survey used a self-reported questionnaire, which does not investigate the psychological status of nurses, especially for sensitive topics. However, to avoid bias, we adopted two validated questionnaires with reliable cut-offs that have been widely used in the study population. The above limitations have also been described in some of the pandemic literature and appear to be acceptable and

TABLE 6 Factors associated with post-traumatic stress disorder (IES-R $\geq$ 33) in nurses.

Post-traumatic stress disorder		aOR	95% CI	p-value
Sex (female)		1.88	1.09–3.22	0.022
Age (≤35 years old)		1.14	0.70–1.85	0.606
Marital status (married)		1.13	0.70–1.84	0.608
Employed in Northern Italy		0.90	0.77–2.10	0.342
Employed in COVID-19 departments during the first and second waves		1.09	0.56–1.45	0.669
COVID-19 employment wards/area				
	Primary care	Ref.		
	Critical care	1.74	1.01–3.00	0.046
	Medical wards	1.33	0.73–2.43	0.353
	Surgical wards	1.12	0.19–6.63	0.901
	Other	1.30	0.41–4.13	0.652
COVID-19-positive		1.48	0.82–2.68	0.197
Symptomatic COVID-19-positive family members/friends		0.81	0.51–1.28	0.362
Generalized anxiety disorder (moderate–severe)		4.54	2.93–7.05	0.001

aOR, odds ratio; CI, confidence interval.

understandable given the particularity of the pandemic context. In addition, the authors are aware that multiple other factors, such as a concurrent traumatic event experienced by HCWs, or pre-existing COVID-19 disorders, may have influenced our results. However, this summary allows us to obtain a current view of the emotional and psychological state of the nurses analyzed. Finally, the cross-sectional design of the study is a limitation, especially since it is a single measurement in a changing context (i.e., the pandemic); however, pending longitudinal analyses, these data can provide a useful overview of the health problem in question.

In conclusion, levels of PTSD symptoms and anxiety among nurses were high during the pandemic (27, 28) especially in the female sample (10, 61). These findings suggest that, as a primary prevention measure, screening for psychological problems among HCWs should be carefully conducted by healthcare organizations to protect the most vulnerable. Screening for anxiety disorders should be a priority; assessment can be conducted using commonly used validated instruments, such as the GAD-7 questionnaire. Indeed, assessment of anxiety disorders appears to be a reliable predictor for second-level screening of, for example, PTSD in employees with higher-than-average anxiety scores. This would enable organizations to identify the extent of the disorder early and to direct the at-risk population to targeted psychological support interventions. Routine assessment of nurses' mental well-being is critical considering the results on reported PTDS symptoms, which seem to predict, especially for females, possible long-term sequelae (strong presence of intrusion symptoms). Finally, it seems necessary to implement gender policies in the post-pandemic period to address and modify support services specifically for female nurses, who have emerged as a vulnerable target population. The implementation of an early screening service for GAD and PTSD and the establishment of psychological programs for nurses (especially for those employed in critical care settings) seem to be mandatory actions that are required to promote organizational well-being and improve the quality of care. In addition, the scientific literature highlights that acute COVID-19 stress-related disorders and personal growth are linked and influenced by multiple factors. For this reason, it is necessary to develop support

strategies that consider the resilience and emotions regulation skills of HCWs as an instrument for growth and psychological well-being. This strategy must be implemented at the organizational level with the purpose of promoting social support (62).

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Ethics Board of the Policlinico Umberto I Teaching Hospital/Sapienza University of Rome (protocol number 0489/2021). The patients/participants provided their written informed consent to participate in this study.

Author contributions

Acknowledgments

Conflict of interest

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

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1083693/full#supplementary-material

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The psychological impact of COVID-19 on healthcare work force in the Middle East region C-S study

Marwa Ahmed El-Gammal[1]*, Amira Elgendy[2], Petra Heidler[3,4],
Tarek A. Owais[5], Nael Kamel Eltewacy[5,6] and
Nouran Hamza[2,7] the EARG group

[1]Nanotechnology Program, The American University of Cairo, Cairo, Egypt, [2]Medical Agency for Research
and Statistics, Cairo, Egypt, [3]Department of International Business and Export Management, IMC University
of Applied Management Sciences Krems, Krems an der Donau, Austria, [4]Department of Health Sciences,
St. Pölten University of Applied Sciences, St. Pölten, Austria, [5]Faculty of Pharmacy, Beni-Suef University,
Beni Suef, Egypt, [6]Eltewacy Arab Research Group, Cairo, Egypt, [7]Clinical Research Key, Nairobi, Kenya

Introduction: COVID-19, is one of the biggest challenges facing humanity in the 21st century (1). The pandemic outbreak as affected all human activities, starting with healthcare and medical service passing with economy and social relationships, as well as political, religious and cultural enactments (2). The healthcare workers were the most affected fighting in the frontline working longer hours under a high risk of being infected (3). This study aims to assess the depression, anxiety and stress levels of the healthcare workforce (physicians, nurses, pharmacists and dentists) in the Middle East and North Africa—MENA—region.

Methods: We invited healthcare workers in the Middle East to participate in our cross-sectional survey by answering to the DASS-21 questionnaire.

Results: A total of 4,845 healthcare workers participated in the study. The participants were from 11 countries as follows: 436 from Egypt, 430 from Algeria, 458 from Iraq, 453 from Jordan, 473 from Libya, 428 from Palestine, 419 from Saudi Arabia, 452 from Sudan, 451 from Syria, 424 from Tunisia, and 421 from Yemen. The doctors among the healthcare workers were 51.7%, 19.0% were from the nursing staff, 16.8% were pharmacists, and 12.5% were from dentists. The depression level among the healthcare workers was as follows: 29.1% were normal, 13.7% were mildly depressed, 26.9% were moderately depressed, 14.4% were suffering from severe depression, and the depression state was extremely severe for the last 15.9%. At the same time, 29.1% were suffering from no anxiety, while 6.9% were at a mild level, 22.3% were at a moderate level, 13.4% were at a severe level, and 28.3% were at an extremely severe level. For the stress levels, 38.6% were normal, 14.9% were suffering from mild stress, 20.3% were moderate, 17.4% were severe, and the stress level was extremely severe for the other 8.9%.

Discussion: This study indicates that in the Middle East and North Africa—MENA—region, the prevalence of depression, anxiety, and stress among the healthcare workforce during the COVID-19 pandemic was 70.9, 70.9, 61.4, respectively.

KEYWORDS

COVID-19, psychology, healthcare worker (HCW), depression, anxiety, stress, wellbeing

Introduction

SARS corona virus-2, known as COVID-19, is one of the biggest challenges facing humanity in the 21st century (1). The pandemic outbreak as affected all human activities, starting with healthcare and medical service passing with economy and social relationships, as well as political, religious and cultural enactments (2). The healthcare workers were the most affected fighting in the frontline working longer hours under a high risk of being infected (3). They were saving lives and facing enormous physical and psychological pressure, working hard and being socially isolated from their families and friends (4).

Globally health care workers were experiencing anxiety, depression, exhaustion, Post-traumatic stress disorder (PTSD), stress and mental health issues (5, 6). This study aims to assess the depression, anxiety and stress levels of the healthcare workforce (physicians, nurses, pharmacists, and dentists) in the Middle East and North Africa—MENA—region. This region is facing poverty, deficiency on the personal protective equipment (PPE) and civil wars. According to the UN Syria is one of the countries that are undergoing "the largest humanitarian crisis since the second world war" (1, 7) and Yemen where it's crisis was described by the UN in 2017 as the worst humanitarian crisis since 1945 (8). In addition, war, riots and terrorism complicate the situation in Libya, Palestine, South Sudan, Ethiopia, Central African Republic, Mali, Niger, Burkina Faso, and Cameroon.

Our investigation includes 11 countries from the MENA region (Egypt, Algeria, Iraq, Jordon, Libya, Palestine, Saudi Arabia, Sudan, Syria, Tunisia, and Yemen) using the depression anxiety stress scale (DASS-21). In addition, our study aimed to assess the psychological effect of COVID-19 infection on the mental health of individuals by calculating the odds ratio of the psychological state of those who were infected with COVID-19 to that of others who did not have the disease. Moreover, the study aimed to assess the effect of the vaccines on the mental health of the individuals through the same criteria.

Methodology

Study design and participants

We invited healthcare workers in the Middle East to participate in our cross-sectional survey between November 2021 and December 2021. We created a Google survey, and the link was used by our collaborators to the healthcare workers in the 11 countries.

We used Snowball sampling (9) using a few healthcare workers as a start who met the inclusion criteria of our study and were requested to be involved in the study. The accepted volunteers are then requested to indorse other individuals who also met the study criteria and so on.

We used social networks as social media platforms such as WhatsApp and Facebook to create primary associations, catching a growing sequence of volunteers. Sampling stopped when the required sample number had been obtained.

For example, Chaim Noy (10) detected in his snowball sampling study that there was a dependence on social capital and networking. Additionally, he gained access to travelers, whereby an easy and responsive sampling method was necessary because of the flexibility

and briefness of the required individuals. Furthermore, to recruit from another movable set, males who were semiprofessional motorists in Jerusalem, but establish it to be a lower easy procedure than in the travelers' trail, difficult by doubts above his own positionality and by wrong prospects within those communicated about what the research could accomplish.

They also field visited healthcare facilities (hospitals and pharmacies) in some countries that are suffering from internet disconnection in many areas due to wars and conflicts, such as Yemen, Sudan, Syria, Libya, and Palestine.

The inclusion criteria of the investigation included (1) physicians, nurses, pharmacists, and dentists from any of the 11 countries, (2) those who were introducing healthcare at any of the healthcare facilities, and (3) 18 years old or older. Participants who reported not being from the four categories or not working in one of the healthcare facilities were excluded from the study.

Study survey

We designed the questionnaire in two languages (Arabic and English), and it was composed of three sections, as follows:

Section 1 included the language and a brief description of the aim of the study.

Section 2 included the socio-demographic and occupational feature questions, including age (discreet between 18 and 99), gender (male or female), country (Egypt, Jordan, UAE, KSA, Yemen, Syria, Palestine, Algeria, Libya, Tunisia, Iraq, Sudan, Nigeria, and Lebanon), place of living (village, city, coastal village and desert village), work hours per week (discrete value), specialization (medical doctor, dentist, pharmacist and nursing), and type of working facility (isolation hospital, normal hospital, clinic, private clinic and pharmacy).

Section 3 included questions from the DASS-21 questionnaire. This questionnaire is a short version (21 items) of a 42-item self-report instrument designed to measure three related negative emotional states: depression, anxiety and tension/stress. It started with a brief description of the aim of the questions and how every question would be assessed and evaluated. The DASS-21 is composed of 21 questions to assess 3 different psychological distresses:

- Seven questions were used to assess the depression level by evaluating hopelessness dysphoria, self-deprecation, devaluation of life, lack of interest and involvement, anhedonia and inertia.
- Seven questions assessed anxiety levels through the assessment of autonomic arousal, skeletal musculature effect, situational anxiety, and subjective experience of anxious affect.
- Seven questions measured the level of stress by assessing difficulty relaxing, nervous arousal, easily upset agitated, irritable over reaction and impatience.

The participant must determine to what degree the question fits with and describe his feelings by choosing a number from a rating scale between 0 and 3, as score (0) means did not apply to me at all, score (1) Applied to me to some degree or some of the time, Score (2) Applied to me to a considerable degree, (3) Applied to me very much or most of the time (11).

The same section contained two more questions: the first question asks if the participant is fully vaccinated, and the second

question asks if the participant has been diagnosed with COVID-19 to determine if there is any relationship between those two variables and the psychological state of the participant. All the questions were mandatory.

Statistical analysis

The scores of every participant were calculated and multiplied by two, and then the final scores were classified as follows in Table 1.

Ethical consideration

We obtained 10 ethical approvals from the 11 countries, one for each through our collaborators teams. The approvals were obtained from the universities, and each participant was informed that his answers would be used for research purposes without revealing his identity or his personal data, which is considered to be approval on the participant level. Furthermore, we followed all the guidelines for Good Clinical Practice and Declaration of Helsinki.

Non-linear regression models were performed using the data to assess the relationship between each of the psychological disorders and the other variables depending on the p-value and the confidence interval (CI). The variables that were included in each model were age, gender, work hours per week, previous COVID-19 infection, vaccination statement, number of workplaces and specialization. The data were analyzed using R software version 4.0.5 (2021-03-31), platform x86_64-w64-mingw32.

Results

A total of 4,845 healthcare workers participated in the study. The participants were from 11 countries as follows: 436 from Egypt, 430 from Algeria, 458 from Iraq, 453 from Jordan, 473 from Libya, 428 from Palestine, 419 from Saudi Arabia, 452 from Sudan, 451 from Syria, 424 from Tunisia, and 421 from Yemen. The doctors among the healthcare workers were 51.7%, 19.0% were from the nursing staff, 16.8% were pharmacists, and 12.5% were from dentists.

The distribution of the age groups was as follows: ≤30 [2,799 (75.8)], 31–40 [1,323 (27.3)], >40 [723 (14.9)], and they were 42.5% males and 57.5 females, 50.3% reported working 40 h per week or less, 34.4% between 41 and 60 h, 11.1% between 61 and 80 h, while 4.2% only reported working for more than 80 h per week. For the living zone, 74.8 were living in a city, 10.6 were living in a coastal village, 3.2 were living in a desert village, and 11.4 were living in a village. Until

TABLE 1 The psychological scale of depression anxiety stress scale (DASS-21).

Level	Depression	Anxiety	Stress
Normal	0–9	0–7	0–14
Mild	10–13	8–9	15–18
Moderate	14–20	10–14	19–25
Severe	21–27	15–19	26–33
Extremely severe	28+	20+	34+

the date of the end of the data collection, 68.6% reported being fully vaccinated, while 31.4% reported they were not yet fully vaccinated.

The distribution of every variable per country is reported in Table 2.

A. Socio-demographic
B. Psychological state

The depression level among the healthcare workers was as follows: 29.1% were normal, 13.7% were mildly depressed, 26.9% were moderately depressed, 14.4% were suffering from severe depression, and the depression state was extremely severe for the last 15.9%. At the same time, 29.1% were suffering from no anxiety, while 6.9% were at a mild level, 22.3% were at a moderate level, 13.4% were at a severe level, and 28.3% were at an extremely severe level. For the stress levels, 38.6% were normal, 14.9% were suffering from mild stress, 20.3% were moderate, 17.4% were severe, and the stress level was extremely severe for the other 8.9%.

The psychological state per occupation showed some variance between the different occupations, and it is reported in Table 3.

As shown in Figure 1, the first regression generalized non-linear model is used to assess whether there is any type of association between the total depression score and the other variables, such as age, gender, work hours per week, previous COVID infection, vaccination state, and occupation. The model represents a residual deviance value of 515,222 on 4,842 degrees of freedom.

The model shows that some variables, such as being an ex-COVID-19 patient (at a CI 2.04–3.22, P-value = 0.001 and a total increase by 2.36), being fully vaccinated (at a CI 0.48–1.75, P-value = 0.001 and a total increase by 1.12), and being a female (at a CI 0.61–1.83, P-value < 0.001 and a total increase by 1.22), are significantly associated with the elevation of the total depression score, while other factors, such as getting old (at a CI –0.07 to 0.00, P-value = 0.027 and a total decrease by 0.04), and being male (compared to the females), are significantly associated with a decrease in the total depression score (as shown in Figure 1). Despite being non-significant, there was also an association with occupation as a medical doctor (with a total decrease of 0.49) and as a nurse (with a decrease of 1.06) with a decrease in the total depression score. Additionally, the model showed no significant association with working hours.

As shown in Figure 2, the second regression model investigated any association between the total anxiety score and the (age, gender, work hours per week, previous COVID-19 infection, vaccination state and occupation) variables. The model represents a residual deviance of 444,877 on 4,842 degrees of freedom.

The model shows that getting old (at CI 0.01–0.08, P-value = 0.004 and a total increase by 0.04), being an ex-COVID-19 patient (at CI 2.23–3.33, P-value < 0.001 and a total increase by 2.78), being fully vaccinated (at a CI 0.52 – 1.70 and a total increase by 1.11), and being a female (at a CI 0.32–1.45, P-value 0.002 and a total increase by 0.88) are significantly associated variables with the elevation of the total anxiety scores of the participants, while working as a doctor is significantly associated with the decrease in the total anxiety scores at a CI of –0.25 to –0.54, P-value = 0.001 and a total decrease of 1.40. The model also shows that some variables, such as the work hours per week and occupation as a pharmacist or a nurse compared with having a dentist, have no significant association with the total anxiety scores of the participants.

TABLE 2 The socio-demographic and occupational characteristics of the healthcare workers in the Middle East and North Africa (MENA) region.

Characteristics		MENA region	Algeria	Egypt	Iraq	Jordan	Libya	Palestine	KSA	Sudan	Syria	Tunisia	Yemen
No. of participants		4,845	430	436	458	453	473	428	–	419	451	424	421
Age groups	≤30	2,799 (75.8)	208 (48.4)	304 (69.7)	312 (68.1)	166 (36.6)	241 (51.0)	287 (67.1)	135 (32.2)	296 (65.5)	378 (33.8)	176 (41.5)	296 (70.3)
	31–40	1,323 (27.3)	118 (27.4)	84 (19.3)	82 (17.9)	129 (28.5)	185 (39.1)	93 (21.7)	222 (53.0)	53 (11.7)	36 (8.0)	180 (42.5)	90 (21.4)
	>40	723 (14.9)	104 (24.2)	48 (11.0)	64 (14.0)	158 (34.9)	47 (9.9)	48 (11.2)	62 (14.8)	103 (22.8)	37 (8.2)	68 (16.0)	35 (8.3)
Gender	Male	2,058 (42.5)	198 (46.0)	190 (43.6)	184 (40.2)	264 (58.3)	180 (38.1)	160 (37.4)	112 (26.7)	229 (50.7)	163 (36.1)	129 (30.4)	249 (59.1)
	Female	2,787 (57.5)	232 (54.0)	246 (56.4)	274 (59.8)	189 (41.7)	293 (61.9)	268 (62.6)	307 (73.3)	223 (49.3)	288 (63.9)	295 (69.6)	172 (40.9)
Work hours per week	≤40	2,438 (50.3)	266 (61.9)	251 (57.6)	269 (58.7)	119 (26.3)	284 (60.0)	211 (49.3)	136 (32.5)	180 (39.8)	163 (36.1)	299 (70.5)	260 (61.8)
	41–60	1,667 (34.4)	158 (36.7)	146 (33.5)	144 (31.4)	180 (39.7)	131 (27.7)	174 (40.7)	260 (62.1)	145 (32.1)	106 (23.5)	104 (24.5)	119 (28.3)
	61–80	537 (11.1)	6 (1.4)	31 (7.1)	31 (6.8)	149 (32.9)	53 (11.2)	32 (7.5)	21 (5.0)	74 (16.4)	89 (19.7)	20 (4.7)	31 (7.4)
	>80	203 (4.2)	–	8 (1.8)	14 (3.1)	5 (1.1)	5 (1.1)	11 (2.6)	2 (0.5)	53 (11.7)	93 (20.6)	1 (0.2)	11 (2.6)
Living zone	City	3,624 (74.8)	202 (47.0)	233 (53.4)	425 (92.8)	375 (82.8)	286 (60.5)	286 (66.8)	353 (84.2)	391 (86.5)	408 (90.5)	268 (63.2)	397 (94.3)
	Coastal village	515 (10.6)	123 (28.6)	60 (13.8)	1 (0.2)	29 (6.4)	100 (21.1)	12 (2.8)	28 (6.7)	7 (1.5)	12 (2.7)	136 (32.1)	7 (1.7)
	Desert village	156 (3.2)	69 (16.0)	7 (1.6)	1 (0.2)	16 (3.5)	39 (8.2)	3 (0.7)	12 (2.9)	2 (0.4)	1 (0.2)	6 (1.4)	–
	Village	550 (11.4)	36 (8.4)	136 (31.2)	31 (6.8)	33 (7.3)	48 (10.1)	127 (29.7)	26 (6.2)	52 (11.5)	30 (6.7)	14 (3.3)	17 (4.0)
Occupation	Doctor	2,506 (51.7)	188 (43.7)	96 (22.0)	212 (46.3)	238 (52.5)	291 (61.5)	146 (34.1)	259 (61.8)	305 (67.5)	283 (62.7)	257 (60.6)	231 (54.9)
	Nursing	922 (19.0)	59 (13.7)	55 (12.6)	71 (15.5)	65 (14.3)	49 (10.4)	148 (34.6)	116 (27.7)	49 (10.8)	133 (29.5)	114 (26.9)	63 (15.0)
	Pharmacist	813 (16.8)	78 (18.1)	251 (57.6)	94 (20.5)	55 (12.1)	79 (16.7)	60 (14.0)	28 (6.7)	63 (13.9)	25 (5.5)	25 (5.9)	55 (13.1)
	Dentist	604 (12.5)	105 (24.4)	34 (7.8)	81 (17.7)	95 (21.0)	54 (11.4)	74 (17.3)	16 (3.8)	35 (7.7)	10 (2.2)	28 (6.6)	72 (17.1)
Ex-Covid-19 inf.	Yes	1,971 (40.7)	251 (58.4)	177 (40.6)	256 (55.9)	158 (34.9)	178 (37.6)	213 (49.8)	142 (33.9)	140 (31.0)	168 (37.3)	192 (45.3)	96 (22.8)
	No	2,874 (59.3)	179 (41.6)	259 (59.4)	202 (44.1)	295 (65.1)	295 (62.4)	215 (50.2)	277 (66.1)	312 (69.0)	283 (62.7)	232 (54.7)	325 (77.2)
If fully vaccinated	Yes	3,324 (68.6)	275 (64.0)	324 (74.3)	400 (87.3)	416 (91.8)	244 (51.6)	386 (90.2)	406 (96.9)	311 (68.8)	146 (32.4)	373 (88.0)	43 (10.2)
	No	1,521 (31.4)	155 (36.0)	112 (25.7)	58 (12.7)	37 (8.2)	229 (48.4)	42 (9.8)	13 (3.1)	141 (31.2)	305 (67.6)	51 (12.0)	378 (89.8)

TABLE 3 Psychological state per occupation.

		MENA region	Occupation			
			Doctors	Nursing	Pharmacists	Dentists
The psychological disorder	The level	4,845	2,506 (51.7)	922 (19.0)	813 (16.8)	604 (12.5)
Depression	Normal	1,409 (29.1)	766 (30.6)	282 (30.6)	216 (26.6)	145 (24.0)
	Mild	663 (13.7)	338 (13.5)	127 (13.8)	118 (14.5)	80 (13.2)
	Moderate	1,302 (26.9)	639 (25.5)	242 (26.2)	216 (26.6)	205 (33.9)
	Severe	699 (14.4)	359 (14.3)	135 (14.6)	118 (14.5)	87 (14.4)
	Extremely severe	772 (15.9)	404 (16.1)	136 (14.8)	145 (17.8)	87 (14.4)
Anxiety	Normal	1,410 (29.1)	800 (31.9)	274 (29.7)	202 (24.8)	134 (22.2)
	Mild	334 (6.9)	188 (7.5)	49 (5.3)	61 (7.5)	36 (6.0)
	moderate	1,080 (22.3)	546 (21.8)	196 (21.3)	180 (22.1)	158 (26.2)
	Severe	648 (13.4)	322 (12.8)	120 (13.0)	104 (12.8)	102 (16.9)
	Extremely severe	1,373 (28.3)	650 (25.9)	283 (30.7)	266 (32.7)	174 (28.8)
Stress	Normal	1,870 (38.6)	936 (37.4)	400 (43.4)	293 (36.0)	241 (39.9)
	Mild	720 (14.9)	367 (14.6)	116 (12.6)	136 (16.7)	101 (16.7)
	Moderate	983 (20.3)	532 (21.2)	181 (19.6)	157 (19.3)	113 (18.7)
	Severe	843 (17.4)	438 (17.5)	154 (16.7)	155 (19.1)	96 (15.9)
	Extremely severe	429 (8.9)	233 (9.3)	71 (7.7)	72 (8.9)	53 (8.8)
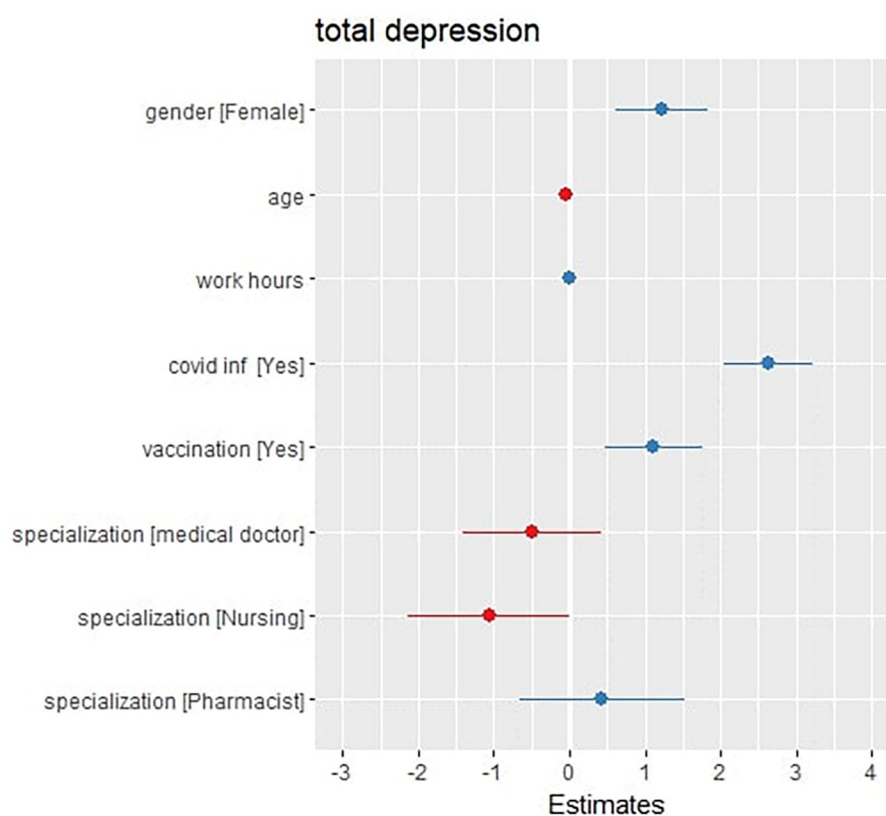
FIGURE 1

Forest (dot whisker) plot of the depression generalized non-linear regression model (shows the positions and direction of significance).

As shown in Table 4, the last generalized non-linear regression model investigated any association between the total stress score for the participants and the other variables (age, sex, work hours per week, previous COVID-19 infection, vaccination state and occupation). The model represents a residual deviance of 498,266 on 4,842 degrees of freedom.

As shown in Figure 3, the third regression model investigated any association between the total stress score and the (age, gender, work
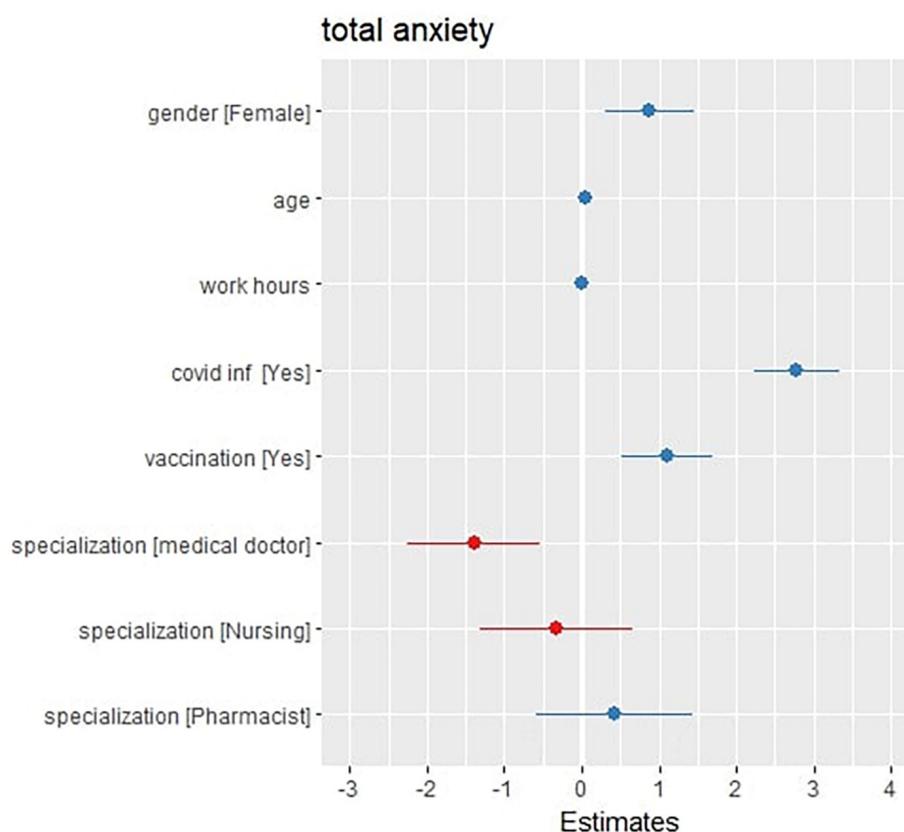
Forest (dot whisker) plot of the anxiety generalized non-linear regression model (shows the positions and direction of significance).

hours per week, previous COVID-19 infection, vaccination state and occupation) variables. The model represents a residual deviance of 444,877 on 4,842 degrees of freedom.

The model shows that some variables, such as being an ex-COVID-19 patient (at a CI 1.80–2.97, P-value < 0.001 and a total increase by 2.39), being fully vaccinated (at a CI 0.45–1.71, P-value 0.001 and a total increase by 1.08), and being a female (at a CI 0.79–1.98, P-value < 0.001, and a total increase by 1.39), are significantly associated with the elevation of the total stress scores of the participants, while other variables, such as being male (compared with the females) and being a nurse (at a CI –2.42 to –0.33, P-value = 0.01 and a total decrease by 1.38), are associated with the decrease of the total stress score of the participants. The model also showed that some other variables, such as age, the work hours per week, and the occupation as a doctor or pharmacist, have no association with the total stress scores that are recorded to the participants.

Discussion

This study indicates that in the Middle East and North Africa—MENA—region, the prevalence of depression, anxiety, and stress among the healthcare workforce during the COVID-19 pandemic was 70.9, 70.9, 61.4, respectively. Similarly, the levels in some countries, such as Egypt and Saudi Arabia, were previously investigated in another study by Arafa et al. (12) which found that 69% of the healthcare workers in both countries were depressed,

58.9% had anxiety, and 55.9% had stress. In contrast, another study in Singapore in 2020 during the COVID-19 pandemic reported a prevalence of depression of 8.1%, anxiety of 10.8% and stress of 6.4%, which are significantly lower than those in the MENA region. The prevalence of depression levels was 42.8% normal/mild and 57.2% moderate to extremely severe. The prevalence of anxiety levels was 36% normal/mild and 64% moderate to extremely severe. The study also showed the prevalence of stress levels among the healthcare workforce to be 53.4% normal/mild and 46.6% moderate to extremely severe. The percentage of those with mild to extremely severe depression, stress or anxiety in the MENA region is higher than that in European countries. Hummel et al. (13) represented depression levels in eight European countries as 30.51% moderate to extremely severe, anxiety levels as 32.2% moderate to extremely severe and stress levels as 41.24% moderate to extremely severe.

In the study of Chen et al. (20) it was found that the pooled prevalence rate for anxiety in the African population is 37%, which is significantly higher than those in China reported in Bareeqa et al. (14) (22%; p-value < 0.0001) and Pappa et al. (5) (23%; p-value < 0.0001). However, no, the pooled prevalence rate for anxiety in South Asian countries is significantly higher than that in Africa (41.3%; p-value < 0.0001) (15). In addition, the pooled prevalence of anxiety in Africa (37%) is higher than those in individual cross-country individual studies, such as a study of 10 countries (China, India, Japan, Iran, Iraq, Italy, Nepal, Nigeria, Spain, and the UK) (32%; p-value < 0.0001) (16) and a study in 17 countries in the regions of Asia (China, Pakistan, India, Japan, Singapore, Vietnam), Latin America (Argentina, Brazil, Chile, and

TABLE 4 The prevalence of depression, anxiety and stress levels among the healthcare workers in the MENA region.

| The psychological disorder	The level	MENA region	Country										
			Algeria	Egypt	Iraq	Jordan	Libya	Palestine	KSA	Sudan	Syria	Tunisia	Yemen
Depression	Normal	1,409 (29.1)	51 (11.9)	103 (23.6)	51 (11.1)	89 (19.6)	187 (39.5)	126 (29.4)	191 (45.6)	157 (34.7)	134 (29.7)	121 (28.5)	199 (47.3)
	Mild	663 (13.7)	37 (8.6)	61 (14.0)	58 (12.7)	76 (16.8)	59 (12.5)	62 (14.5)	47 (11.2)	68 (15.0)	86 (19.1)	44 (10.4)	65 (15.4)
	Moderate	1,302 (26.9)	174 (40.5)	110 (25.2)	137 (29.9)	172 (38.0)	88 (18.6)	141 (32.9)	87 (20.8)	89 (19.7)	120 (26.6)	110 (25.9)	199 (47.3)
	severe	699 (14.4)	80 (18.6)	68 (15.6)	96 (21.0)	73 (16.1)	79 (16.7)	53 (12.4)	35 (8.4)	51 (11.3)	66 (14.6)	61 (14.4)	37 (8.8)
	Extremely severe	772 (15.9)	88 (20.5)	94 (21.6)	116 (25.3)	43 (9.5)	60 (12.7)	46 (10.7)	59 (14.1)	87 (19.2)	45 (10.0)	88 (20.8)	46 (10.9)
Anxiety	Normal	1,410 (29.1)	60 (14.0)	105 (12.4)	75 (16.4)	65 (14.3)	170 (35.9)	142 (33.2)	178 (42.5)	131 (29.0)	173 (38.4)	139 (32.8)	172 (40.9)
	Mild	334 (6.9)	35 (8.1)	30 (6.9)	27 (5.9)	18 (4.0)	28 (5.9)	34 (7.9)	23 (5.5)	39 (8.6)	30 (6.7)	32 (7.5)	38 (9.0)
	moderate	1,080 (22.3)	150 (34.9)	91 (20.9)	84 (18.3)	98 (21.6)	94 (19.9)	102 (23.8)	68 (16.2)	120 (26.5)	110 (24.4)	78 (18.4)	85 (20.2)
	Severe	648 (13.4)	103 (24.0)	54 (12.4)	68 (14.8)	92 (20.3)	45 (9.5)	42 (9.8)	42 (10.0)	57 (12.6)	56 (12.4)	39 (9.2)	50 (11.9)
	Extremely severe	1,373 (28.3)	82 (19.1)	156 (35.8)	204 (44.5)	180 (39.7)	136 (28.8)	108 (25.2)	108 (25.8)	105 (23.2)	82 (18.2)	136 (32.1)	76 (18.1)
Stress	Normal	1,870 (38.6)	124 (28.8)	105 (24.1)	75 (16.4)	65 (14.3)	170 (35.9)	142 (33.2)	178 (42.5)	131 (29.0)	173 (38.4)	139 (32.8)	172 (40.9)
	Mild	720 (14.9)	91 (21.2)	30 (6.9)	27 (5.9)	18 (4.0)	28 (5.9)	34 (7.9)	23 (5.5)	39 (8.6)	30 (6.7)	32 (7.5)	38 (9.0)
	Moderate	983 (20.3)	91 (21.2)	91 (20.9)	84 (18.3)	98 (21.6)	94 (19.9)	102 (23.8)	68 (16.2)	120 (26.5)	110 (24.4)	78 (18.4)	85 (20.2)
	Severe	843 (17.4)	88 (20.5)	54 (12.4)	68 (14.8)	92 (20.3)	45 (9.5)	42 (9.8)	42 (10.0)	57 (12.6)	56 (12.4)	39 (9.2)	50 (11.9)
	Extremely severe	429 (8.9)	36 (8.4)	156 (35.8)	204 (44.5)	180 (39.7)	136 (28.8)	108 (25.2)	108 (25.8)	105 (23.2)	82 (18.2)	136 (32.1)	76 (18.1)
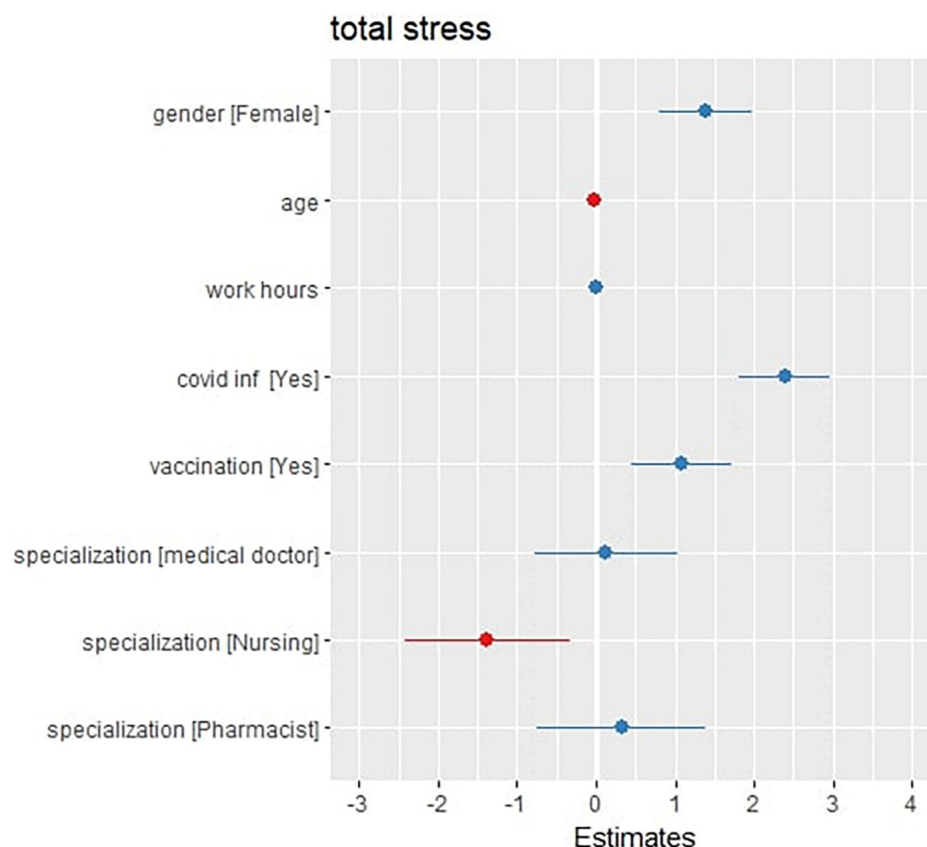
FIGURE 3
Forest (dot whisker) plot of the stress generalized non-linear regression model (shows the positions and direction of significance).

Mexico) (33%; *p*-value < 0.0001) and middle East (Palestine, Iran), Europe (Denmark, Greece, Turkey, Italy, Spain) (17). Moreover, they find that the pooled prevalence rate of anxiety among frontline HCWs in Africa (51%) is significantly higher than Bareeqa et al. (14) (24%; *p*-value < 0.0001), Krishnamoorthy et al. (19) (26%; *p*-value < 0.0001), and Ren et al. (18) (27%; *p*-value < 0.01). Similarly, we find that the pooled prevalence rate of anxiety among the general population (37%) in Africa is significantly higher than Ren et al. (18) (24%; *p*-value < 0.0001). The pooled prevalence rate for depression in the African population (45%) is significantly higher than those in China reported by Bareeqa et al. (14) (27%; *p*-value < 0.0001), Pappa et al. (5) (23%; *p*-value < 0.0001), Krishnamoorthy et al. (19) (26%; *p*-value < 0.0001), and Ren et al. (18) (28%; *p*-value < 0.0001). The pooled prevalence rate for depression in the African population (45%) is higher than those in Spain (23%; *p*-value < 0.0001) (20). In South Asian countries reported by Hossain et al. (15) (34%; *p*-value < 0.0001). The pooled prevalence for depression in Africa (45%) is also higher than the pooled prevalence in a study including over 17 countries reported by Luo et al. (17) (28%; *p*-value < 0.01) and another study of 10 countries reported by Salari et al. (16) (34%; *p*-value < 0.01). However, the prevalence rate for depression in Africa is lower than Italy which is the country with the highest prevalence for depression (67%) (17). In addition, the pooled prevalence rates of anxiety and depression in Sub-Saharan Africa were found to be (31 and 30%) which are lower than those reported in North Africa (44 and 55%) that may suggest that there is a high heterogeneous

prevalence of mental health symptoms within the regions of Africa, and this heterogeneous prevalence rate between Sub-Saharan Africa and North Africa may arise because of the lack of awareness of the danger of COVID-19 as a result of the insufficient COVID-19 testing or the lower death rates due to the younger population in Sub-Saharan Africa (21).

To assess the mental health symptoms in southeast Asia, 32 samples from 25 studies including 20,352 persons were included in the study of Pappa et al. (22). Depression in 15 studies and anxiety was assessed in 25 studies and the prevalence rates were 16 and 22%, respectively. In addition, the prevalence of anxiety and depression was similar among general HCWs (17%), frontline HCWs (18%) while being higher in the general population (27%), which is lower than the recorded scores of 33 and 32% for anxiety and 28 and 34% for depression in the meta-analysis by Luo et al. (17) from 17 countries (China, Singapore, India, Japan, Pakistan, Vietnam, Iran, Palestine, Italy, Spain, Turkey, Denmark Greece, Argentina, Brazil, Chile, and Mexico), and the meta-analysis by Salari et al. (23) from 10 countries (China, India, Japan, Iran, Iraq, Italy, Nepal, Nigeria, Spain, and UK), Respectively.

Our study showed a significant association between the total DASS-21 scores of the participants and the other variables. Regarding age, getting old is associated with dissension in the depression total score and elevation of the anxiety total score. Regarding sex, the three models showed that males had dissension in the total scores of depression, anxiety and stress by 1.27, 0.92, and 1.44, respectively, compared with females. Regarding occupation, doctors

had dissension in the total scores of depression and anxiety, and nurses had dissension in the total scores of depression and stress. Additionally, being an ex-COVID-19 patient showed a significant positive association with depression, anxiety, and stress. Our findings of depression, anxiety, and stress risk factors differ from those of other studies. For example, a cross-sectional survey in 12 Arab countries reported that the prevalence of mental health symptoms was higher in healthcare workers (HCWs) aged 30–39 years, those who worked > 44 h/week, those in contact with COVID-19 cases, and HCWs who were not satisfied with the preventive measures. The prevalence of mental health symptoms was lower among male HCWs (14).

In addition, a multiple-method design in the Bangkok study determined the risk factors for emotional exhaustion, which were male sex, nurses, doctors, working in the COVID-19 inpatient unit, and working in the COVID-19 intensive care unit. Additionally, pre-existing mental illness was associated with anxiety, depression, and PTSD (5). Furthermore, In U.S, a cross-sectional survey found that higher levels of anxiety were observed with younger ages and female gender, while occupational roles with increased exposure risk did not report higher levels of anxiety (15). Moreover, being fully vaccinated was significantly associated with elevated depression, anxiety, and stress total scores. The results could be considered evidence of the association between the psychiatric statement of the participants and the vaccines. A cross-sectional study in Iraq illustrated that the majority of participants had a normal level of DASS-21 after receiving the vaccine (80% were females). Higher scores were obtained among graduated young age groups and among individuals who had side effects associated with the vaccine (16). Another investigation by Perez-Arce F et al. (17) reported a decrease in mental distress after receiving the first dose of the COVID-19 vaccine.

Conclusion

COVID-19 had critical psychological effects on the medical health workforce in the Middle East and North Africa—MENA—region. Being women, being ex-COVID-19 and being fully vaccinated were associated with an increased risk of depression, anxiety and stress. They required special attention, health-related education, and psychological support. Additionally, to improve their mental health, strategies such as supportive and respectful colleagues, appropriate financial compensation, reduced workload, clarity of policy and communication channels, and adequate personal protective equipment should be implemented.

Limitations

The study has some limitations. First, snowball sampling was used. This may cause oversampling a particular network of peers to lead to bias. Additionally, respondents may be hesitant to provide names of peers, and asking them to do so may raise ethical concerns. Furthermore, there is no guarantee about the representativeness of the samples. In addition, it is not possible to determine the actual pattern of distribution of the population. Moreover, it is not possible to determine the sampling error and make statistical inferences from the sample to the population due to the absence of random selection

of samples. Finally, the age group >40 is relatively underrepresented in comparison to the other age groups, which also leads to bias.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board Committee (IRB) in Egypt, Palestine, Yemen, Iraq, Libya, Sudan, Syria, Tunisia, Saudi, Jordan. The patients/participants were informed that their answers will be used in this study.

The EARG group (Eltewacy Arab research group)

DMD, Algiers Department of Dental Medicine, Algeria: Mohammed Amir Rais. Faculty of Medicine, Al-Azhar University, Egypt: Reman Ashraf. Faculty of Pharmacy, Damanhour University, Egypt: Entesar kamal abdou. Faculty of Pharmacy, Sohag University, Sohag, Egypt: Ereen Sobhy Kiddees and Arwa Abdelrazek Abdellah. Faculty of Pharmacy (Boys), Al-Azhar University, Assiut Branch, Egypt: Mostafa S. M. Abd El-Maksoud. Faculty of Pharmacy Mansoura University, Egypt: Aseel MitwallyAwad. Faculty of Medicine and Health Sciences, An-Najah National University, Nablus, Palestine: Ahmad Hanani, Duha Yousef Suboh, Samaa Elkhader, and Salsabeel Hanayshe. Faculty of Medicine, Al-Quds University, Palestine: Gharam Kiswani. Faculty of Medicine of Tunis, University Tunis El Manar, Tunisia: Hanen Ben Ammar and Ghada Hamdi. Faculty of Medicine of Monastir, Tunisia: Lina Brahmi l. Faculty of Medicine Sfax, Sfax University Tunisia, Sfax, Tunisia: Malek mohamed Ayadi. Faculty of Medicine, Aleppo University, Syria: Bayan Zitani, Nour Karkar, Tasneem othman, Tasnim Assalyeh, Batoul Al Sari, and Baraa Altweel. College of Medical Technology, Department of Public Health, Derna, Libya: Raga A. Elzahaf. Radiologist Almogarief Teaching Hospital, Libya: Moufiq abdulrasoul Hasan. Internal Medicine Resident at Brega General Hospital BGH, Libya: Almajdoub Ali Mohammed. Faculty of Medicine, Omar Al-Mukhtar University, Al-Bayda, Libya: Wisam A. Hasan. Faculty of Medicine of Sabha University, Sabha, Libya: Hajar Alkokhiya Aldare. Benghazi Medical Center, Benghazi, Libya: Ayoub Akwaisah. Internal Medicine Department, University of Science and Technology Hospital, Yemen: Ali Ahmed Awas, Dares Fateh Mohammed, and Hareth Al-duais. Faculty of Medicine and Health Sciences, University of Science and Technology, Yemen: Kholood Ahmed Al-subari and Badr Alhalool. Faculty of Medicine and Health Science, University of Gadarif, Sudan: Ahmed Abdelrahim Musbah, Elhusseini Abdelrahim Musbah, Hassan Salih Eisa, Khider Altayeb Bakheet, and Mohammed Al Monje Amir. Faculty of Medicine, Gabir Ibin Hayyan Medical University, Iraq: Ali Riyadh abdulabbas. Faculty of Medicine,

University of Baghdad, Iraq: Jaafar D. Al-Dabagh. College of Medicine, Al-Nahrain University, Baghdad, Iraq: Karrar H. Alnajjar. Alnoor University College, Mosul, Iraq: Mareb Hameed Ahmed. University of Mosul, Aljumhori Hospital, Iraq: Daniah Adil Tawfeeq. School of Medicine, University of Jordan, Amman, Jordan: Wahid Aloweiwi and Zaid Alkayed. Faculty of Engineering and IT, British University in Dubai, United Arab Emirates: Abdullah Sughayer. Albalqa Applied University, Jordan: Aya Thaer Albaddawe and Lina A. Abu-Sirhan. Ribat University Hospital, National Ribat University, Khartoum, Sudan: Hind AbdAlla Hamad and Omnia Omer Ibrahim. Alsalam Health Medical Hospital, Saudi Arabia: Asmaa abdulmonem Ahmed.

Author contributions

ME-G: conceptualization and supervision. ME-G, TO, and AE: data curation. NE and ME-G: collecting the authors team. MR, WA, DS, MA, BZ, RE, AAw, AMu, and HH: country specific team leaders. TO, AE, and NH: data analysis and data interpretation. TO and NH: validation. WA, RA, AH, HA, BZ, AMo, AAw, AMu, AR, and HH: ethical approvals. TO and ME-G: writing—original draft. ME-G and NH: writing—review and editing. All authors approved the final draft of the manuscript.

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Conflict of interest

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

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Psychological status of medical staff dedicated to nucleic acid collection in COVID-19 epidemic during closed-loop management: A cross-sectional study

Mingzhu Sun[1], Xiaowei Li[1]*, Jie Yao[1], Xi Huang[1], Yujuan Kang[2] and Zixuan Li[1]

[1]School of Nursing, Shaanxi University of Chinese Medicine, Xianyang, Shaanxi, China, [2]Department of Nursing, Affiliated Hospital of Shaanxi University of Chinese Medicine, Xianyang, Shaanxi, China

Background: To investigate the depression, anxiety and somnipathy situation occurred in the nucleic acid collection staff during the closed-loop management period of COVID-19. And try to understand the influencing factors of related psychological status.

Methods: A cross-sectional study of 1,014 nucleic acid collection staff from seven Chinese hospitals was conducted. Various investigation methods were involved in the questionnaires to collect data, including 12-items self-made questionnaire survey of basic demographic information, 9-items patient health questionnaire depression scale (PHQ-9), 7-items generalized anxiety disorder scale (GAD-7) and Pittsburgh sleep quality index (PSQI). Data analysis was performed using SPSS version 26.0 and Excel software. Mann-Whitney U-test, Chi-square test, correlation analysis, mono-factor analysis and binary logistic regression were applied accordingly for further analysis.

Results: The positive rate of depression, anxiety and sleep disorder of 1,014 nucleic acid collectors under closed-loop management were 33.5, 27.2, and 50.1%, respectively. Depression was significantly positively correlated with anxiety and sleep ($P < 0.05$). The scores of depression scale were positively correlated with the age and the fear for infection ($r = 0.106, 0.218$, both $P < 0.05$); The scores of anxiety scale were also positively correlated with the age and the fear for infection ($r = 0.124, 0.225$, both $P < 0.05$); The length of service, collection time and the degree of worry about infection and was positively correlated with the score of sleep scale ($r = 0.077, 0.074, 0.195$, both $P < 0.05$); Education level had a significant negative association with PHQ-9, GAD-7 and PSQI ($r = -0.167, -0.172$, both $P < 0.05$). Binary logistic regression analysis showed that age, technical title, education level, collection time, collection frequency, collection location, fear for infection and external environment were important influencing factors of depression, anxiety and sleep disorders.

Conclusion: The results of this study suggested that when carrying out nucleic acid collection mission, managers should intervene to optimize the collection location, control the duration of each collection mission, replace the collection staff in time and pay close attention to the psychological state of the collection staff.

1. Introduction

A novel coronavirus disease (COVID-19), caused by Coronavirus type 2 (SARS-CoV-2) emerged in Wuhan, China in December 2019, has become the third coronavirus in the past 20 years since the outbreak of severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 and the Middle East outbreak of respiratory syndrome coronavirus (MERS-CoV) in 2012. With rapidly spread all over the world and concomitant mortality burden, the COVID-19 outbreak represents a global public health issue which unseen in the last century (1–4). So far, the world has been witnessed four waves of viruses: Alpha variant (B.1.1.7), Beta variant (B.1.351), Gamma variant (P.1) and Delta variant (B.1.617.2). However, the new strain, Omicron (B.1.1.529), was discovered for the first time in South Africa in November 2021 (5). This strain has the characteristics of fast transmission, strong infectivity, high pathogenicity and short incubation period (6). Therefore, we need more rapid and immediate responses in healthcare to avoid more infections.

In December 2021, a case of localized Omicron variant occurred in Xi'an, Shaanxi. There were 2,080 new cases of coronavirus pneumonia confirmed within 40 days, the largest local outbreak in a megacity since the Wuhan outbreak (7). According to the COVID-19 Diagnostic Guide issued by China and related research, a positive real-time reverse transcription polymerase chain reaction (RT-PCR) test is considered the main criterion for the diagnosis of COVID-19 (8, 9). Nucleic acid collectors are one of the important pillars during the pandemic and play a key role during the pandemic.

In order to prevent the further spread of the epidemic, the medical institutions actively arranged nucleic acid collection teams to carry out wide range nucleic acid sampling throughout the city and closed-loop management for nucleic acid collection employees in accordance with the local epidemic prevention and control procedures. Closed-loop management is a management method formed by integrated information system, closed-loop system, management control and management closure principle. It can be effectively used in epidemic prevention and control (10). Point-to-point management allowed for closed-loop hospital locations, closed-loop roadways, closed-loop lodging sites, closed-loop epidemics and closed-loop patient status (hospital to hotel accommodation sites, hospital to quarantine sites).

During the sampling period, due to the large population of Xi'an, the sampling workload is extremely heavy, and the maximum sample size can reach 8.92 million people per day. The nucleic acid collectors need to start the preparation work at 3 am every day. The sampling site conditions are rudimentary, most of them are mobile sampling points which are temporarily constructed outdoors. And the weather is cold during the epidemic, the protective suits are too thin to keep warm. The working hours are also uncertain, most people work more than 8 h a day. Due to strict protection requirements, medical staff can barely drink water when sampling, and it is inconvenient to go to the toilet. All these factors may cause high work pressure on both physical and mental aspects among nucleic acid collectors.

Previous studies have found that frontline workers are prone to a range of psychological problems, including fear, depression, anxiety, post-traumatic stress symptoms and insomnia during

high-risk and stressful situations during the pandemic (11–13). For example, a large proportion of healthcare workers battling SARS suffer from depression, anxiety and sleep problems (14, 15). Recent studies have shown that health workers have higher psychological problems during COVID-19 than in past epidemics (16). Several studies have shown that physical, emotional, and mental health can all be impaired by overwork (17–20). The potential negative psychological impact is not only detrimental to the growth of medical staff, but also may reduce effective response to emergencies (11, 21).

At present, there have been many investigations on the anxiety and depression of medical staff in the fight against the epidemic. But during the strict closed-loop management, nucleic acid collectors face great physical and mental challenges, and there are few studies on the impact of such management methods on psychological state. The purpose of this paper was to conduct a preliminary psychological evaluation of nucleic acid collectors who participated in closed-loop management during the Omicron epidemic in Xi'an, and analyze the influencing factors to provide a scientific basis for later psychological recovery.

2. Method

2.1. Setting and sampling

This survey based on convenience sampling was conducted for medical personnel for nucleic acid collection during closed-loop management in 7 Grade III Grade A hospitals in Shaanxi Province from March 25 to April 18, 2022. To facilitate the sample collection, all personnel participated in nucleic acid collection-related training, informed consent and voluntary participation in this study. Thompson's study suggested a sample size of 10–15 times the questionnaire items for the structural equation model (22). Forty seven items made up the self-administered questionnaire, which had a total sample size of 705 participants. Due to incomplete questionnaires, the sample size was increased by 20% to a total of 846; nevertheless, the final sample size was 1,028 individuals.

2.2. Ethical approval

All personnel volunteered to participate in this study and were allowed to withdraw during the process. The electronic information submitted was anonymous and only researchers had access to the data. The Ethics Committee of the Affiliated Hospital of Shaanxi University of Traditional Chinese Medicine, Shaanxi Province, China approved this study (Ethical number:2022-0516).

2.3. Data collection

Wenjuanxing, an online crowdsourcing platform on the Chinese mainland, was used to make the questionnaire because of the outbreak. It was then sent to the WeChat group, which is a public social networking tool in China, for the staff who collect nucleic acids. The WeChat group was informed of the objective

TABLE 1 Demographic characteristics of study sample [$N = 1,014(\%)$].

Variable		Gender		N	χ^2	P
		Male (%)	Female (%)			
Professional	Doctor	84 (52.8)	123 (14.4)	207	187.727	<0.001
	Nurse	48 (30.2)	696 (81.4)	744		
	Medical student	27 (17.0)	31 (3.6)	58		
	Medical technician	0	5 (0.6)	5		
Age (years)	≤25	38 (23.9)	152 (17.8)	190	4.304	0.352
	26~<30	46 (28.9)	295 (34.5)	341		
	31~<40	54 (33.9)	302 (35.3)	356		
	41~<50	18 (11.4)	85 (9.9)	103		
	≥50	3 (1.9)	21 (2.5)	24		
Education level	Junior college or below	50 (31.5)	201 (23.5)	251	25.463	<0.001
	College	79 (49.8)	583 (68.2)	662		
	postgraduate or above	30 (18.7)	71 (8.3)	101		
Professional title	Basic	105 (66.0)	603 (70.5)	708	3.534	0.171
	Advance	45 (28.3)	227 (26.6)	272		
	Senior	9 (5.7)	25 (2.9)	34		
Length of service (years)	≤1	41 (25.8)	139 (16.3)	180	10.943	0.027
	2~5	40 (25.1)	192 (22.5)	232		
	6~10	39 (24.5)	265 (31.0)	304		
	11~15	24 (15.1)	147 (17.1)	171		
	>15	15 (9.5)	112 (13.1)	127		
Acquisition frequency (days)	One time	51 (32.1)	318 (37.3)	369	7.814	0.020
	Many times	43 (27.0)	283 (33.1)	326		
	Once/every other day	65 (40.9)	254 (29.6)	319		
Collection site	community	97 (61.0)	465 (54.4)	562	6.568	0.161
	School	19 (11.9)	113 (13.2)	132		
	Mobile Cabin Hospital	14 (8.9)	69 (8.1)	83		
	Hospital	24 (15.1)	134 (15.7)	158		
	Door-to-Door	5 (3.1)	74 (8.6)	79		
Collection time (h/d)	<4	29 (50.0)	194 (41.8)	223	2.198	0.532
	4~<6	35 (22.8)	190 (27.2)	225		
	6~<8	83 (19.1)	399 (21.3)	482		
	>8	12 (8.1)	72 (9.7)	84		
External environment	Yes	118 (74.2)	637 (74.5)	755	0.921	0.504
	No	41 (25.8)	218 (25.5)	259		
Worry about the degree	No worry	32 (20.2)	144 (16.7)	176	3.267	0.352
	General worry	57 (35.8)	369 (43.2)	426		
	More worried	49 (30.8)	248 (29.1)	297		
	Very worried	21 (13.2)	94 (11.0)	115		

TABLE 2 Positive rate of depression, anxiety and sleep disorders among 1,014 nucleic acid collectors under closed-loop management [N = 1,014(%)].

Variables	Gender	Positive (%)	Degree				Z	P
			None (%)	Light (%)	Medium (%)	Heavy (%)		
Depression	Male	340 (33.5)	66 (41.5)	36 (22.6)	7 (4.4)	50 (31.5)	−0.365	0.715
	Female		357 (41.8)	215 (25.1)	70 (8.1)	213 (24.9)		
Anxiety	Male	276 (27.2)	82 (51.6)	27 (17.0)	23 (14.5)	27 (16.7)	−0.555	0.579
	Female		476 (55.7)	153 (17.9)	116 (13.5)	110 (12.9)		
Sleep	Male	508 (50.1)	75 (47.2)	64 (40.3)	17 (10.7)	3 (1.8)	−2.555	0.011
	Female		324 (37.9)	404 (47.2)	102 (11.9)	25 (3.0)		

*$P < 0.05$, **$P < 0.01$.

and importance of this survey and one response is allowed from a given IP address. After the questionnaire had been reviewed and examined by two quality controllers, the entire survey results were collected from the questionnaire star platform. Those who chose the same option in questionnaires and those who missed >10% of items were excluded. After filtering, 1,014 questionnaires were included in the subsequent analysis with a response rate of 98.64%.

2.4. Measurements

The survey consisted of the following four parts: Sociodemographic data, Patient health questionnaire-9 (PHQ-9), Generalized anxiety disorder 7-item (GAD-7) Scale and Pittsburgh sleep quality index (PSQI).

2.4.1. Demographic information of survey respondents

A self-administered general data questionnaire was used, mainly including gender, age, occupation, years of work, education level, technical title, nucleic acid collection attendance frequency in the past 3 months (hereinafter referred to as "collection frequency"), continuous collection time per attendance (hereinafter referred to as "collection time"), a regular presence at the site of nucleic acid collection (hereinafter referred to as "collection place"), and whether external environmental factors (winter, summer, rain, wind) affect nucleic acid collection (hereinafter referred to as "external environment"). The degree of concern about infection is hereinafter referred to as "the degree of concern."

2.4.2. Patient health questionnaire-9 (PHQ-9)

The Chinese Patient Health Questionnaire-9 (PHQ-9), a self-measuring reporting method used to assess the severity of depression, is widely used as an open screening tool for depression in different healthcare and community environments (23). PHQ-9 is composed of 9 items, with a Likert score of 4, divided into scores of 0 (none at all), 1 (a few days), 2 (most of the time), and 3 (almost every day), for a total score of 27 points. The higher the score, the more severe the depression. Scoring criteria: no depression (0∼4), mild depression (5∼9), moderate depression (10∼14), severe depression (15∼27). The psychometric characteristics of

the PHQ-9 are reliable to measure depression allied with clinical features with strong consistency (Cronbach's alpha = 0.86) (24). The study concluded that a score of 10 was the optimal threshold for PHQ-9 with a sensitivity of 92.8% and specificity of 95.7% (25). Therefore, a score of 10 on the PHQ-9 questionnaire indicated the presence of depression.

2.4.3. Generalized anxiety disorder 7-item (GAD-7) scale

The generalized anxiety scale, developed by Spitzer et al. (26) in 2006 to identify anxiety disorders with optimal reliability and validity, assesses the severity of anxiety symptoms over 2 weeks. GAD-7 is composed of seven items, with a Likert score of 4, divided into scores of 0 (none at all), 1 (a few days), 2 (most of the time), and 3 (almost every day), for a total score of 21 points. The higher the score, the more severe the anxiety suppression. Scoring criteria were no anxiety (0∼4), mild anxiety (5∼9), moderate anxiety (10∼14), and severe anxiety (15∼21). On the other hand, the psychometric characteristics of the GAD-7 are also reliable to measure anxiety allied with clinical features with strong consistency (Cronbach's alpha = 0.92) and good test-retest reliability ($r = 0.88$) (26). In this questionnaire, people with GAD-7 score ≥10 were very likely suffering anxiety, a score of 10 was considered the optimal cut-off value for the GAD-7 with a sensitivity of 89% and specificity of 82% (27).

2.4.4. Pittsburgh sleep quality index, PSQI

This scale was compiled by Buysse et al. (28) and translated into Chinese (29) to evaluate the sleep quality. The scale can evaluate the sleep situation of nearly a month and contains 18 items and 7 dimensions, including sleep quality, time to sleep, sleep time, sleep efficiency, sleep disorder, hypnotics and daytime dysfunction. The responses to the items are weighted on a scoring scale between 0 and 3. The total PSQI score is from 0 to 21 points. The seven component scores are then summed to yield a global PSQI score, which has a range of 0–21, higher scores indicate worse sleep quality. The scoring criteria were normal sleep quality (0∼5), mild sleep disorder (6∼10), moderate sleep disorder (11∼15), and severe sleep disorder (16∼21). The PSQI has internal uniformity and a reliability coefficient (Cronbach's alpha) of 0.90 for its seven components, the overall PSQI global score correlation coefficient

TABLE 3 Correlations for all variables.

Variables	Depression	Anxiety	Sleep	Age	Length of service	Education level	Acquisition frequency	Collection time	Worry about the degree
Depression	1.000								
Anxiety	0.885**	1.000							
Sleep	0.333**	0.289**	1.000						
Age	0.106**	0.124**	0.048	1.000					
Length of service	−0.027	−0.016	0.077*	0.788**	1.000				
Education level	−0.167**	−0.172**	−0.038	0.038	−0.016	1.000			
Acquisition frequency	0.046	0.050	0.016	0.004	0.018	−0.028	1.000		
Collection time	0.009	0.002	0.074*	−0.011	−0.024	−0.042	−0.048	1.000	
Worry about the degree	0.218**	0.225**	0.195**	0.03	−0.001	−0.048	0.021	−0.011	1.000

$*P < 0.05$, $**P < 0.01$.

for test-retest reliability was 0.87 (30). When PSQI is applied in different populations, in order to achieve better screening effect, it is necessary to adjust the judgment cut-off. Applying PSQI ≥ 7 as a reference value for sleep quality problems in Chinese adults (31, 32).

2.5. Data analysis

The collected data were analyzed using SPSS version 26 and Excel software. The distribution of PHQ-9, GAD-7, and PSQI scores in the general population did not adhere to a normal distribution, according to a first evaluation of the measured data's normality. The median and quartile were used to represent M (P_{25}, P_{75}), and the non-parametric rank sum test (Mann Witney U) was employed for intergroup comparison, and count data were expressed as ratio or composition ratio (%). Second, the differences between groups were compared using the Chi-square test (χ^2), and all of the variables' correlations were determined using Pearson's correlation coefficients. Third, monofantor analysis and binary logistic regression were used to analyze the influencing factors of depression, anxiety and sleep disorder. The OR value and 95% CI were calculated, with P-values < 0.05 being regarded as statistically significant (2-sided tests).

3. Results

3.1. General participant characteristics

The demographic and work-related characteristics and scores of 1,014 nucleic acid collections are shown in Table 1. Demographic data analysis by gender showed that 84.3% of the 1,014 participants were female; 73.4% were nurses; 35.1% were 31–40 years old; 66.2% were undergraduates; junior professional titles accounted for the majority, 69.8%; the participants acquired once per day (36.4%); 55.4% were community-based; the acquisition time was 6–8 h per day, accounting for 47.5%; 74.5% would be influenced by the external environment; and 42.0% were generally concerned about infection.

3.2. Score and prevalence of PHQ-9, GAD-7 and PSQI

PHQ-9, GAD-7 and PSQI of the nucleic acid collectors were statistically analyzed by sex. The results showed that the median M (P_{25}, P_{75}) score of PHQ-9 was 7 (1, 17) for males and 6 (2, 14) for females; GAD-7: 4 (0, 13) for males and 3 (0, 11) for females; PSQI was 6 (3, 8) for males and 7 (4, 9) for females. The positive rates of depression, anxiety and sleep disorders among nucleic acid collectors were 33.5, 27.2, and 50.1%, respectively; there was a significant difference between male and female groups in sleep disorder ($P < 0.05$) (Table 2).

TABLE 4 Monofactor analysis of depression, anxiety and sleep disorder in 1,014 nucleic acid collectors under closed-loop management [$N = 1,014$(%)].

Variables	N	Depression [n(%)]	χ^2	P	Anxiety [n(%)]	χ^2	P	Sleep[n(%)]	χ^2	P
Gender										
Male	159	57 (35.8)	0.455	0.500	50 (31.4)	1.701	0.192	69 (43.4)	3.388	0.066
Female	855	283 (33.1)			226 (26.4)			439 (51.3)		
Professional										
Doctor	207	77 (37.1)	11.556	0.009	68 (32.8)	13.574	0.004	100 (8.3)	4.101	0.251
Nurse	744	253 (34.0)			202 (27.2)			380 (51.1)		
Medical student	58	8 (13.8)			5 (8.6)			24 (41.4)		
Medical technician	5	2 (40.0)			1 (20.0)			4 (80.0)		
Age (years)										
≤25	190	68 (35.8)	47.402	<0.001	62 (32.6)	72.135	<0.001	96 (50.5)	4.529	0.339
26~<30	341	98 (27.3)			78 (22.9)			169 (49.6)		
31~<40	356	104 (29.2)			68 (19.1)			174 (48.9)		
41~<50	103	49 (47.6)			49 (57.6)			60 (58.2)		
>50	24	21 (87.5)			19 (79.2)			9 (37.5)		
Education level										
Junior college or below	251	123 (49.0)	42.818	<0.001	106 (42.2)	38.308	<0.001	132 (52.5)	6.125	0.047
College	662	193 (29.1)			150 (22.7)			337 (50.9)		
postgraduate or above	101	24 (23.8)			20 (19.9)			39 (38.6)		
Professional title										
Basic	708	264 (37.2)	17.944	<0.001	230 (32.5)	40.780	<0.001	351 (49.6)	0.532	0.766
Advance	272	63 (23.2)			34 (12.5)			141 (51.8)		
Senior	34	13 (38.2)			12 (35.3)			16 (47.1)		
Length of service (years)										
≤1	180	61 (33.9)	5.441	0.245	57 (31.7)	11.120	0.025	78 (43.3)	4.834	0.305
2~5	232	90 (38.8)			74 (31.9)			124 (53.4)		
6~10	304	94 (31.0)			70 (23.0)			158 (52.0)		
11~15	171	50 (29.2)			36 (21.1)			84 (49.1)		
>15	127	45 (35.4)			39 (30.7)			63 (49.6)		
Collection time (h/d)										
<4	223	81 (36.3)	31.637	<0.001	72 (32.3)	38.867	<0.001	108 (48.4)	2.135	0.545
4~<6	225	77 (34.2)			63 (28.0)			106 (47.1)		
6~<8	482	133 (27.6)			98 (20.3)			248 (51.5)		
>8	49	43 (87.8)			43 (87.8)			46 (93.9)		
Acquisition frequency (days)										
One time	369	86 (23.3)	45.478	<0.001	76 (20.6)	32.278	<0.001	204 (55.3)	9.437	0.009
Many times	326	154 (47.2)			126 (38.7)			165 (50.6)		
Once/every other day	319	100 (31.3)			74 (23.2)			139 (43.2)		
Collection site										
community	562	112 (19.9)	209.404	<0.001	67 (11.9)	287.183	<0.001	288 (51.2)	5.199	0.267
School	132	63 (47.7)			59 (44.7)			56 (42.4)		
Mobile cabin hospital	83	76 (91.6)			75 (90.4)			46 (55.4)		
Hospital	158	76 (48.1)			68 (43.0)			82 (51.9)		
Door-to-door	79	13 (16.5)			7 (8.9)			36 (45.6)		

(Continued)

TABLE 4 (Continued)

Variables	N	Depression [n(%)]	χ^2	P	Anxiety [n(%)]	χ^2	P	Sleep[n(%)]	χ^2	P
External environment										
Yes	755	277 (36.7)	13.228	<0.001	219 (29.0)	4.768	0.029	418 (55.4)	32.783	<0.001
No	259	63 (24.3)			57 (22.0)			90 (37.4)		
Worry about the degree										
No worry	176	58 (33.0)	46.452	<0.001	53 (30.1)	53.346	<0.001	60 (34.1)	30.483	<0.001
General worry	426	105 (24.6)			79 (18.5)			208 (48.8)		
More worried	297	111 (37.4)			84 (28.3)			168 (56.6)		
Very worried	115	66 (57.9)			60 (52.2)			72 (62.6)		

TABLE 5 Model goodness of fit test.

Variables	Chi square	Degree of freedom	Significance
Depression	11.510	8	0.174
Anxiety	12.127	8	0.146
Sleep	7.202	5	0.515

3.3. Correlation analysis of depression, anxiety and sleep quality

PHQ-9, GAD-7, and PSQI were found to be positively correlated ($P < 0.05$) in a correlation analysis. Age and fear for infection were positively correlated with depression and anxiety scores ($P < 0.05$). Years of work, collection time and fear for infection were positively correlated with sleep disorder scores ($P < 0.05$). Notably, education level had a significant negative association with PHQ-9, GAD-7 and PSQI ($P < 0.05$), as can be found in Table 3.

3.4. Monofactor analysis

Monofactor analysis revealed significant differences between the type of personnel, age, education level, technical title, collection time, collection frequency, collection location, external environment and worry level and the positive rate of depression and anxiety (all $P < 0.05$). There were statistically significant differences between the positive rate of sleep disorders and different education levels, collection frequency, external environment and worry level (all $P < 0.05$), as indicated in Table 4.

3.5. Binary logistic regression

The following independent variables were included in the binary logistic regression model with whether depression, anxiety and sleep were abnormal as dependent variables (values of 1 for yes and 0 for no). Each variable was based on "0." The reference group was assigned to the category of medical

personnel (0 for doctors), education level (0 for junior college students), technical title (0 for junior students), collection time (0 for<4 h/day), collection frequency (0 for once/every other day), and collection location (0 for communities), Worry level (no worry is 0).

3.5.1. Overall fit of the model

The goodness-of-fit of this paper focused on the H-L index to test the goodness-of-fit of the logistic model. When the significance is >0.05, it indicates that the model fits well, and when the significance is <0.05, it suggests that the model fits poorly, and the model test results are shown in Table 5.

3.5.2. Binary logistic model results

Figure 1 depicts the depression of medical students as being 0.373 times lower than that of doctors (95% CI: 0.152 to 0.910); education level is the protective factor for depression. Undergraduate and graduate students with higher education backgrounds had 0.475 times lower depression levels compared to undergraduates (95% CI: 0.323 to 0.699); 1.329 times higher depression prevalence per additional age unit (95% CI: 1.099 to 1.608); and 0.605 times lower intermediate levels compared to junior level (95% CI: 0.397 to 0.921); the longer the collection time, the higher the depressive mood. The risk of depressive mood of those who collected more than 8 h per day was 2.911 times higher than that of those who collected 4 h per day (95% CI: 1.547 to 5.476); the number of people with multiple collection times/day was 1.787 times that of people with one collection every other day (95% CI: 1.206 to 2.649); The people in the mobile cabin hospital were the most depressed, 31.413 times as many as those in the community (95% CI: 13.495 to 73.120); 2.324 times (95% CI: 1.289 to 4.191) of those who were very worried about infection than those who were not; the external environment could affect the depression of the collectors (95% CI: 0.318 to 0.716) (All $P < 0.05$).

Figure 2 depicts the anxiety of nurses as being 0.544 times lower than that of doctors (95% CI: 0.333 to 0.889), and that of medical students was 0.251 times lower than that of doctors (95% CI: 0.084 to 0.757); the degree of education was a protective factor of anxiety. Compared with college students, the anxiety of undergraduates and postgraduates with higher education is 0.513 times lower (95% CI:
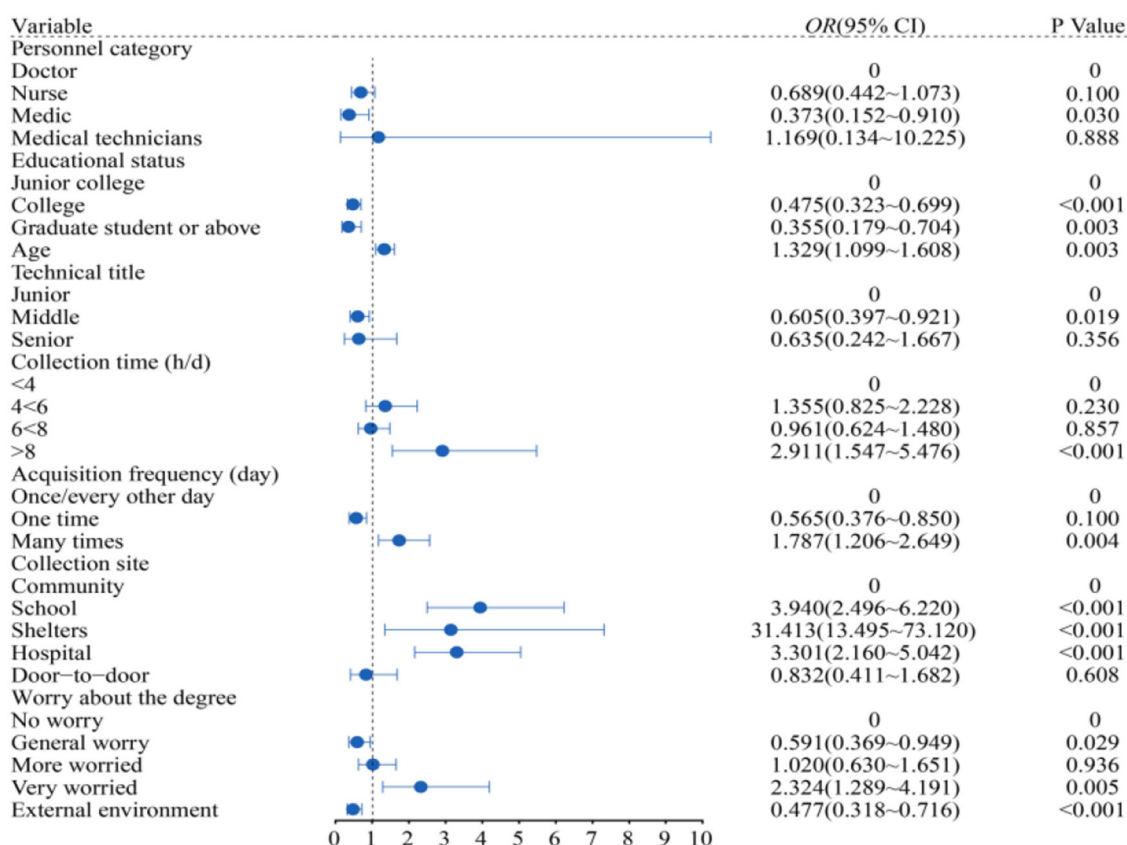
FIGURE 1
Results of binary logistic model to predict depression factors.

0.335 to 0.783); the incidence of anxiety increased 1.340 times (95% *CI*: 1.087 to 1.652) with the increase in age; Compared with primary professional titles, intermediate professional titles decreased by 0.237 times (95% *CI*: 0.161 to 0.462); The longer the collection time, the greater the inhibition of anxiety was. The risk of depression was 2.542 times (95% *CI*: 1.228 to 4.944) higher for those who collected more than 8 h a day than those for collected 4 h a day; the number of people with multiple collection times/day was 1.976 times that of people with one collection every other day (95% *CI*: 1.252 to 3.118); people in mobile cabin hospital were the most anxious, 52.945 times as much as those in the community (95% *CI*: 23.041 to 121.657); 2.267 times (95% *CI*: 1.209 to 4.252) of those who were very worried about infection than those who were not; the external environment affected the anxiety of the collectors (95% *CI*: 0.406 to 0.997) (All *P* < 0.05).

Figure 3 depicts that education level is the protective factor for sleep disorder. Compared with college students, the sleep disorder of postgraduates and above decreased by 0.475 times (95% *CI*: 0.276–0.820); The personnel who collected once a day were 1.169 times as many as those who collected once every other day (95% *CI*: 1.216 to 2.292); People who were very worried about infection were 2.883 times more likely to have sleep disorders than others (95% *CI*: 1.731 to 4.803); The external environment can affect the sleep of the collector (95% *CI* 0.341 to 0.636) (All *P* < 0.05).

4. Discussion

This study analyzed the psychological status of 1,014 nucleic acid collection staff in Shaanxi Province under closed-loop management through monofactor and binary logistic regression models. And the research found a high proportion of nucleic acid collectors with depression, anxiety and sleep disorders during closed-loop management. Age, technical title, education level, collection time, collection frequency, collection location, fear for infection and external environment also affected the psychological state. The PHQ-9, GAD-7 and PSQI used in this study are mainly used for clinical screening for depression, generalized anxiety disorders and sleep disorders. When PHQ-9 and GAD-7 scores ≥ 10 points, PSQI ≥ 7 points, usually considered that the patients may have depressed mood, anxiety or sleep disorder problems and need further diagnosis (25, 26).

First, the incidence of depression, anxiety and sleep disorders among nucleic acid collection personnel throughout the closed-loop management period were 33.5, 27.2, and 50.1%, respectively. Previous research showed that during the epidemic, 14.3% of clinical doctors and nurses suffered from depression, 11.2% from anxiety (33), and 61.67% (34) from sleep disorders. During the non-epidemic period, the incidence of depression, anxiety and sleep disorders of medical staff were 1.98%, 6.52% (35), and 39.2%
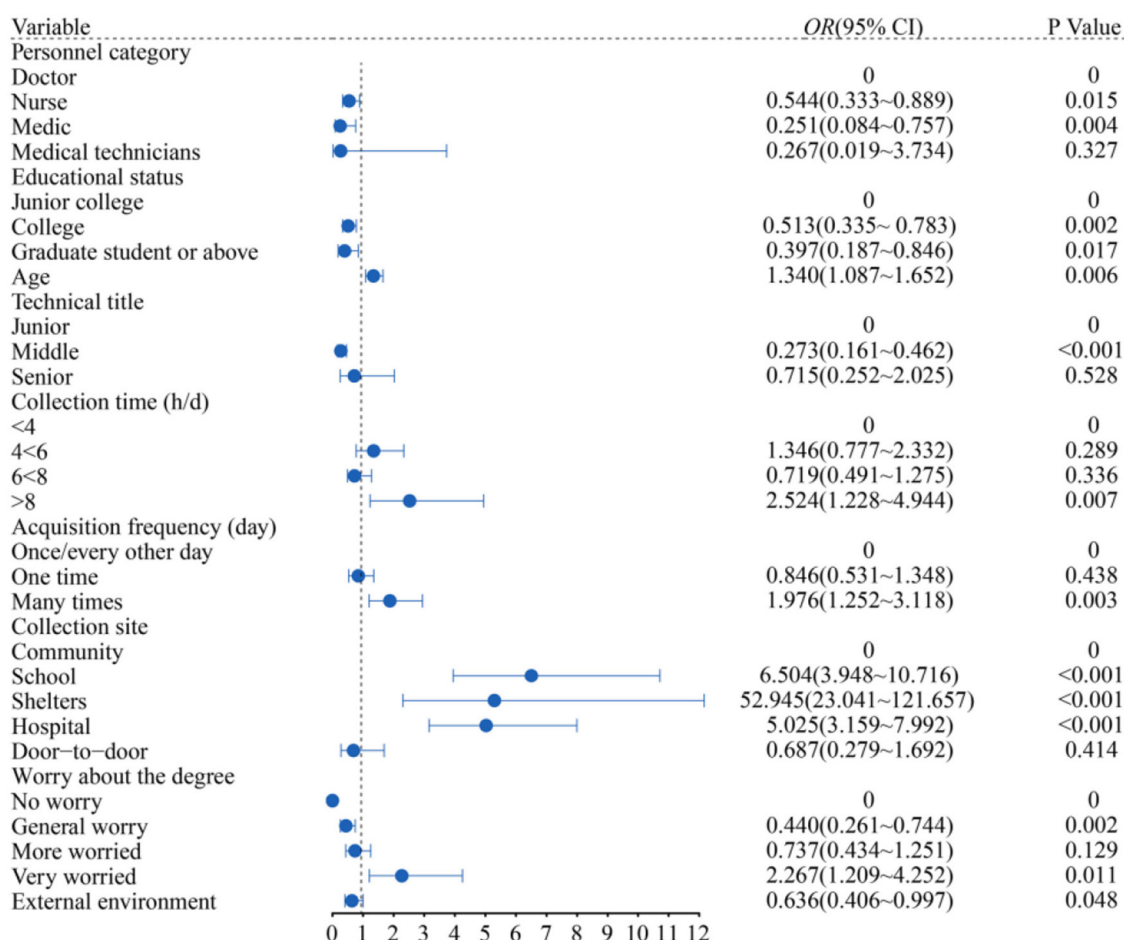
FIGURE 2
Results of binary logistic model to predict anxiety factors.

(36), respectively. Moreover, compared with more research data from other countries on the incidence of depression, anxiety and sleep disorders among medical personnel during the COVID-19 pandemic. The incidence of depression, anxiety and sleep disorders were 36, 34, and 52%, respectively in Spanish medical personnel (37); 37, 23, and 34% in Latin America (38); 55, 51, and 28% in Africa (39); 34%, 46% (40), and 40% (41) in Eastern Europe. And the prevalence of depression, anxiety and sleep disorders among health-care workers in south-east Asia were generally lower than other regions during the pandemic, which were 14, 23, and 18% (42), respectively. Therefore, the prevalence of mental health symptoms during the COVID-19 pandemic is not homogeneous across different regions. Compared with the results in this study, the incidence of depression and anxiety in above countries are much higher. On the one hand, different research tools may lead to differences results. On the other hand, since the COVID-19 outbreak, the world has experienced many waves of the epidemic, medical staff's mental state is also different from the beginning. Moreover, the different incidence of depression, anxiety and sleep disorders between different countries are more likely related to region, cultural and political factors. For instance,

African health-care workers have the highest rates of depression and anxiety in these countries, and it may be that in economically underdeveloped areas, the incidence of infectious diseases is high, health facilities are poor and mental health receives less attention (39). These are likely to lead to an increase in the incidence of depression and anxiety in health-care workers. On the contrary, the incidence of sleep disorders among nucleic acid collection personnel in this study is higher than in other countries. It was hypothesized that researchers and nucleic acid collectors were engaged in long-term epidemic prevention, which leading to high mental stress and heavy workload. In addition, frequent shifts, lack of sleep also increased the risk of infection during closed-loop management. The sudden outburst of this highly infectious disease and the containment measures such as quarantine and social distancing have posed immense pressure on the work and life of the health-care workers (43). This could lead to an increased incidence of sleep disorders among the nucleic acid collection staff.

Second, this study examined the correlation between the research variables among the nucleic acid collection staff. The higher the score on the depression and anxiety scale, the higher
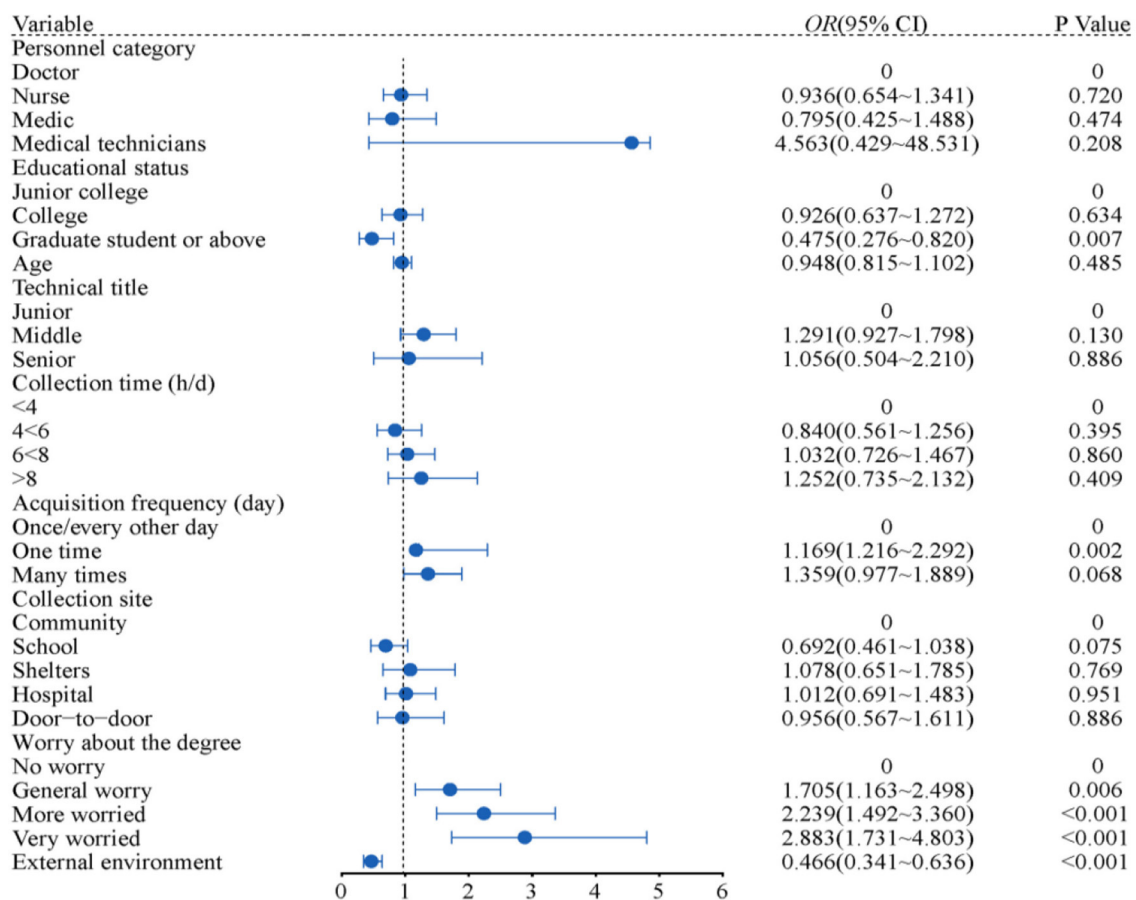
FIGURE 3
Results of binary logistic model to predict sleep disorder factors.

the total score of sleep disorder, indicating that medical staff sleep quality is poor. At the same time, when the sleep disorder score increased, the occurrence of depression and anxiety increased. The age of the nucleic acid collection staff was positively related to depression and anxiety, indicating that the older the patient, the more likely he or she was to suffer from depression and anxiety, the present study findings are in line with other reports (35, 44). Younger adults, however, appear to be more susceptible to sleeplessness and anxiety, according to Wang et al. (45). The discrepancy may be caused by older medical staff members' worse health state in terms of nucleic acid collection and their decreased tolerance and capacity to adjust to cold and demanding work situations compared to those under the age of 40. Depression, anxiety and sleep disorders were negatively correlated with education level, that is, the higher the education level, the lower the incidence of depression, anxiety and sleep disorders. Among people suffering from serious physical health problems, those with higher education were less likely to experience symptoms of depression and anxiety than those with lower education. Higher levels of education help to regulate the relationship between psychological and stress responses, thus reducing the occurrence of depression and anxiety (46, 47). The findings showed that fear

for infection was positively associated with depression, anxiety and sleep disorders, which was because the outbreak of COVID-19 is the largest public health emergency in China in the past decade (48). At the same time, the developing Omicron variant has a high incidence and expands quickly (49). In the short term, there were many more confirmed cases in Xi'an, which can add to their psychological strain.

By analyzing data from a binary logistic regression model, we discovered greater positive rates of depression and anxiety among the mobile cabin hospital collecting staff than at other collection locations in the current research. The results of the analysis revealed that the collection personnel had extended direct contact with the sampled subjects (positive patients) and that this increased both parties' risks of infection or cross-infection compared to those in the community or schools. According to other research, medical professionals working in high-risk situations are more likely to experience depression, anxiety, and sleep difficulties as well as higher levels of "fear about infection" than those working in low-risk conditions (50). Similar to door-to-door nucleic acid collection, floor-by-floor sampling by medical professionals raises the risk of aberrant psychological situations under heavy load and external environmental effects. As evidenced by the frequency and duration

of nucleic acid collection, the intensity of nucleic acid collection is relatively high and overload is more common. Among them, 79.1% were overloaded. Previous research has shown that prolonged and intensive work tends to worsen medical personnel's mental health [51]. In addition, the heavy workload may make medical staff more susceptible to illness and the shifts in the outside environment will have an impact on collectors' attitudes. Previous studies have shown that the weather to some extent affects the psychological two important factors are the season and outdoor time [52]. In January, the temperature outdoor Xi'an was relatively low, and the collecting staff worked longer in the low-temperature environment, which was more likely to lead to negative emotions than the more comfortable indoor environment.

5. Conclusion

The public was poorly informed about the mental health implications of the SARS pandemic when it first appeared in China, and those who need it did not receive any specific psychological support. In public health emergencies, the intensity and duration of medical staff increases, the risk of infection increases, and they face greater physical strength and mental stress, which leads to the occurrence of depression and anxiety, which is seriously affected sleep quality [53, 54]. Staff members who performing nucleic acid collection always get physically and mentally exhausted during a protracted period of epidemic preparation, particularly during line-points closed-loop management. The suggestions are as follows. First, the staff can engage in appropriate physical exercise during closed-loop management to reduce psychological stress and relieve psychological tension. Second, relevant management departments should strengthen human resources to improve detection efficiency, optimize nucleic acid collection process, reduce the workload of nucleic acid collection staff, and improve the working environment for nucleic acid collection. Finally, the mental health status of nucleic acid collection medical staff should be investigated regularly and corresponding psychological assistance measures should be taken to alleviate depression, anxiety and sleep disorders of nucleic acid collection personnel under closed-loop management.

6. Limitations

There are some limitations in this study. First, we used a practical sample strategy based on an online questionnaire survey, which made our sampling dependent on the online network environment and potentially prone to selection bias. Second, it has a cross-sectional design which limits the ability to interpret the causal relationships between the different variables in this study. The association and causality can be more accurately determined in randomized prospective research. Finally, since the scope of our study was restricted to Shaanxi Province and the sample size was modest, a bigger sample size is required for the validation of our findings.

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 Ethics Committee of the Affiliated Hospital of Shaanxi University of Traditional Chinese Medicine, Shaanxi Province, China approved this study (Ethical number: 2022-0516). The patients/participants provided their written informed consent to participate in this study.

Author contributions

MS implemented this study and was responsible for data collection and analysis and writing. XL, JY, and YK took part in the process of data collection. XH and ZL provided assistance in reviewing the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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Investigation on sleep-related cognition of Chinese health care workers during the first wave of COVID-19 pandemic

Wei Wang[1†], Xincan Ji[1†], Hao-Yang Guo[1], Mengjun Tao[2],
Lairun Jin[3], Miao Chen[1], Hui Yuan[1]* and Hui Peng[4]*

[1]School of Public Health, Wannan Medical College, Wuhu, Anhui, China, [2]Health Management Center,
The First Affiliated Hospital of Wanan Medical Collegue, Wuhu, Anhui, China, [3]School of Public Health,
Southeast University, Nanjin, Jiangsu, China, [4]Department of Science and Technology Administration,
The First Affiliated Hospital of Wanan Medical Collegue, Wuhu, Anhui, China

Background: The COVID pandemic has brought tremendous negative effects on the mental health of health care workers, such as anxiety, depression, and sleep disorders. We conducted this study to evaluate the sleep-related cognition of Chinese health care workers (HCWs) during the first wave of COVID-19 pandemic and analyze its association with sleep quality, so as to provide scientific reference for improving sleep of HCWs.

Patients and methods: A total of 404 HCWs from Yijishan Hospital of Wuhu City, China were enrolled in the study, selected by randomized cluster sampling in May 2020. We made a questionnaire to collect the general demographic information of the participants. The Pittsburgh Sleep Quality Index (PSQI) and a brief version of Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16) were used to measure sleep quality and sleep-related cognition, respectively.

Results: The results showed that 312 HCWs (77.2%) had false beliefs and attitudes about sleep, while only 92 HCWs (22.8%) had correct beliefs about sleep. In addition, we found that those HCWs who were older, married, with a bachelor's degree or higher, nurses, more daily working hours (> 8h) and monthly night shifts (≥5 times), had higher DBAS-16 scores (all $p<0.05$). However, we did not find significant differences between men and women in DBAS-16 scores. According to the definition of PSQI, a total of 1/4 of the HCWs are poor sleepers and their DBAS-16 score was higher than good sleepers ($t=7.622$, $p<0.001$). In the end, we confirmed a positive correlation between sleep cognition and sleep quality ($r=0.392$, $p<0.01$).

Conclusion: Our study revealed false beliefs and attitudes about sleep were prevalent among HCWs during the first wave of COVID-19 pandemic, and these false beliefs about sleep were closely correlated to sleep quality. We recommend fighting against these false beliefs about sleep.

KEYWORDS

sleep-related cognition, dysfunctional beliefs about sleep, sleep quality, health care workers, COVID-19

1. Introduction

Sleep is an essential physiological need for human beings, whose basic function is to relieve fatigue and restore energy. In addition, sleep plays a very important role in growth and development, maintenance of mental health and cardiovascular metabolism (1–3). Adequate sleep helps flush out the neurotoxic waste that builds up during waking hours from the brain (4). Lack of sleep often leads to fatigue, poor concentration, slow reactions and impaired judgment, which increase the risk of traffic accidents, industrial accidents, medical errors, and reduced productivity (5, 6). Moreover, long-term insomnia can cause anxiety, depression, and affect immune function, memory and cognitive function (7–9).

Many studies have shown that sleep disorders are related to sleep-related cognition (10–12), but the relevant mechanism is not yet clear. Harvey AG proposed a cognitive model of sleep disorders, showing that thinking activities can trigger autonomous arousal and emotional distress and excessive worry about sleep is a manifestation of dysfunctional sleep beliefs (13). Previous studies have shown that patients with mental diseases and sleep disorders are prone to early awakening and difficulty falling asleep (14, 15). They had wrong sleep beliefs and attitudes, such as paying more attention to the consequences caused by insomnia and worrying too much about sleep. And because they worry about sleep excessively and exaggerate its consequences, their insomnia symptoms may be sustained and developed. Through the intervention of distorted sleep beliefs in insomnia patients, sleep quality, mental and physical disorders can be effectively improved (16).

Because of the particularity of work, HCWs often have long working hours and frequent shift work (17). In their daily work, they also face complex clinical situations, high workload, as well as some emotional patients and family members of violence (18), they are burdened with great pressure. As a result, sleep deprivation is a common problem among medical professionals, and this can have potentially adverse effects on them personally and the patients they treat (19). In particular, during the COVID-19 pandemic, the rising number of novel coronavirus diagnoses has put an increasing burden on health care systems around the world, and HCWS easily become direct victims. Studies have shown that HCWS are one of the most vulnerable groups in COVID-19 outbreak, their mental health symptoms are worse than those of the general population (20, 21). Besides, HCWs are responsible for nucleic acid testing, managing patients and dealing with emergencies in their daily work, so they usually need to extend their working hours, long-term exposure to patients can increase the risk of infection. Anxiety, depression and stress/post-traumatic stress disorder the most prevailing COVID-19 pandemic-related mental health problems affecting HCWs, other mental health problems include burnout, fear of infection, phobias, somatic symptoms and substance abuse (6). During COVID-19, the world witnessed the vital role of HCWs. HCWs around the world, not just in China, are making enormous sacrifices. They are working day and night on the frontlines of the battle, regardless of personal safety, worrying about their families, and facing serious shortages of manpower and protective equipment. Many of them were also infected, and some even lost their lives. HCWs have made an outstanding contribution to the fight against COVID-19, but their sleep deprivation is often overlooked, with many complaining of difficulty getting good sleep. Even after leaving the COVID-19 ward, some of the frontline HCWs still had sleep disorders (22). Although an increasing number of studies have found an important role for cognitive factors in sleep onset and maintenance, few have been based on a large sample and variable combination among HCWs. Therefore, we hope to study the effect of cognitive factors during this major epidemic and to see whether the misperception of sleep is related to sleep disorders, to provide some reference for improving the poor sleep condition of HCWs.

2. Materials and methods

2.1. Patients

A descriptive cross-sectional study was conducted at Yijishan Hospital Affiliated to Wannan Medical College in Wuhu City, Anhui Province, China in May 2020. In this study, a total of 404 HCWs were selected by randomized cluster sampling and they were asked to fill out the study questionnaire. The exclusion criteria used in this study included individuals who submitted ineligible questionnaire or blank questionnaire, those who filled out the questionnaire wrongly, and those with inaccurate or incomplete demographic information needed for data analysis. These HCWs include clinicians, nurses, medical technicians, administrative staff and so on.

2.2. Methods

2.2.1. General demographic information

General demographic information for the study participants included age, sex (male/female), marital status, education level, occupation type, number of night shifts (per month), and average hours worked (per day).

2.2.2. Dysfunctional beliefs and attitudes about sleep scale (DBAS-16)

DBAS is widely used to measure and assess an individual's views and attitudes toward sleep. The original 30-item scale was shortened to a 16-item, our study uses a scaled-down version of DBAS (23). DBAS-16 reflected participants' beliefs and attitudes toward sleep in four different domains: (a) the consequences of insomnia (items 5, 7, 9, 12, and 16), (b) worry/helplessness about sleep (items 3, 4, 8, 10, 11, and 14), (c) Sleep expectations (items 1 and 2), and (d) Drugs (items 6, 13, and 15). Participants were asked to answer all 16 questions and circled a number ranging from 0 (strongly disagree) to 10 (strongly agree). The score of sub-scale can be computed by adding the sum of scores for the items and divided by the number of items making up each subscale. The total score of DBAS-16 is calculated by adding all items and dividing by 16. The higher the DBAS-16 score, the more distorted the sleep beliefs and attitudes. Finally, we considered the total score over/equal to 4 as false sleep beliefs, and less than 4 as right sleep beliefs according to a recent research (24).

2.2.3. The Pittsburgh sleep quality index

PSQI is commonly used to assess of sleep quality in patients with sleep disorders, mental disorders and general population (25). It is a self-reported questionnaire with nine questions (19 items in total) that reflect the subjects' sleep quality over the past few months. The test was divided into seven sub-scales: sleep quality (item 6), sleep

duration (item 4), sleep latency (item 2 and 5a), sleep efficiency (item 1, 3, and 4), sleep disorder (item 5b-5j), use of sleep medication (item 7) and daytime dysfunction (item 8 and 9). Each subscale is scored on a scale of 0–3, with an overall score of 0–21. The researchers found that PSQI score = 7 was used for the cut-off point had high sensitivity and specificity, which was suitable for Chinese people (26). Therefore, we defined that the total score of PSQI for good sleepers was lower than 7, while the total score of PSQI for people with poor sleep quality was 7 or above. The lower the PSQI score, the better the sleep quality.

2.3. Statistical analysis

Epidata 3.0 software was used to enter data. The descriptive statistics approach was used to describe the demographic variables such as age, gender, marital status, education level, and profession. The t-test and one-way analysis of variance (ANOVA) were used for comparison among different demographic groups. The Student–Newman–Keuls (SNK) was used for *post hoc* analyzes. A two-tailed *value of p* < 0.05 was considered to be statistically significant. The statistical analysis of the data was performed using the statistical software SPSS 18.0.

2.4. Ethics approval

All participants were informed of the research intention and signed an informed consent form and volunteered to participate in the study. The study was approved by the Ethics Committee of Wannan Medical College.

3. Results

3.1. Demographic characteristics of the sample

A total of 450 questionnaires were distributed, while 404 valid questionnaires were collected after some blank or invalid questionnaires were excluded. The mean age of the participants was 25.10 ± 6.32 years, and there were 182 males (45.0%) and 222 females (55.0%). As defined by the PSQI score, 25% of the participants were poor sleepers. The average DBAS-16 total score of the participants was 5.11 ± 1.65, among which 312 (77.2%) had false beliefs about sleep, while only 92 medical workers (22.8%) had correct sleep beliefs about sleep. The demographic information of participants was shown in Table 1.

3.2. DBAS-16 scores of the sample

The total score of DBAS-16 and the consequences of insomnia subscale score were significant differences among different age, marital status, education level, profession, average working hours per day and average number of night shifts per month. In the two subscales of worry/helplessness and medication, the results of ANOVA showed significant differences among levels of education (worry/helplessness subscale: $F = 6.382$, $p = 0.002$; Drug subscale: $F = 7.672$, $p = 0.001$) and

TABLE 1 Demographic characteristics of the study sample (N=404).

Variables	Number (%)
Gender	
Male	182 (45.0)
Female	222 (55.0)
Age (years, Mean ± SD)	25.10 ± 6.32
Marital status	
Unmarried / Divorced / Widowed	322 (79.7)
Married	82 (20.3)
Education	
Below bachelor	53 (13.1)
Bachelor	280 (69.3)
Master / Doctor	71 (17.6)
Profession	
Clinician	184 (45.5)
Nurse	29 (7.2)
Medical technician	108 (26.7)
Administrative staff	21 (5.2)
Other	62 (15.4)
PSQI	
<7	303 (75.0)
≥7	101 (25.0)
DBAS-16 (Mean ± SD)	5.11 ± 1.65
<4	92 (22.8)
≥4	312 (77.2)

Abbreviation: SD, Standard deviation; DBAS-16, Dysfunctional Beliefs and Attitudes about Sleep Scale; PSQI, Pittsburgh Sleep Quality Index.

monthly night shifts (worry/helplessness subscale score: $F = 4.910$, $p = 0.008$; Drug subscale score: $F = 6.223$, $p = 0.002$). There were significant differences in the subscale scores of sleep expectation among different genders, ages, marital status, education level, occupation and average night shifts per month (all $p < 0.05$). In addition, the DBAS-16 total score and four subscales score of poor sleepers were higher than those of good sleepers (DBAS-16 total score: $t = 7.622$, $p = 0.001$; consequences subscale score: $t = 5.801$, $p < 0.001$; worry/helplessness subscale score: $t = 8.357$, $p < 0.001$; expectations subscale score: $t = 5.572$, $p < 0.001$ and medication subscale score: $t = 3.845$, $p < 0.001$). The specific results are shown in Supplementary Table S2.

3.3. Correlation between PSQI and DBAS-16 sub-scale scores

As shown in Table 2, the total score of PSQI was positively correlated with the total score of DBAS-16 and the scores of four subscales. In addition, subscales of PSQI such as subjective sleep quality and sleep latency were correlated with all DBAS-16 subscales and DBAS-16 total score. Sleep duration was correlated with consequences subscale, worry/helplessness subscale, medication subscale, and total DBAS-16 score. Sleep disturbances, sleeping medication and daytime dysfunction were correlated with DBAS-16

TABLE 2 Correlation between PSQI subscale and DBAS-16 subscale.

Variables	DBAS-16 consequences	DBAS-16 worry/helplessness	DBAS-16 expectations	DBAS-16 medication	DBAS-16 total score
subjective sleep quality	0.242**	0.377**	0.198**	0.105*	0.307**
sleep latency	0.239**	0.391**	0.211**	0.140**	0.322**
sleep duration	0.122*	0.168**	−0.017	0.137**	0.144**
sleep efficiency	0.058	0.028	0.022	0.024	0.042
sleep disturbances	0.258**	0.301**	0.211**	0.187**	0.302**
sleeping medication	0.150**	0.167**	0.105*	0.270**	0.208**
daytime dysfunction	0.296**	0.290**	0.346**	0.132**	0.324**
PSQI total score	0.330**	0.412**	0.279**	0.206**	0.392**

$*p < 0.05$, $**p < 0.01$.
Abbreviations: DBAS-16, Dysfunctional Beliefs and Attitudes about Sleep Scale; PSQI, Pittsburgh Sleep Quality Index.

consequences scale, DBAS-16 worry/helpless subscale, DBAS-16 medication subscale and DBAS-16 total score. The specific data of PSQI scores are shown in our previous study (27).

4. Discussion

Our results showed that false beliefs about sleep were prevalent among HCWs, especially in those who were older, married, had a bachelor's degree or above, were nurses, worked more hours per day, and had more night shifts per month. In addition, we confirmed that there is a positive correlation between DBAS-16 scores and PSQI scores, that is, distorted beliefs and attitude about sleep are associated with poor sleep quality, which is consistent with relevant research results (28, 29). Therefore, the intervention of HCWs' false beliefs and attitude about sleep contributed to the improvement and recovery of sleep disorders.

First, nearly 77% of HCWs revealed false beliefs about sleep in our study, which is lower than those recently reported by Janati et al. in Morocco for the general population (24). Besides, 25% of HCWs reported sleep disorders, which was lower than reported in previous meta-analyzes and studies in other regions or countries during the COVID-19 pandemic. For example, previous meta-analyzes of insomnia in China indicated that the pooled prevalence of insomnia among HCWs ranged from 35 to 46% (30–32). The pooled prevalence of insomnia symptoms was 28% in Africa and 35% in Latin America (33, 34). An international collaborative study from 13 countries found that the prevalence of insomnia among adults was 37% during the first wave of the pandemic (35). However, prior to the COVID-19 pandemic, the meta-analyzes showed that the prevalence of insomnia was 7.4% in the general population and 18.5% in college students (36, 37), both of which were lower than our findings.

Meta-analyzes indicated women are more likely to experience symptoms of insomnia, anxiety and depression during the COVID-19 pandemic (31, 38, 39). Interestingly, our results suggested that there were no significant differences in sleep beliefs between men and women. The gender difference in insomnia may be due more to a complex interplay of other biological, psychological and social factors (40). Younger people appear to be associated with worse mental health outcomes and more sleep problem (35, 41). However, in this study,

we found better sleep beliefs in the younger group. This might be due to the fact that younger HCWs recover more quickly from symptoms of anxiety and depression (42). Liu Y et al. found that married HCWs had a high risk of mental symptoms (43). Similarly, we found that married HCWs had higher DBAS-16 scores than unmarried HCWs. The main reason might be related to their higher family burdens. Our study also found that HCWs with higher level education had more false sleep beliefs, the main reason may be that they were more prone to anxiety and depression and suffered additional pressure from scientific research and work (44). Moreover, our results showed that nurses' DBAS-16 scores were higher than those medical technicians and administrative staff. In fact, nurses suffered more often from sleep problems and symptoms of anxiety and depression than doctors during the COVID-19 pandemic (45). The main reason might be that nurses needed to spend longer time in contact with patients, and they were faced with a higher risk of infection.

In terms of working hours, our results showed that the participants with longer working hours and more night shifts had higher DBAS-16 scores. On the one hand, it might be because the extra work time brought a greater workload, and they sleep less time. More night duty was the risk factor of developing depressive and anxiety symptoms (46). On the other hand, artificial light at night interferes with the circadian rhythm. Circadian dysregulation impairs cognitive function, increases the risk of severe sleepiness, and causes errors of attention. Additionally, circadian misalignment is a specific risk factor for viral diseases, including the COVID-19 disease (47). Therefore, it is necessary to have a flexible working schedule that is appropriate to the current situation so that HCWs can get adequate rest.

Finally, we compared poor and good sleepers and found that poor sleepers had higher DBAS-16 scores, which was consistent with the results of previous studies (10, 28, 48), suggesting that cognitive factors might increase the risk of developed sleep disorders. The four subscale scores of DBAS-16 were all correlated with the total score of PSQI, among which the worry/helplessness subscale had the highest correlation with the PSQI total score, which means that feelings of worry may play a leading role in the effect on sleep quality. Indeed, sleep quality of HCWs was affected by anxiety, depression and other emotions under the COVID-19 epidemic, and false sleep beliefs may affect sleep and lead to the maintenance and development of insomnia (49).

Though the study of health care workers' sleep cognition during COVID-19 yielded a lot of useful data, there were some limitations. The study used a cross-sectional design and limited our ability to establish exact causality, and we call for more cohort studies to examine the effect of time. Second, the Yijishan Hospital Affiliated to Wannan Medical College from which the subjects of our study came is the only one designated by Wuhu Municipal government for COVID-19 treatment, so our results may not be applicable to all populations, and we call for future research in other countries or regions.

5. Conclusion

The false beliefs about sleep of HCWs should be corrected, and we should provide adequate rest time and psychological support to HCWs with poor sleep.

Data availability statement

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

Author contributions

WW: conceptualization, investigation, data curation, and writing - original draft. XJ and H-YG: investigation, data curation, and writing. MT and LJ: investigation and writing - review and editing. MC: investigation, data curation, and writing. HY and HP: conceptualization and writing - review and editing. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1019837/full#supplementary-material

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The impact of COVID-19 on the mental health of Lebanese pharmacists: A national cross-sectional study

Jihan Safwan[1,2]*, Dalal Hammoudi Halat[3,4], Marwan Akel[2,5,6], Samar Younes[1,2], Mohamad Rahal[4], Nisreen Mourad[2,4], Zeina Akiki[2], Michelle Cherfane[2,7], Faraj Saade[1,8,9], Etwal Bouraad[1,10], Mariam Dabbous[5] and Fouad Sakr[1,2,11,12]

[1]Biomedical Sciences Department, School of Pharmacy, Lebanese International, University, Beirut, Lebanon, [2]INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban), Beirut, Lebanon, [3]Academic Quality Department, QU Health, Qatar University, Doha, Qatar, [4]Pharmaceutical Sciences Department, School of Pharmacy, Lebanese International, University, Beirut, Lebanon, [5]Pharmacy Practice Department, School of Pharmacy, Lebanese International, University, Beirut, Lebanon, [6]School of Education, Lebanese International University, Beirut, Lebanon, [7]Population Health Division, Gilbert and Rose-Marie Chagoury School of Medicine, Lebanese American University, Byblos, Lebanon, [8]Alice Ramez Chagoury School of Nursing, Lebanese American University, Byblos, Lebanon, [9]Lebanese Order of Pharmacists, Beirut, Lebanon, [10]Department of Epidemiology and Population Health, American University of Beirut, Beirut, Lebanon, [11]UMR U955 INSERM, Institut Mondor de Recherche Biomédicale, Université Paris-Est, Créteil, France, [12]École Doctorale Sciences de la Vie et de la Santé, Université Paris-Est, Créteil, France

Introduction: The COVID-19 pandemic has induced a global mental health crisis with variable consequences. This study aimed to assess the psychological impact of COVID-19 regarding anxiety, insomnia, depression, and response to trauma on pharmacists in Lebanon during COVID-19, and to identify factors contributing to psychological distress.

Methods: This was a cross-sectional study among pharmacists that involved the use of the 7-item Generalized Anxiety Disorder (GAD-7), 7-item Insomnia Severity Index (ISI), Patient Health Questionnaire 9-item depression module (PHQ-9), and Impact of Event Scale revised (IES-R) subscales. Descriptive statistical analyses were performed to determine the study distribution. The associations between the scores and the participants' characteristics were assessed using the Chi-square test. Four binary logistic regression models were used to evaluate the association between the scores and the potential confounders, followed by four multivariable logistic regressions. An alpha of 0.05 was used to determine statistical significance.

Results: Participants comprised 311 pharmacists from all Lebanese districts, of whom 251 (80.7%) were females and 181 (58.2%) aged between 26 and 35years. The majority of the participants were community pharmacists (*n* =178, 57.2%). A considerable proportion of participants had symptoms of anxiety (*n* =128, 41.2%), insomnia (*n* =64, 20.6%), depression (*n* =157, 50.5%), and subjective stress (*n* =227, 78.8%). Higher anxiety (aOR: 1.73, 95% CI: 1.08; 2.78, *p*-value: 0.02), higher depression (aOR: 3.06, 95% CI: 1.73; 5.39, p-value: 0.001), and higher stress (aOR: 1.86, 95 percent CI: 1.11; 3.14, p-value: 0.02) scores were significantly associated with pharmacists who reported that their work involves contact with infected/suspected COVID-19 patients. Interestingly, pharmacists who expressed concern about contracting COVID-19 infection had significantly higher anxiety (aOR: 2.35, 95% CI: 1.40; 3.94, *p*-value: 0.001) and higher depression scores (aOR: 2.64, 95% CI: 1.49; 4.67, p-value: 0.001) respectively.

Conclusion: The preliminary results from pharmacists in Lebanon reflect increase in stress, burden, and frustration felt by pharmacists, creating a negative impact on their mental health and well-being during the global pandemic. As frontline healthcare workers, the role of pharmacists in the community should not be overlooked, and their mental health should be well investigated.

Introduction

On December 31, 2019, the first case of coronavirus disease 2019 (COVID-19), a severe infectious respiratory disease brought on by a new coronavirus (SARS-CoV-2), was reported in Wuhan, China (1). On March 11, 2020, the World Health Organization (WHO) formally designated it a global pandemic (2). Person-to-person transmission is *via* droplets released through coughing, sneezing, speaking, and contact with contaminated surfaces (3). In addition to raising concerns about global public health, COVID-19 also caused extraordinary disruptions to daily lives, with strong recommendations for social withdrawal, self-isolation, work interruptions, educational disruption, and travel limitations (4–7).

The COVID-19 pandemic has had detrimental psychological effects on healthcare workers who are on the front lines of treating infected patients (8). Personal and professional factors have contributed to fear, burnout, anxiety, depression, mental exhaustion, and insomnia among this population (4, 7). Some of the personal factors include a sense of fear, anxiety, and uncertainty, and a desire for appreciation, respect, and support, while work-related factors include unfamiliar responsibilities, insufficient resources, a lack of knowledge with personal protective equipment (PPE), and increased workloads (9).

Among the frontline healthcare workers are the pharmacists, who have been devotedly delivering essential services throughout the pandemic (10), and this has resulted in having them increasingly acknowledged as vital service providers around the world (11). This recognition stems from their ability to demonstrate that they are a dynamic workforce dedicated to public health and who can competently deliver a variety of services and products to meet current societal needs (12). During the lockdown, pharmacists were the most accessible healthcare members with whom patients could interact (13–16). They have actively participated in medical activities related to COVID-19 through utilizing their pharmacological expertise in screening, medication dispensing, as well as closely collaborating with other healthcare workers and governmental organizations to discover solutions and break down barriers (17, 18). Besides, they have played an essential role in community settings by raising public awareness related to health issues (19). As such, pharmacists are definitely frontline healthcare workers who are particularly positioned to provide care to a substantial segment of the population and have a high potential to contribute to the pandemic response.

While lockdown and staying at home regulations lingered, pharmacists continued working despite the numerous challenges. Hence, alongside this serious infectious public health event, the mental burden of pharmacists may be exacerbated by the rising number of confirmed and suspected cases, heavy workloads, negative emotions, exhaustion from PPE use, lack of certain medications, fear of spreading the disease to family, friends, and coworkers, as well as feelings of inadequate support (20, 21).

Due to the challenging conditions brought on by COVID-19, it has become crucial to evaluate the mental health of pharmacists who have been exposed to a variety of stress-related factors that have increased their stress levels, anxiety, depressive symptoms, and exacerbations of pre-existing mental disease (7, 20, 22, 23). In Lebanon, the COVID-19 pandemic, along with a severe economic downturn, has severely impacted an already struggling profession (24). The determination of the psychological impact of the COVID-19 regarding anxiety, insomnia, depression, and response to trauma on pharmacists in Lebanon during COVID-19, and the identification of characteristics that contribute to psychological distress, are warranted (25). Consequently, this study aimed to assess the psychological impact of COVID-19 regarding anxiety, insomnia, depression, and response to trauma on pharmacists in Lebanon during COVID-19, and to identify factors contributing to psychological distress.

Methods

Study design, setting, and participants

This was a cross-sectional study that involved pharmacists from all over Lebanon. Data were collected *via* an anonymous online questionnaire using Google Forms, over a period of 2 months during the COVID-19 outbreak from May 8 to July 5, 2020. A snowball sampling technique was used to collect data across the eight governorates (Mohafazat) of Lebanon and to target only Lebanese pharmacists who work in community, hospital, drug company, academic, and other settings.

Sample size calculation

The minimal sample size was calculated using CDC's Epi-Info for population surveys. The population size was set 13,000, which is the number of pharmacists in Lebanon. The expected frequency was set at 75%, which is the previously reported frequency of community pharmacists who are familiar with the recommendations of the Lebanese Order of Pharmacists (26). Consequently, a minimum sample of 282 pharmacists was required to produce a 95% confidence level and an acceptable margin of error of 5%.

Data collection

The online questionnaire was developed in English language and piloted with 10 pharmacists to check for content and clarity. Amendments were then done and the final questionnaire was distributed forwarding its link to all pharmacists working in Lebanon. The study scope and purpose were explained at the beginning of the questionnaire, confirming that the survey was strictly confidential and conducted in compliance with the relevant data protection law. Participants were informed that their participation in the study is voluntary and they were assured that their responses would remain anonymous and confidential. They were requested to indicate through a mandatory selection box before beginning the survey that this was their first time doing so (ensuring 100% consent rate and preventing duplicate replies), and completion of the questionnaire until the end was considered as informed consent to participate.

Ethical approval

The Ethics and Research Committee of the School of Pharmacy at the Lebanese International approved the study protocol (protocol number: 2020RC-042-LIUSOP) and followed the Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects. The procedures pertaining to the anonymity of the data and the information provided to the volunteers were anticipated and the nature of the elements to be collected did not carry the risk of disclosing weaknesses unknown to the volunteer and thereby causing unpredictable reactions.

Measurement tools

The questionnaire consisted of three sections. The first and second sections were concerned with the participants' sociodemographic data and the pharmacists' knowledge and concerns about COVID-19. In the following section, four validated scales that serve the purpose of the study in measuring the mental health status of the participants during the COVID-19 pandemic have been included. The 7-item Generalized Anxiety Disorder (GAD-7), 7-item Insomnia Severity Index (ISI), Patient Health Questionnaire 9-item depression module (PHQ-9), and Impact of Event Scale revised (IES-R) have been used to assess the psychological impact. The questionnaires were administered in English language because it is understood by the vast majority of Lebanese pharmacists who speak English. In fact, the OPL has adopted English as the language for their continuing education.

The 7-item insomnia severity index

The 7-ISI is a self-reporting instrument composed of 7 items that was used to assess the nature, severity, and impact of insomnia. Each item is rated on a 5-point Likert scale from 0 to 4 with a total score ranging from 0 to 28. The total score was calculated and interpreted as follows: normal with no insomnia (0–7), subthreshold (8–14), moderate (15–21), and severe (22–28) insomnia (27, 28). The Cronbach's alpha among our sample was 0.886.

The patient health questionnaire 9-item depression module

Participants' depressive symptoms during the COVID-19 pandemic were assessed using PHQ-9, which scores each of the nine Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) criteria of depression on a scale ranging from "0" (not at all) to "3" (nearly every day). The total sum of the responses ranging from 0 to 27 suggests varying levels of depression: no/minimal depression (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27) (29). The Cronbach's alpha among our sample was 0.868.

The 7-item generalized anxiety disorder scale

This 7-item self-rated tool was used to measure participants' anxiety symptoms over the previous 2 weeks. Each item is assigned a score from "0" (not at all) to "3" (nearly every day). The total score of GAD-7 ranges from 0 to 21 and is grouped into four categories as follows: no/minimal anxiety (0–4), mild (5–9), moderate (10–14), and severe (15–21) (30). The Cronbach's alpha among our sample was 0.930.

Impact of event scale revised

The IES-R has been utilized as a self-report measure to assess the level of symptomatic response to specific traumatic events as the COVID-19 pandemic as it was manifested in the previous 7 days. It consisted of a brief self-administered 22-item questionnaire, and for response, a five-point Likert scale was used. Scale scoring of IES-R included a total score (ranging from 0 to 88) that indicated the global subjective stress regarding COVID-19. Higher levels of distress are reflected by higher total (or subscale) scores. The total IES-R score was divided into: absence of PTSD in those with little or no symptoms (0–23), being at risk with several symptoms (24–32), and probable PTSD (≥33) (31). The Cronbach's alpha among our sample was 0.960.

Statistical analysis

Descriptive statistics were performed to represent the participants' characteristics, COVID-19 related information, the GAD-7 anxiety score, ISI insomnia severity score, PHQ-9 depression severity score, and IES-R global subjective stress score, and were expressed as percentages.

The GAD-7 anxiety score was expressed as "moderate and severe" versus "minimum and mild"; the insomnia severity index as "clinical insomnia (moderate and severe)" versus "no clinically significant insomnia and subthreshold insomnia"; the depression score as "moderate, moderately severe, and severe depression" versus "minimal and mild depression"; and the IES-R score as "little or no symptoms" versus "several symptoms" and "probable PTSD." The bivariate associations between the scores and the participants' characteristics were assessed using the Chi-square test for all variables or Fisher exact test (when >20% of the

expected cell count were less than 5). Thereafter, four binary logistic regression models using the forward method were performed to preclude potential confounding. The dependent variables were the anxiety, insomnia, depression, and IES-R scores in the first, second, third, and fourth models, respectively. The participants' characteristics having a p-value of less than 0.05 in the bivariate analysis were included as independent variables to account for them as potential confounding. The models were tested for adequacy in all the analysis. An alpha of 0.05 was used to determine statistical significance. All analyses were performed using the IBM's Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM, Inc., Chicago, IL).

Results

Demographic data of Lebanese pharmacists

A total of 311 Lebanese pharmacists participated in the study whose sociodemographic characteristics are shown in Table 1. The analyzed sample included participants from all Lebanese districts, of whom 251 (80.7%) were females and 181 (58.2%) aged between 26 and 35 years. As for the professional field, 57.2% work in community pharmacy, 6.1% work as hospital/clinical pharmacists, 14.8% in drug companies, 6.8% work in academia, 1% work in regulatory departments of pharmaceutical companies, and 14.1% in other pharmaceutical fields. Educational variables showed that 56.3% had a BPHARM degree and 43.7% had a BPHARM and postgraduate degrees (MS/PharmD/PhD). The majority ($n = 112$, 36%) belonged to the middle socioeconomic class with an average family income of more than 4,000,000 LBP per month.

Lifestyle changes during COVID-19 time

More than half of the participants stated that they drank at least 2 liters of water per day and were physically active during quarantine. However, the lifestyle of Lebanese pharmacists was affected during the pandemic, where alcohol intake was increased by 20% among alcohol consumers (51 [16.4%]). As for smoking, 23 (7.4%) were cigarette while 85 (27.3%) were waterpipe smokers respectively, and more than half of those reported increased smoking during the COVID-19 time. Caffeinated beverages were consumed by 271 (87.1%) and less than half (38%) increased their consumption during COVID-19. Energy drinks consumption was reported by 30 (9.6%), of whom 33.3% also had raised consumption during the pandemic, while alcohol consumption was reported by 51 (16.4%) and almost 20% increased their consumption during COVID-19.

Health and concerns about COVID-19, and results of the four mental health scales

Around half of the Lebanese pharmacists ($n = 157$, 50.5%) reported that they were in direct contact with infected/suspected

COVID-19 patients during the pandemic period and 85 (27.3%) reported being frontline workers. Only 40 (12.9%) reported a history of chronic disease. The majority ($n = 270$, 86.8%) reported getting sufficient protection against COVID-19 infection during work and 196 (63%) reported that they were concerned about contracting COVID-19. A considerable proportion of participants had symptoms of anxiety ($n = 128$, 41.2%), insomnia ($n = 64$, 20.6%), depression ($n = 157$, 50.5%), and subjective stress ($n = 227$, 78.8%). Further details are shown in Table 2.

Scores of measurement and association of possible influence factors with anxiety, insomnia, depression, and stress during COVID-19 pandemic

Numerous factors were shown to be significantly associated to anxiety, insomnia, depression, and stress among the pharmacists in Lebanon in the bivariate analysis. Tables 3–6 show the association of possible influence factors with GAD, insomnia, depression, and stress during COVID-19 pandemic.

Anxiety

Being married was significantly associated with lower anxiety levels as compared to single status (aOR: 0.51, 95% CI: 0.31; 0.83, p-value: 0.007). Interestingly, higher anxiety scores were significantly associated with pharmacists who expressed concern about contracting COVID-19 infection (aOR: 2.35, 95% CI: 1.40; 3.94, p-value: 0.001) and those who reported that their work involves contact with infected/suspected COVID-19 patients (aOR: 1.73, 95% CI: 1.08; 2.78, p-value: 0.02) respectively.

Insomnia

Higher rates of insomnia were associated with the presence of chronic medical disorders. Having a medical condition was significantly associated with greater scores for insomnia compared to those who did not have co-morbidities (aOR: 2.99, 95% CI: 1.45; 6.19, p-value: 0.003). On the other hand, being employed was significantly associated with lower levels of insomnia (aOR: 0.42, 95% CI: 0.22; 0.78, p-value: 0.006).

Depression

Interestingly, higher depression scores were significantly associated with pharmacists who expressed concern about contracting COVID-19 infection (aOR: 2.64, 95% CI: 1.49; 4.67, p-value: 0.001) and those who reported that their work involves contact with infected/suspected COVID-19 patients (aOR: 3.06, 95% CI: 1.73; 5.39, p-value: 0.001). Regarding variations to lifestyle, consuming energy drinks (aOR: 5.37, 95% CI: 1.81; 15.9, p-value: 0.002) was found to be significantly associated with higher depression scores. However, drinking more than 2 liters of

TABLE 1 Participants' Characteristics (*n*=311).

		n (%)
Gender	Female	251 (80.7)
Age	18 to 25	77 (24.8)
	26 to 35	181 (58.2)
	36 to 45	34 (10.9)
	46 and above	19 (6.1)
Nationality	Lebanese	301 (96.8)
	Non-Lebanese	10 (3.2)
Area of residence	Beirut	72 (23.2)
	Baalbak-Hermel and Bekaa	98 (31.5)
	Mount Lebanon	74 (23.8)
	Nabatieh and South	49 (15.8)
	North and Akkar	18 (5.8)
Marital status	Single	179 (57.6)
	Married	128 (41.2)
	Widow/Divorced	4 (1.3)
Being employed	Yes	245 (78.8)
Field of work	Community pharmacist	178 (57.2)
	Hospital-based pharmacist	19 (6.1)
	Drug company	46 (14.8)
	Academia	21 (6.8)
	Regulatory	3 (1)
	Others	44 (14.1)
Degree	BPHARM	175 (56.3)
	BPHARM & (MS/PharmD/PhD)	136 (43.7)
Smoking cigarettes	Yes	23 (7.4)
Smoking more during COVID time	Yes	15 (65.2)
Smoking arguileh	Yes	85 (27.3)
Smoking more during COVID time	Yes	37 (43.5)
Consuming caffeinated beverage	Yes	271 (87.1)
Consuming more during COVID time	Yes	103 (38)
Consuming energy drinks	Yes	30 (9.6)
Consuming more during COVID time	Yes	10 (33.3)
Drinking alcohol	Yes	51 (16.4)
Drinking more during COVID time	Yes	10 (20)
Physical activity during lockdown	No	153 (49.2)
	2–3 times/week	117 (37.6)
	> 3 times per week	41 (13.2)
Drinking water during lockdown (≥ 2 Liters/day)	Yes	169 (54.3)
Family income per month in LBP	≤ 750,000	7 (2.3)
	[750,001 – 2,000,000]	95 (30.5)
	[2,000,001 – 4,000,000]	97 (31.2)
	> 4,000,000	112 (36)

COVID-19, Coronavirus disease 2019; LBP, Lebanese pounds; BPHARM, Bachelor of Pharmacy; MS, Master of Science; PharmD, Doctor of Pharmacy; PhD, Doctor of Philosophy.

water per day during lockdown (aOR: 0.52, 95% CI: 0.31; 0.88, *p*-value: 0.02) and receiving appropriate COVID-19 infection prevention at work (aOR: 0.28, 95% CI: 0.12; 0.64, p-value: 0.003) were protective factors towards depression. Similarly, being employed was significantly associated with lower depression scores (aOR: 0.35, 95% CI: 0.18; 0.69, *p*-value: 0.003).

TABLE 2 Health and COVID-19 related information (*n*=311).

		n (%)
Having any medical condition	Yes	40 (12.9)
Being diagnosed with COVID-19	Yes	0
Family members/colleagues diagnosed with COVID-19	Yes	15 (4.8)
Work involve contact with infected/suspected COVID-19 patients	Yes	157 (50.5)
Directly engaged in clinical activities with patients having elevated temperature or confirmed COVID-19	No – Second-line worker	226 (72.7)
	Yes – Frontline worker	85 (27.3)
Getting sufficient protection against COVID-19 infection during work	Yes	270 (86.8)
Hours reading COVID-19 updates (past week)	<1 h/day	169 (54.3)
	1–2 h/day	110 (35.4)
	3–4 h/day	24 (7.7)
	5 or more hours per day	8 (2.6)
Getting sufficient support (state, community, and social media) during COVID-19	No Yes Somehow	112 (36.5)
		78 (25.4)
		117 (38.1)
Worried about getting COVID-19 infection	Yes	196 (63)
GAD-7 anxiety score	No / Minimal	82 (26.4)
	Mild	101 (32.5)
	Moderate	72 (23.2)
	Severe	56 (18)
ISI insomnia score	No clinically significant insomnia	138 (44.4)
	Subthreshold insomnia	109 (35)
	Clinical insomnia (moderate)	54 (17.4)
	Clinical insomnia (severe)	10 (3.2)
Sleeping hours / night	<5	43 (13.8)
	5 to 7	188 (60.5)
	8 to 10	76 (24.4)
	>10	4 (1.3)
Taking naps during the day	Yes	76 (24.4)
PHQ-9 depression severity score	No / Minimal depression	54 (17.4)
	Mild depression	100 (32.2)
	Moderate depression	97 (31.2)
	Moderately severe	39 (12.5)
	Severe depression	21 (6.8)
IES-R	Little or no symptoms	61 (21.2)
	Several symptoms	131 (45.5)
	Probable PTSD	96 (33.3)

COVID-19, Coronavirus disease 2019; GAD, 7-item Generalized Anxiety Disorder; ISI, 7-item Insomnia Severity Index; PHQ-9, Patient Health Questionnaire 9-item depression module; IES-R, Impact of Events Scale-Revised; PTSD, Post-traumatic stress disorder.

Stress

Notably, pharmacists who stated that their work involves contact with COVID-19 patients who are infected or suspected of being infected, were substantially more likely to report greater stress levels (aOR: 1.86, 95% CI: 1.11; 3.14, *p*-value: 0.02).

Discussion

This study is among the very few ones addressing mental health in Lebanon during COVID-19 pandemic, and is the first to explore the effect of the pandemic on mental health of pharmacists. Most of

the sociodemographic characteristics of the analyzed sample were aligned with previously published reports about pharmacists in Lebanon (32). Even though there aren't many studies on this subject in this particular population, it was deemed suitable to compare and discuss the findings based on research on healthcare workers as well as general population surveys.

High levels of stress, insomnia, anxiety, and depression were observed among Lebanese pharmacists. A number of variables including poor pharmacists' wages, which are typically not commensurate with their skills, as well as internal political upheaval and high inflation, could be to blame (33, 34). In fact, on November 19, 2020, Lebanon was ranked as the second-highest nation in terms of global inflation (Lebanon: 365%), only after Venezuela (2,133%).

TABLE 3 Bivariate and multivariable associations for GAD-7 anxiety scale.

		Bivariate analysis		Multivariable analysis n=311	
		Minimum & Mild (n =183) n (%)	Moderate & Severe (n =128) n (%)	aOR (95% CI)	p-value
Gender	Male	39 (65)	21 (35)	-	
	Female	144 (57.4)	107 (42.6)		
Age	18 to 25	37 (48.1)	40 (51.9)	-	
	26 to 35	112 (61.9)	69 (38.1)		
	36 to 45	24 (70.6)	10 (29.4)		
	46 and above	10 (52.6)	9 (47.4)		
Nationality	Lebanese	174 (57.8)	127 (42.2)*	Reference	0.2
	Non-Lebanese	9 (90)	1 (10)	0.25 (0.03; 2.07)	
Area of residence	Beirut	40 (55.6)	32 (44.4)	-	
	Baalbak-Hermel and Bekaa	62 (63.3)	36 (36.7)		
	Mount Lebanon	35 (47.3)	39 (52.7)		
	Nabatieh and South	32 (65.3)	17 (34.7)		
	North and Akkar	14 (77.8)	4 (22.2)		
Marital status	Single	1q2	84 (46.9)*	Reference	
	Married	86 (67.2)	42 (32.8)	0.51 (0.31; 0.83)	0.007
	Widow/Divorced	2 (50)	2 (50)	0.98 (0.13; 7.29)	0.9
Being employed	No	37 (56.1)	29 (43.9)	-	
	Yes	146 (59.6)	99 (40.4)		
Field of work	Community pharmacist	105 (59)	73 (41)	-	
	Hospital-based pharmacist	11 (57.9)	8 (42.1)		
	Drug company	24 (52.2)	22 (47.8)		
	Academia	15 (71.4)	6 (28.6)		
	Regulatory	1 (33.3)	2 (66.7)		
	Others	27 (61.4)	17 (38.6)		
Degree	BPHARM	106 (60.6)	69 (39.4)	-	
	BPHARM & (MS/PharmD/ PhD)	77 (56.6)	59 (43.4)		
Smoking cigarettes	No	172 (59.7)	116 (40.3)	-	
	Yes	11 (47.8)	12 (52.2)		
Smoking arguileh	No	129 (57.1)	97 (42.9)	-	
	Yes	54 (63.5)	31 (36.5)		
Consuming caffeinated beverage	No	23 (57.5)	17 (42.5)	-	
	Yes	160 (59)	111 (41)		
Consuming energy drinks	No	166 (59.1)	115 (40.9)	-	
	Yes	17 (56.7)	13 (43.3)		
Drinking alcohol	No	157 (60.4)	103 (39.6)	-	
	Yes	26 (51)	25 (49)		
Physical activity during lockdown	No	90 (58.8)	63 (41.2)	-	
	2–3 times/week	69 (59)	48 (41)		
	>3 times per week	24 (58.5)	17 (41.5)		
Drinking water during lockdown (≥ 2 Liters/day)	No	79 (55.6)	63 (44.4)	-	
	Yes	104 (61.5)	65 (38.5)		

(Continued)

TABLE 3 (Continued)

		Bivariate analysis		Multivariable analysis n=311	
		Minimum & Mild (n =183) n (%)	Moderate & Severe (n =128) n (%)	aOR (95% CI)	p-value
Family income per month in LBP	≤750,000	3 (42.9)	4 (57.1)	-	
	[750,001 – 2,000,000]	51 (53.7)	44 (46.3)		
	[2,000,001 – 4,000,000]	60 (61.9)	37 (38.1)		
	>4,000,000	69 (61.6)	43 (38.4)		
Having any medical condition	No	161 (59.4)	110 (40.6)	-	
	Yes	22 (55)	18 (45)		
Family members/ colleagues diagnosed with COVID-19	No	171 (57.8)	125 (42.2)	-	
	Yes	12 (80)	3 (20)		
Work involve contact with infected/suspected COVID-19 patients	No Yes	101 (65.6) 82 (52.2)	53 (34.4) * 75 (47.8)	Reference 1.73 (1.08; 2.78)	0.02
Directly engaged in clinical activities with patients having elevated temperature or confirmed COVID-19	No	137 (60.6)	89 (39.4)	-	
		46 (54.1)	39 (45.9)		
	Yes				
Getting sufficient protection against COVID-19 infection during work	No	19 (46.3)	22 (53.7)	-	
	Yes	164 (60.7)	106 (39.3)		
Hours reading COVID-19 updates (past week)	<1 h/day	107 (63.3)	62 (36.7)	-	
	1–2 h / day	61 (55.5)	49 (44.5)		
	3–4 h /day	11 (45.8)	13 (54.2)		
	5 or more hours per day	4 (50)	4 (50)		
Getting sufficient support (state, community, and social media) during COVID-19	No	64 (57.1)	48 (42.9)	-	
	Yes Somehow	48 (61.5) 69 (59)	30 (38.5) 48 (41)		
Worried about getting COVID-19 infection	No	82 (71.3)	33 (28.7)**	Reference	0.001
	Yes	101 (51.5)	95 (48.5)	2.35 (1.40; 3.94)	

Logistic regression model assumptions met: Omnibus test likelihood ratio chi-square $p < 0.001$; Hosmer-Lemeshow test for goodness of fit $p > 0.05$. COVID-19, Coronavirus disease 2019; GAD, 7-item Generalized Anxiety Disorder; aOR, Adjusted Odds ratio; CI, Confidence Interval; BPHARM, Bachelor of Pharmacy; MS, Master of Science; PharmD, Doctor of Pharmacy; PhD, Doctor of Philosophy. *$p < 0.05$ (bivariate analysis). **$p < 0.01$ (bivariate analysis).

The pandemic, which exacerbated the burden on pharmacists' mental health, made this situation much worse. This may eventually continue to reduce pharmacists' productivity, performance, and optimism (34). The anxiety, insomnia, depression, and stress findings in this population are also in conformity with reported high prevalence among healthcare workers according to results of a systematic review and meta-analysis published in 2021 (35).

Our findings showed that throughout the pandemic, there was an increase in the respondents' unhealthy behaviors. The rates of alcohol consumption, smoking, and caffeinated and energy drinks were increased and this was earlier reported among the Lebanese population during the pandemic (36), probably as a strategy to react to stressful situations, and has been reported elsewhere (37, 38). The increase in smoking and drinking alcohol during stressful experiences

is actually consistent with the "coping effect" of tobacco versus psychological stress (39, 40).

Lower anxiety was noted among married individuals, which is consistent with a previous study by Lawal and colleagues, which reported better coping among married females (41). However, Tan and Colleagues reported that single people experience less of the negative effects of events, stress, anxiety, and depression than divorced, separated, or widowed individuals (42). On the other hand, those with chronic medical diseases were shown to experience high levels of mental health distress. This was in line with the findings of other studies that have documented COVID-19 fatalities in patients with comorbidities (43).

The current study is in line with an extensive body of evidence which indicated that consumption of energy drinks was increased (36,

TABLE 4 Bivariate and multivariable associations for Insomnia severity score (ISI).

		Bivariate analysis		Multivariable analysis n=311	
		No clinical/ subthreshold n =247 n (%)	Moderate/Severe insomnia n=64 n (%)	aOR (95% CI)	p-value
Gender	Male	51 (85)	9 (15)	-	
	Female	196 (78.1)	55 (21.9)		
Age	18 to 25	55 (71.4)	22 (28.6)	-	
	26 to 35	148 (81.8)	33 (18.2)		
	36 to 45	28 (82.4)	6 (17.6)		
	46 and above	16 (84.2)	3 (15.8)		
Nationality	Lebanese	237 (78.7)	64 (21.3)	-	
	Non-Lebanese	10 (100)	0		
Area of residence	Beirut	59 (81.9)	13 (18.1)	-	
	Baalbak-Hermel and Bekaa	82 (83.7)	16 (16.3)		
	Mount Lebanon	52 (70.3)	22 (29.7)		
	Nabatieh and South	38 (77.6)	11 (22.4)		
	North and Akkar	16 (88.9)	2 (11.1)		
Marital status	Single	136 (76)	43 (24)	-	
	Married	107 (83.6)	21 (16.4)		
	Widow/Divorced	4 (100)	0		
Being employed	No	45 (68.2)	21 (31.8)*	Reference	0.006
	Yes	202 (82.4)	43 (17.6)	0.42 (0.22; 0.78)	
Field of work	Community pharmacist	148 (83.1)	30 (16.9)	-	
	Hospital-based pharmacist	14 (73.7)	5 (26.3)		
	Drug company	33 (71.7)	13 (28.3)		
	Academia	18 (85.7)	3 (14.3)		
	Regulatory	2 (66.7)	1 (33.3)		
	Others	32 (72.7)	12 (27.3)		
Degree	BPHARM	145 (82.9)	30 (17.1)	-	
	BPHARM & (MS/ PharmD/PhD)	102 (75)	34 (25)		
Smoking cigarettes	No	230 (79.9)	58 (20.1)	-	
	Yes	17 (73.9)	6 (26.1)		
Smoking arguileh	No	182 (80.5)	44 (19.5)	-	
	Yes	65 (76.5)	20 (23.5)		
Consuming caffeinated beverage	No	34 (85)	6 (15)	-	
	Yes	213 (78.6)	58 (21.4)		
Consuming energy drinks	No	224 (79.7)	57 (20.3)	-	
	Yes	23 (76.7)	7 (23.3)		
Drinking alcohol	No	203 (78.1)	57 (21.9)	-	
	Yes	44 (86.3)	7 (13.7)		
Physical activity during lockdown	No	121 (79.1)	32 (20.9)	-	
	2–3 times/week	95 (81.2)	22 (18.8)		
	>3 times per week	31 (75.6)	10 (24.4)		

(Continued)

TABLE 4 (Continued)

		Bivariate analysis		Multivariable analysis n=311	
		No clinical/ subthreshold n =247 n (%)	Moderate/Severe insomnia n=64 n (%)	aOR (95% CI)	p-value
Drinking water during lockdown (≥ 2 Liters/ day)	No	106 (74.6)	36 (25.4)	-	
	Yes	141 (83.4)	28 (16.6)		
Family income per month in LBP	≤750,000	5 (71.4)	2 (28.6)	-	
	[750,001–2,000,000]	76 (80)	19 (20)		
	[2,000,001–4,000,000]	72 (74.2)	25 (25.8)		
	>4,000,000	94 (83.9)	18 (16.1)		
Having any medical condition	No	222 (81.9)	49 (18.1)**	Reference	0.003
	Yes	25 (62.5)	15 (37.5)	2.99 (1.45; 6.19)	
Family members/ colleagues diagnosed with COVID-19	No	232 (78.4)	64 (21.6)		
	Yes	15 (100)	0		
Work involve contact with infected/suspected COVID-19 patients	No Yes	120 (77.9) 127 (80.9)	34 (22.1) 30 (19.1)		
Directly engaged in clinical activities with patients having elevated temperature or confirmed COVID-19	No	181 (80.1)	45 (19.9)		
	Yes	66 (77.6)	19 (22.4)		
Getting sufficient protection against COVID-19 infection during work	No	31 (75.6)	10 (24.4)		
	Yes	216 (80)	54 (20)		
Hours reading COVID-19 updates (past week)	<1 h/day	133 (78.7)	36 (21.3)		
	1–2 h/day 3–4 h/day 5 or more hours per day	90 (81.8) 18 (75) 6 (75)	20 (18.2) 6 (25) 2 (25)		
Getting sufficient support (state, community, and social media) during COVID-19	No	87 (77.7)	25 (22.3)		
	Yes Somehow	64 (82.1) 94 (80.3)	14 (17.9) 23 (19.7)		
Worried about getting COVID-19 infection	No	98 (85.2)	17 (14.8)		
	Yes	149 (76)	47 (24)		

Logistic regression model assumptions met: Omnibus test likelihood ratio chi-square $p < 0.001$; Hosmer-Lemeshow test for goodness of fit $p > 0.05$. COVID-19, Coronavirus disease 2019; ISI, 7-item Insomnia Severity Index; aOR, Adjusted Odds ratio; CI, Confidence Interval; BPHARM, Bachelor of Pharmacy; MS, Master of Science; PharmD, Doctor of Pharmacy; PhD, Doctor of Philosophy. *$p < 0.05$ (bivariate analysis). **$p < 0.01$ (bivariate analysis).

44) and significantly associated with depression symptoms (45). Notable preventive factors against depression included appropriate COVID-19 protection at work and good hydration. To maintain better immune systems and reduce the risk of chronic illnesses and infectious diseases, drinking water is essential (46). Lack of access to PPE has been directly linked to psychological distress and depressive symptoms (47), although having enough PPE might lessen the potential negative effects of COVID exposure on mental health (48). Healthcare workers would feel safer with PPE as this relates to their own health, that of

their patients, and that of their loved ones (48). Similarly, lower insomnia and depression scores were noted among employed pharmacists. This appears logical in a country with collapsed economy and the need for relative financial security through having a job.

As previously documented in a recent study among Portuguese pharmacists, increased anxiety and stress scores were reported with pharmacists who claimed that their profession entails contact with infected/suspected COVID-19 patients (49). Furthermore, anxiety and depression scores were much higher in pharmacists who showed

TABLE 5 Bivariate and multivariable associations for PHQ-9 depression severity score.

		Bivariate analysis		Multivariable analysis n=290	
		Minimum & Mild n =154 n (%)	Moderate/ moderately Severe & Severe n =136 n (%)	aOR (95% CI)	p-value
Gender	Male	28 (48.3)	30 (51.7)	-	
	Female	126 (54.3)	106 (45.7)		
Age	18 to 25	30 (42.9)	40 (57.1)	-	
	26 to 35	95 (56.2)	74 (43.8)		
	36 to 45	18 (56.3)	14 (43.8)		
	46 and above	11 (57.9)	8 (42.1)		
Nationality	Lebanese	146 (52)	135 (48)*	Reference	0.049
	Non-Lebanese	8 (88.9)	1 (11.1)	0.07 (0.005; 0.99)	
Area of residence	Beirut	34 (51.5)	32 (48.5)	-	
	Baalbak-Hermel and Bekaa	49 (52.7)	44 (47.3)		
	Mount Lebanon	33 (50.8)	32 (49.2)		
	Nabatieh and South	24 (50)	24 (50)		
	North and Akkar	14 (77.8)	4 (22.2)		
Marital status	Single	79 (47.3)	88 (52.7)*	Reference	
	Married	71 (59.7)	48 (40.3)	0.69 (0.40; 1.19)	0.2
	Widow/Divorced	4 (100)	0	0	
Being employed	No	25 (41)	36 (59)*	Reference	0.003
	Yes	129 (56.3)	100 (43.7)	0.35 (0.18; 0.69)	
Field of work	Community pharmacist	90 (53.9)	77 (46.1)	-	
	Hospital-based pharmacist	7 (36.8)	12 (63.2)		
	Drug company	23 (54.8)	19 (45.2)		
	Academia	12 (57.1)	9 (42.9)		
	Regulatory	1 (50)	1 (50)		
	Others	21 (53.8)	18 (46.2)		
Degree	BPHARM	86 (51.8)	80 (48.2)	-	
	BPHARM & (MS/ PharmD/PhD)	68 (54.8)	56 (45.2)		
Smoking cigarettes	No	146 (54.5)	122 (45.5)	-	
	Yes	8 (36.4)	14 (63.6)		
Smoking arguileh	No	117 (54.9)	96 (45.1)	-	
	Yes	37 (48.1)	40 (51.9)		
Consuming caffeinated beverage	No	19 (48.7)	20 (51.3)	-	
	Yes	135 (53.8)	116 (46.2)		
Consuming energy drinks	No	146 (55.5)	117 (44.5)*	Reference	0.002
	Yes	8 (29.6)	19 (70.4)	5.37 (1.81; 15.9)	
Drinking alcohol	No	130 (53.9)	111 (46.1)	-	
	Yes	24 (49)	25 (51)		
Physical activity during lockdown	No	66 (47.5)	73 (52.5)	-	
	2–3 times/week	66 (59.5)	45 (40.5)		
	> 3 times per week	22 (55)	18 (45)		

(Continued)

TABLE 5 (Continued)

		Bivariate analysis		Multivariable analysis n=290	
		Minimum & Mild n =154 n (%)	Moderate/ moderately Severe & Severe n =136 n (%)	aOR (95% CI)	p-value
Drinking water during lockdown (≥ 2 Liters/day)	No	59 (44.7)	73 (55.3)**	Reference	0.02
	Yes	95 (60.1)	63 (39.9)	0.52 (0.31; 0.88)	
Family income per month in LBP	≤ 750,000	3 (42.9)	4 (57.1)	-	
	[750,001 – 2,000,000]	46 (51.1)	44 (48.9)		
	[2,000,001 – 4,000,000]	49 (56.3)	38 (43.7)		
	> 4,000,000	56 (52.8)	50 (47.2)		
Having any medical condition	No	140 (55.6)	112 (44.4)*	Reference	0.1
	Yes	14 (36.8)	24 (63.2)	2.00 (0.87; 4.61)	
Family members/colleagues diagnosed with COVID-19	No	142 (51.6)	133 (48.4)*	Reference	0.03
	Yes	12 (80)	3 (20)	0.17 (0.03; 0.80)	
Work involve contact with infected/suspected COVID-19 patients	No Yes	87 (60) 67 (46.2)	58 (40) * 78 (53.8)	Reference 3.06 (1.73; 5.39)	<0.001
Directly engaged in clinical activities with patients having elevated temperature or confirmed COVID-19	No	115 (53.7)	99 (46.3)	-	
	Yes	39 (51.3)	37 (48.7)		
Getting sufficient protection against COVID-19 infection during work	No	13 (33.3)	26 (66.7)**	Reference	0.003
	Yes	141 (56.2)	110 (43.8)	0.28 (0.12; 0.64)	
Hours reading COVID-19 updates (past week)	<1 h/day	83 (52.9)	74 (47.1)	-	
	1–2 h / day	55 (53.4)	48 (46.6)		
	3–4 h /day	13 (59.1)	9 (40.9)		
	5 or more hours per day	3 (37.5)	5 (62.5)		
Getting sufficient support (state, community, and social media) during COVID-19	No	55 (53.4)	48 (46.6)	-	
	Yes Somehow	38 (52.1) 59 (53.6)	35 (47.9) 51 (46.4)		
Worried about getting COVID-19 infection	No	73 (65.2)	39 (34.8)**	Reference	0.001
	Yes	81 (45.5)	97 (54.5)	2.64 (1.49; 4.67)	

Logistic regression model assumptions met: Omnibus test likelihood ratio chi-square $p < 0.001$; Hosmer-Lemeshow test for goodness of fit $p > 0.05$. COVID-19, Coronavirus disease 2019; PHQ-9, Patient Health Questionnaire 9-item depression module; aOR, Adjusted Odds ratio; CI, Confidence Interval; BPHARM, Bachelor of Pharmacy; MS, Master of Science; PharmD, Doctor of Pharmacy; PhD, Doctor of Philosophy. *$p < 0.05$ (bivariate analysis). **$p < 0.01$ (bivariate analysis).

fear about developing COVID-19 infection, possibly highlighting the severe and wide-ranging psychological effects that the pandemic can have on daily life (50). The increase in the number of patients seen, the amount of triage done, the bulk of COVID-19 information delivered, the vast medication shortages, and the amount of workplace harassment, may have all affected the mental health of Lebanese pharmacists in the studied sample.

Limitations

This study, which was based on an electronic survey, has several limitations. First of all, it is difficult to determine the temporal link between exposure and outcomes from the cross-sectional design of the study. Second, the snowball sampling technique may have been associated with a possible risk of selection bias, which may affect the generalizability of the current findings. However, it is believed that this risk is minimized as our sample included pharmacists from districts all over Lebanon, which can provide some generalizability to the current findings. Moreover, although a web-based survey is one of the most efficient ways to obtain quick data, especially if social interactions are prohibited (i.e., lockdown), it may be associated with another possible risk of selection bias as it may have excluded senior pharmacists with lesser digital literacy. Further research is still recommended to include a broader range of pharmacists and evaluate their mental health amid pandemics as COVID-19 and influenzae to confirm the current findings. However, recall bias may still arise as a consequence of self-reporting assessment methods. Nevertheless, it is believed that this bias is minimized as the survey utilized validated scales with good internal consistency and using the English language that is well understood by all Lebanese pharmacists.

TABLE 6 Bivariate and multivariable associations for IES-R.

		Bivariate analysis		Multivariable analysis n=288	
		Little or several symptoms n =192 n (%)	Probable PTSD n =96 n (%)	aOR (95% CI)	p-value
Gender	Male	34 (65.4)	18 (34.6)	-	
	Female	158 (66.9)	78 (33.1)		
Age	18 to 25	44 (60.3)	29 (39.7)	-	
	26 to 35	111 (66.1)	57 (33.9)		
	36 to 45	22 (73.3)	8 (26.7)		
	46 and above	15 (88.2)	2 (11.8)		
Nationality	Lebanese	186 (66.2)	95 (33.8)	-	
	Non-Lebanese	6 (85.7)	1 (14.3)		
Area of residence	Beirut	40 (60.6)	26 (39.4)	-	
	Baalbak-Hermel and Bekaa	64 (68.8)	29 (31.2)		
	Mount Lebanon	39 (59.1)	27 (40.9)		
	Nabatieh and South	35 (76.1)	11 (23.9)		
	North and Akkar	14 (82.4)	3 (17.6)		
Marital status	Single	102 (61.1)	65 (38.9)	-	
	Married	87 (74.4)	30 (25.6)		
	Widow/Divorced	3 (75)	1 (25)		
Being employed	No	36 (59)	25 (41)	-	
	Yes	156 (68.7)	71 (31.3)		
Field of work	Community pharmacist	111 (66.1)	57 (33.9)	-	
	Hospital-based pharmacist	13 (76.5)	4 (23.5)		
	Drug company	27 (61.4)	17 (38.6)		
	Academia	13 (81.3)	3 (18.8)		
	Regulatory	2 (66.7)	1 (33.3)		
	Others	26 (65)	14 (35)		
Degree	BPHARM	113 (67.3)	55 (32.7)	-	
	BPHARM & (MS/ PharmD/PhD)	79 (65.8)	41 (34.2)		
Smoking cigarettes	No	180 (67.4)	87 (32.6)	-	
	Yes	12 (57.1)	9 (42.9)		
Smoking arguileh	No	146 (69.2)	65 (30.8)	-	
	Yes	46 (59.7)	31 (40.3)		
Consuming caffeinated beverage	No	22 (61.1)	14 (38.9)	-	
	Yes	170 (67.5)	82 (32.5)		
Consuming energy drinks	No	176 (68)	83 (32)	-	
	Yes	16 (55.2)	13 (44.8)		
Drinking alcohol	No	166 (68.6)	76 (31.4)	-	
	Yes	26 (56.5)	20 (43.5)		
Physical activity during lockdown	No	94 (65.3)	50 (34.7)	-	
	2–3 times/week	74 (69.8)	32 (30.2)		
	> 3 times per week	24 (63.2)	14 (36.8)		

(Continued)

TABLE 6 (Continued)

		Bivariate analysis		Multivariable analysis n=288	
		Little or several symptoms n =192 n (%)	Probable PTSD n =96 n (%)	aOR (95% CI)	p-value
Drinking water during lockdown (≥2 Liters/day)	No	95 (69.3)	42 (30.7)	-	
	Yes	97 (64.2)	54 (35.8)		
Family income per month in LBP	≤ 750,000	3 (42.9)	4 (57.1)	-	
	[750,001 – 2,000,000]	63 (67.7)	30 (32.3)		
	[2,000,001 – 4,000,000]	63 (70.8)	26 (29.2)		
	> 4,000,000	63 (63.6)	36 (36.4)		
Having any medical condition	No	169 (67.6)	81 (32.4)	-	
	Yes	23 (60.5)	15 (39.5)		
Family members/ colleagues diagnosed with COVID-19	No	184 (66.4)	93 (33.6)	-	
	Yes	8 (72.7)	3 (27.3)		
Work involve contact with infected/suspected COVID-19 patients	No Yes	108 (74.5) 84 (58.7)	37 (25.5) ** 59 (41.3)	Reference 1.86 (1.11; 3.14)	0.02
Directly engaged in clinical activities with patients having elevated temperature or confirmed COVID-19	No	150 (70.1)	64 (29.9)*	Reference	0.2
	Yes	42 (56.8)	32 (43.2)	1.47 (0.83; 2.60)	
Getting sufficient protection against COVID-19 infection during work	No	23 (57.5)	17 (42.5)	-	
	Yes	169 (68.1)	79 (31.9)		
Hours reading COVID-19 updates (past week)	<1 h/day	114 (69.9)	49 (30.1)	-	
	1–2 h/day 3–4 h/day 5 or more hours per day	63 (64.9) 11 (55) 4 (50)	34 (35.1) 9 (45) 4 (50)		
Getting sufficient support (state, community, and social media) during COVID-19	No	68 (64.8)	37 (35.2)	-	
	Yes Somehow	47 (67.1) 73 (67)	23 (32.9) 36 (33)		
Worried about getting COVID-19 infection	No	72 (72.7)	27 (27.3)	-	
	Yes	120 (63.5)	69 (36.5)		

Logistic regression model assumptions met: Omnibus test likelihood ratio chi-square $p < 0.001$; Hosmer-Lemeshow test for goodness of fit $p > 0.05$. COVID-19, Coronavirus disease 2019; IES-R, Impact of Events Scale-Revised; PTSD, Post-traumatic stress disorder; aOR, Adjusted Odds ratio; CI, Confidence Interval; BPHARM, Bachelor of Pharmacy; MS, Master of Science; PharmD, Doctor of Pharmacy; PhD, Doctor of Philosophy. *$p < 0.05$ (bivariate analysis). **$p < 0.01$ (bivariate analysis).

Finally, the current study applied generic validated scales rather than COVID-19 specific scales to assess mental health. Further studies are recommended to minimize the current biases.

Practical implications and future directions

The preliminary results from pharmacists in Lebanon reflect increase in stress, burden, and frustration felt by pharmacists, creating a negative impact on their mental health and well-being in the wake of the global pandemic. As frontline healthcare workers, the role of pharmacists in the community should not be overlooked, and their mental health should be well investigated. As we move towards a post-pandemic world, pertinent information about the mental health of pharmacists and associated factors should come up with essential recommendations on how to assist pharmacists in coping with anxiety, insomnia, depression, and stress occurring as collateral effects of COVID-19. With pharmacists being an integral segment of the healthcare system, their mental health and well-being is vital for proper health services. Accordingly, the impact of this study shall relate to pharmacists' community role, and should help to purposefully interpret their ability to effectively serve their community.

Conclusion

During the COVID-19 pandemic, pharmacists played a crucial role in providing treatment on the front lines, but the increasing demand for their services also led to changes in their mental health. Throughout the pandemic, pharmacists have remained essential to the efficient provision of healthcare. The findings indicated that the COVID-19 pandemic and the ensuing lockdown had a significant negative influence on the mental health of Lebanese pharmacists. Therefore, it is as important for pharmacy professionals to put their own mental health first as it is for them to assist their patients. They must take the time to assess their own mental health for symptoms of burnout and general psychological strain in order to continue providing the best care for patients. It is important to keep in mind that stress is a typical response to a global infectious disease pandemic, however, it is crucial to prepare for stress and take the necessary actions to reduce its negative effects on the body and mind. A well-equipped workforce may be maintained by efforts towards a regular schedule, engaging in fun activities, asking for assistance from coworkers and family, and creating stress-reduction techniques. To make sure that enough resources and assistance are being offered, pharmacy managers should maintain frequent and regular communication with their staff. In light of the ongoing challenges brought on by COVID-19, it is imperative to treat the mental health of healthcare workers. The development of guidelines and solutions to enhance the safety of pharmacists and other healthcare workers during future pandemics and upcoming global outbreaks should be a top priority for pharmacy organizations.

Data availability statement

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

Ethics statement

The Ethics and Research Committee of the School of Pharmacy at the Lebanese International approved the study protocol (protocol number: 2020RC-042- LIUSOP) and followed the Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects. The participants provided their written informed consent to participate in this study.

Author contributions

JS and DH: study conception and design. FSa, EB, and FSaa: acquisition of data. ZA, JS, MA, and FSaa: analysis and interpretation of results. MD, SY, and NM: investigation. MC, DH, and ZA: methodology. JS, SY, and DH: project administration. SY and JS: resources. ZA: software. DH and MA: visualization. JS, DH, and SY: writing original manuscript draft. SY, MR, DH, FSa, and MA: revision and editing it critically for important intellectual content. FSa and DH: validation. MR: supervision. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

Publisher's note

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*CORRESPONDENCE
Youjin Hong
✉ youjingah@gnah.co.kr
Seockhoon Chung
✉ schung@amc.seoul.kr

†These authors have contributed equally to this work

Validation of the Grief Support in Healthcare Scale among frontline nursing professionals working in COVID-19 inpatient wards in Korea

Junseok Ahn[1], Young Rong Bang[1], Eulah Cho[2], Oli Ahmed[3,4], Jeong Hye Kim[5], Youjin Hong[6]*[†], Seockhoon Chung[2]*[†] and Keith A. Anderson[7]

[1]Department of Psychiatry, Ulsan University Hospital, University of Ulsan College of Medicine, Ulsan, Republic of Korea, [2]Department of Psychiatry, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea, [3]Department of Psychology, University of Chittagong, Chattogram, Bangladesh, [4]National Centre for Epidemiology and Population Health, Australian National University, Canberra, ACT, Australia, [5]Department of Clinical Nursing, University of Ulsan, Seoul, Republic of Korea, [6]Department of Psychiatry, GangNeung Asan Hospital, University of Ulsan College of Medicine, Gangneung, Republic of Korea, [7]Department of Social Work, University of Mississippi, Oxford, MI, United States

Introduction: During the COVID-19 pandemic, healthcare workers (HCWs) have been exposed to higher levels of anxiety and psychological stress than the general population. Nurses who cared for COVID patients could not avoid repeated mourning as they witnessed the deaths of their patients. Therefore, tools are needed to evaluate whether there is adequate support for the grieving process of HCWs in both qualitative and quantitative manners.

Methods: Data from 229 nurses who witnessed the deaths of COVID-19 inpatients were analyzed using an online survey of nurses working in three tertiary hospitals. Factor analysis was conducted to validate the 10-item Korean version of Grief Support in Healthcare Scale (GSHCS). Stress and Anxiety to Viral Epidemics-9 was used to measure stress and anxiety caused by coronavirus, Generalized Anxiety Disorder-7 was used to measure overall anxiety, and Patient Health Questionnaire-9 was used for depression. Convergent validity correlation analysis was also performed with GSHCS.

Results: The two-factor model showed a good fit for the 10-item GSHCS (χ^2=35.233, df=34, p=0.410, CFI=0.999, TLI=0.990, RMSEA=0.013, SRMR=0.064). Cronbach's alpha is 0.918 and McDonald's omega is 0.913, suggesting that the 10-item version of the GSHCS is reliable for determining psychometric properties.

Conclusion: According to this study, the 10-item Korean version of the GSHCS is a reliable and valid measure of psychological support for grief among frontline nursing professionals who have witnessed the deaths of patients they cared for while working in COVID-19 inpatient wards. A two-factor model of the GSHCS has a good model fit and good convergent validity with other rating scales that measure viral anxiety, depression, and general anxiety.

Introduction

With the first COVID-19 case reported in December 2019 (1), the virus has spread rapidly worldwide. Approximately 531 million cases and 6.3 million deaths have been reported worldwide, with 18 million confirmed and 24,323 deaths reported in South Korea by June 2022 (2). There is a high prevalence of psychological issues such as depression, anxiety, insomnia, and post-traumatic stress disorder in the general population (3). It is important to note that the South Korean government recently announced a policy of coping with Coronavirus using a "Step by Step Recovery" strategy; however, this policy has been halted since a rise in the number of confirmed cases of the Omicron variant has occurred (4).

Psychological distress of healthcare workers in the COVID-19 pandemic

As healthcare workers struggled at the frontline of COVID-19, they were more vulnerable to psychological distress than the general population. They suffered from anxiety that they could become infected themselves as well as fear that they could spread the infection to family and friends. During the pandemic era, they also complained of work-related stress due to increased work intensity resulting from an explosion in the workload due to the rapid increase in the number of infected populations (5). However, the big difference between healthcare workers (HCWs) and the general population is that HCWs are forced to experience repetitive grief. In general, HCWs are more likely to see death than the general population, but medical staff working on the frontlines of COVID-19 during the pandemic had to experience a higher rate of patient death than their usual work experiences. During this period, death due to the rapid worsening of symptoms was common in elderly patients or patients with existing chronic diseases, and many HCWs complained of helplessness and guilt for not being able to save the patient.

Grief reaction of and grief support for nursing professionals

Nurses frequently experience the deaths of their patients and are highly exposed to grief. Nurses report grief emotions, such as sadness, fear, guilt, and powerlessness (6). Leaving the emotional experiences of nurses can lead to negative consequences on the physical, emotional, and spiritual health of patients when death and suffering occur repeatedly. However, nurses do not have the time to deal with losses, and they lack training in how to process their emotions. On the other hand, most nurses attempt to overcome this problem (7). There is a lack of policy support and education regarding grief management that can help nurses manage grief and loss after the death of their patients. Therefore, nurses need support to overcome the grief of recurrent patient deaths and maintain professionalism (6).

During the COVID-19 pandemic, family visits to medical institutions were restricted due to patient safety, and nurses were the only point of contact or support for many patients who died without seeing family or friends (8, 9). Traditionally, Korean funerals last 3 to 5 days. Family members spent 2 nights and 3 days together at the funeral home. However, due to the rapid increase in deaths and social distancing caused by the pandemic, most funerals took place in less than 3 days, and only a few people attended. There was no specific prohibition in the United States against being in a room with a dead body, but it is forbidden to be in the same room as an infected person in Korea. Moreover, burials and cremations were not restricted in the United States, but burials were prohibited in Korea. The Korean guidelines of prohibitions regarding funerals were maintained until relatively recently, which indicates a difference in time period. The guideline was amended in January 2022, but approximately 6,000 bereaved families had to say goodbye to their loved ones without saying goodbye.

Instead family members, nurses provide post-mortem care such as closing the eyes of the dead patient, wiping the body, and changing the shroud to respect the patient's dignity. However, during the COVID-19 pandemic, such nursing care is limited owing to concerns about infection, which added to the emotional distress and grief of nurses (6).

Support from others during the grieving process may have a significant influence on nurses' grief (10) and facilitate healing. In patient–nurse relationships, nurses must maintain their professional distance. As a result, their grief may go unrecognized and needed support may be unavailable to them. In end-of-life care, nurses practice emotional distancing to limit their experience of grief and protect the nursing profession. On the other hand, professional identity and responsibility as nurses often prevent emotional support for patients (11). Social support, including the psychological support of colleagues who are best known about their situation relating to the death of their patients, is very important for nurses to overcome grief due to the death of a patient (12). During the COVID-19 pandemic, the support of colleagues and family members decreased owing to the increased demand from patients and the burden of nursing work (9). Additionally, nurses recognized that unexpected death was the most difficult problem. When caring for a dying patient, a nurse should feel supported, including through interactions with colleagues, and be given the opportunity to express their feelings and experiences. In addition, organizational support is needed for nurses' psychological and personal well-being (13). Since many infected patients died unexpectedly in the COVID-19 wards during this pandemic, developing grief support tools for frontline HCWs is justified.

During the COVID-19 pandemic, it is imperative that HCWs receive psychological or environmental support for their grief. The Grief Support in Healthcare Scale (GSHCS) is a rating scale which can assess support for healthcare workers' grief reaction, and was developed using the following components of the theory of disenfranchised grief focused on support: recognition of the relationship, acknowledgment of the loss, and inclusion of the griever (14). Lee et al., developed and validated a pandemic grief scale during the pandemic period, which has been validated in several countries, and they also standardized pandemic grief scale it for HCWs (15). The GSHCS can provide a more comprehensive measure of grief support by incorporating the diversity of sources and forms available to frontline nursing professionals. The purpose of this study was to examine the reliability and validity of the GSHCS among nursing professionals working in COVID-19 inpatient wards who encounter death in the patients they care for.

Methods

Participants and procedures

An online survey was conducted at three tertiary-level affiliated hospitals of the University of Ulsan, including Asan Medical Center in Seoul, Ulsan University Hospital in Ulsan, and GangNeung Asan Hospital in Gangneung, from April 7 to 26, 2022. The online survey was distributed to frontline nursing professionals working in COVID-19 inpatient wards in the three hospitals. We obtained the participants' age, sex, and marital status, but no identifiable personal information was collected. In addition, we gathered responses to questions on COVID-19, such as "Did you witness any deaths of patients caused by COVID-19 while working on COVID-19 inpatient wards?" "Did you experience being quarantined due to COVID-19 infection?," "Did you experience being infected with COVID-19?" or "Did you get vaccinated?." Psychiatric history and current psychiatric distress were assessed.

We developed an e-survey form according to the Checklist for Reporting Results of Internet e-Surveys (CHERRIES) guidelines ([16]), and the investigators checked the usability and technical functionality before implementing the survey. All 339 (239 in Asan Medical Center, 150 in Ulsan University Hospital, and 50 in GangNeung Asan Hospital) nursing professionals were working in COVID-19 inpatient wards in each hospital, and we targeted to collect responses from at least 60% ($N = 203$) of the eligible population. We collected 266 (143 in Asan Medical Center, 94 in Ulsan University Hospital, and 29 in GangNeung Asan Hospital) responses. Out of the 266 respondents, 229 reported that they witnessed the death of patients (126, 85, and 18) who they took care of, which were finally enrolled for statistical analysis.

COVID-19 reached its fifth peak in Korea in March 2022, and our survey was conducted in the duration of fifth waves nationally and globally while epidemic was mainly due to Omicron variant ([2], [17]).

The study protocol was approved by the Institutional Review Boards (IRBs) of the Asan Medical Center (2022–0323), Ulsan University Hospital (UUH 2022–02–016-003), and GangNeung Asan Hospital (2022–03–003-001), which waived the requirement for written informed consent.

Measures

Grief Support in Healthcare Scale

The Grief Support in Healthcare Scale (GSHCS) was designed to evaluate the support available to HCWs in the event of grief. It was developed based on the theory of disenfranchised grief that emphasizes support ([18]). It has 15 items and three subscales: Factor I, recognition of the relationship; Factor II, acknowledgment of the loss; and Factor III, inclusion of the griever. Each item was rated on a 5-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree).

We translated the original English version of the GSHCS into Korean using translation and back-translation methods. The original English version of the GSHCS (Supplementary File 1) was translated into the Korean version (Supplementary File 2) by a bilingual expert. An additional bilingual expert translated the Korean text back into the original English text without referring to the original English text. The reverse-translated English version was compared and verified by a third party, and subtle differences were observed. By completing these steps, we created the Korean version of the GSCHS.

In this study, we explored a 10-item version of the GSHCS. We excluded items 11–15, which are not applicable in terms of the healthcare system or social norms in South Korea. HCWs do not usually attend their patient's funeral in Korea.

Stress and Anxiety to Viral Epidemics-9

The Stress and Anxiety to Viral Epidemics-9 (SAVE-9) scale can measure distress and anxiety experienced by healthcare workers during the COVID-19 pandemic ([19]). Items in the SAVE-9 were originally grouped into two categories: Factor I (items 1–5 and 8), anxiety about the epidemic, and Factor II (items 6–7 and 9), work-related stress associated with the epidemic. Each item on the SAVE-9 is rated on a 5-point Likert scale ranging from 0 (never) to 4 (always), with higher scores indicating greater levels of stress and anxiety. The Korean version of the SAVE-9, originally developed in Korea, was used in this study. Cronbach's alpha was 0.826 for this sample.

Generalized Anxiety Disorder-7

The Generalized Anxiety Disorder-7 (GAD-7) is a self-report scale that measures general symptoms ([20]). The scale contains seven items rated from zero (never at all) to three (almost every day). A high total score indicates a high degree of anxiety. In this study, we used the Korean version of the GAD-7 ([21]), and Cronbach's alpha was 0.934.

Patient Health Questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9) is a self-rating scale used to measure depression severity ([22]). The survey has nine items that can be rated from 0 (never) to 3 (nearly every day). A higher total score indicated more severe depression. In this study, we used the Korean version of the PHQ-9 ([23]), and Cronbach's alpha was 0.880.

Statistical analysis

The distribution of responses was evaluated using descriptive statistics (percentages, means, and standard deviations).

Second, confirmatory factor analysis (CFA) with a diagonal weighted least square estimation method was conducted to confirm the construct validity of the 10-item GSHCS. Before conducting EFA, the normality assumption was checked based on skewness and kurtosis (within the range ± 2 ([22])). The Kaiser–Meyer–Olkin (KMO) value and Bartlett's test of sphericity were examined to explore data suitability and sampling adequacy for factor analysis. A satisfactory model fit was based on the values of a standardized root-mean-square residual (SRMR) ≤ 0.05, a root-mean-square error of approximation (RMSEA) ≤ 0.10, and comparative fit index (CFI) and Tucker–Lewis index (TLI) ≥ 0.90 ([24], [25]). Multi-group CFAs with configural, metric, or scale-invariant models were conducted to examine whether the

10-item GSHCS could assess the degree of support in the same way among frontline nursing professionals with viral anxiety (SAVE-9 ≥ 22), depression (PHQ-9 ≥ 10), or anxiety (GAD-7 ≥ 10).

Second, reliability was assessed using Cronbach's alpha, McDonald's Omega, and split-half reliability (odd-even). Pearson's correlation was performed to examine the convergent validity of the SAVE-9, PHQ-9, and GAD-7 scales. The psychometric properties were assessed using the Rasch model. In the Rasch model, the infit mean square (MnSQ), outfit MnSQ, item difficulty, item and person separation index, and item and person reliability were estimated. SPSS version 21.0, AMOS version 27 (SPSS, Inc., Chicago, Illinois, United States), RStudio, and jMetrik software (version 4.1.1) were used for statistical analysis.

Results

All 229 responses from nursing professionals working in COVID-19 inpatient wards were analyzed. The majority of the respondents were female (n = 216) and had worked at each hospital for an average of 6.9 years. Most of the respondents (95%) were shift workers. Among the participants, 41.5% were quarantined due to COVID-19 and 37.1% were infected with COVID-19. Table 1 displays other demographics and rating scale scores.

Confirmatory factor analysis

The item-level properties of the Korean GSHCS are listed in Table 2. Sampling was adequate, and data were suitable for factor analysis (KMO value of 0.81 and Bartlett's test of sphericity value $p < 0.001$, Table 3). Corrected item-total correlations ranged from.633 to.851, which was above the minimum cutoff value (0.30).

CFA revealed a good fit for the two-factor model of the 10-item version of the GSHCS (χ^2 = 35.233, df = 34, p value = 0.410, CFI = 0.999, TLI = 0.990, RMSEA = 0.013, SRMR = 0.064) (Table 3). Factor loadings in the CFA ranged between 0.727 and 0.870 for subscale 1 and 0.704 and 0.885 for subscale 2 (Figure 1). Based on the results of the multi-group CFA with a configural, metric, or scale-invariant model, we observed that the 10-item version of the GSHCS could measure the degree of support in the same way across viral anxiety, depression, or generalized anxiety (Supplementary Table 1).

Reliability of the 10-item version of the GSHCS and evidence-based relationships with other variables

A full-scale Cronbach's alpha of 0.918 and McDonald's omega of 0.913 indicate that the 10-item version of the GSHCS is reliable (Table 3). Subscales 1 (Cronbach's alpha = 0.903, McDonald's omega = 0.904) and 2 (Cronbach's alpha = 0.914, McDonald's omega = 0.915) also showed good internal consistency. The 10-item version of GSHCS showed a good convergent validity

TABLE 1 Clinical characteristics of participants (*N*=229).

Variables	N (%), Mean±SD
Sex (female)	216 (94.3%)
Age	30.1 ± 6.3
Years of employment	6.9 ± 6.0
*Marital Status**	
Single	175 (76.4%)
Married, without kids	17 (7.4%)
Married, with kids	35 (15.3%)
Are you a shift worker?	218 (95.2%)
Questions on COVID-19	
Are you taking care of COVID-19 infected patients? (Yes)	229 (100.0%)
Did you experience being quarantined due to infection with COVID-19? (Yes)	95 (41.5%)
Did you experience being infected with COVID-19? (Yes)	85 (37.1%)
Did you get vaccinated? (Yes)	229 (100.0%)
Did you experience deaths of COVID-19 infected patients? (Yes)	229 (100.0%)
Psychiatric history	
Did you have experience or treated depression, anxiety, or insomnia? (Yes)	37 (16.2%)
Now, do you think you are depressed or anxious, or do you need help for your mood state? (Yes)	33 (14.4%)
Rating scales scores	
10-item Grief Support in Healthcare Scale	28.9 ± 7.5
Subscale 1–Recognition of the Relationship	14.7 ± 4.2
Subscale 2–Acknowledgment of the Loss	14.2 ± 4.2
Stress and Anxiety to Viral Epidemics-9 items	21.5 ± 6.3
Generalized Anxiety Disorders-7 items	4.2 ± 4.8
Patient Health Questionnaire-9 items	8.1 ± 5.3

*Two values were missing.

with SAVE-9 (r = 0.150, 95% CI [0.021, 0.275], p = 0.023), PHQ-9 (r = 0.145, 95% CI [0.016, 0.269], p = 0.028), and GAD-7 (r = 0.155, 95% CI [0.026, 0.279], p = 0.019). Among the subscales, subscale 1 (recognition of the relationship) was not significantly correlated with SAVE-9 (r = 0.082, p = 0.216), PHQ-9 (r = 0.086, p = 0.196), and GAD-7 (r = 0.064, p = 0.334); however, subscale 2 (acknowledgment of the loss) was significantly correlated with SAVE-9 (r = 0.166, p = 0.012), PHQ-9 (r = 0.146, p = 0.027), and GAD-7 (r = 0.132, p = 0.047).

Rasch model

Supplementary Table 2 present the Rasch model outputs for the GSHCS scale. The fit and outfit mean squares of all the items are

TABLE 2 Item properties of the 10-item Korean version of GSHCS.

Items	Descriptive				CITC	CID	Factor loading
	M	SD	Skewness	Kurtosis			
Item 1	2.841	1.005	−0.218	−0.460	0.757	0.882	0.818
Item 2	2.875	0.988	−0.209	−0.328	0.834	0.865	0.870
Item 3	3.237	0.998	−0.359	−0.071	0.775	0.878	0.788
Item 4	3.082	1.005	−0.449	−0.082	0.795	0.874	0.822
Item 5	2.690	0.971	−0.174	−0.603	0.633	0.907	0.727
Item 6	2.905	0.971	−0.266	−0.069	0.778	0.895	0.797
Item 7	2.905	0.967	−0.272	−0.024	0.851	0.880	0.885
Item 8	3.009	0.998	−0.281	−0.063	0.807	0.889	0.862
Item 9	2.828	0.974	−0.328	−0.220	0.823	0.886	0.876
Item 10	2.569	0.933	−0.203	−0.389	0.647	0.921	0.704

M, mean; SD, standard deviation; CITC, corrected item-total correlation; CID, Cronbach's alpha if item deleted; CFA, Confirmatory factor analysis.

TABLE 3 Scale-level psychometric properties of the 10-item Korean version of GSHCS.

Psychometric properties	Scores			Suggested cut off
	Subscale 1	Subscale 2	Full scale	
Cronbach's alpha	0.903	0.914	0.918	≥ 0.7
McDonald's Omega	0.904	0.915	0.913	≥ 0.7
Split-half reliability (odd-even)	0.956	0.944	0.969	≥ 0.7
Composite reliability	0.903	0.915		≥ 0.7
Standard error of measurement	1.313	1.225		< SD /2
Item separation index	4.387	3.552		≥ 2
Person separation index	2.785	2.528		≥ 2
Item reliability	0.951	0.927		≥ 0.7
Person reliability	0.886	0.865		≥ 0.7
KMO measure of sample adequacy	0.81			0.50
Bartlett's test of sphericity	023.381 (<0.001)			Significant
Model fits of confirmatory factor analysis				
χ^2 (df, *p* value)	35.233 (34, 0.410)			Nonsignificant
CFI	0.999			>0.95
TLI	0.990			>0.95
RMSEA	0.013			<0.08
SRMR	0.064			<0.08

between the recommended ranges (0.50–1.50) except for item 10. The outfit mean square of item 10 was 1.55, which is above the recommended range, but the outfit mean square was 1.49, which is between the recommended ranges; therefore, this factor should be considered. Regarding item difficulty, item 3 had the lowest item difficulty and item 5 had the highest item difficulty in the recognition of the relationship subscale. In the "acknowledgement of the loss" subscale, item 8 has the lowest item difficulty and item 10 has the highest item difficulty. Item and person reliability and separation indices were above the recommended cutoff (≥ 0.80, reliability, and ≥ 2 for separation indices).

Discussion

In this study, we found that the 10-item Korean version of the GSHCS is a reliable and valid rating scale for measuring psychological support for the grief of frontline nursing professionals who witnessed
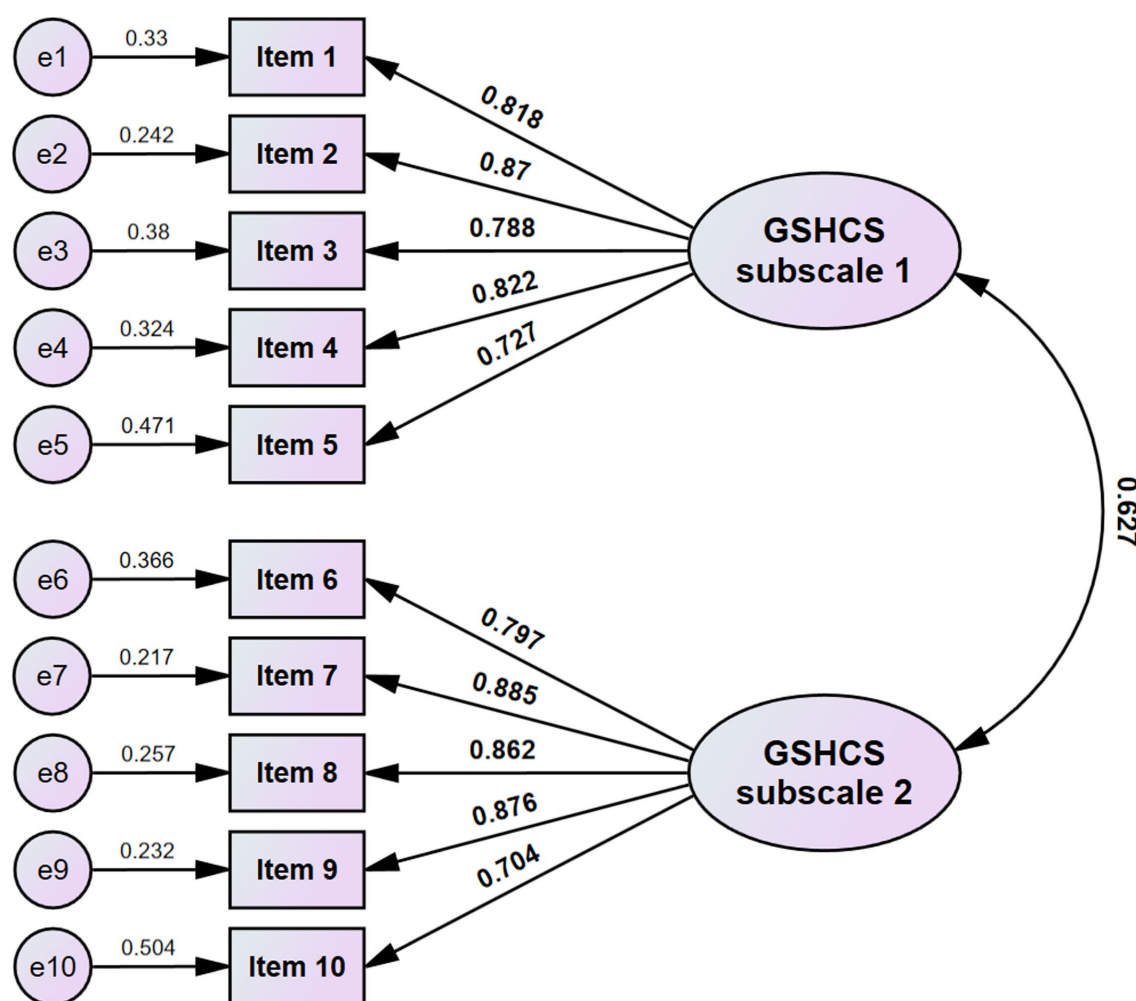
FIGURE 1
Factor structure of 10-item Korean version of the GSHCS.

the deaths of patients they care for while working in COVID-19 inpatient wards. We found a good model fit for a two-factor model of the GSHCS and good convergent validity with other rating scales that can measure viral anxiety, depression, or general anxiety. However, we found that subscale 2 (acknowledgment of the loss) was significantly associated with the level of psychological distress among frontline nursing professionals, whereas subscale 1 (recognition of the relationship) was not.

In this study, we also found good model fits for a two-factor model of the GSHCS, including subscales 1 (recognition of the relationship) and 2 (acknowledgment of the loss). In Doka's study, one of the factors supporting disenfranchised grief was the well-understood relationship between the HCW and the patient they cared for. Recognizing a relationship (subscale 1) was not associated with depression, viral anxiety, or general anxiety. Interestingly, this pattern is similar to that of the original study, which did not find any significant correlation between distress from grief and depression. However, acknowledgment of loss (subscale 2) was highly correlated with depression, viral anxiety, and general anxiety. As in the previous study, it was confirmed

again in the present study that it is important to know that the patients have died in order to reduce grief support for disenfranchised grief among HCWs. In general, patient information is not freely shared by HCWs with others because of confidentiality issues. Furthermore, medical personnel on the frontline of COVID-19 often had an atmosphere of hiding instead of freely expressing their concerns about the disease. In other words, it is both difficult to say that HCWs in the COVID-19 period had an intimate relationship with patients and that their work environment permitted them to discuss their relationship adequately. We found that the psychological distress that HCWs suffered from disenfranchised grief which was associated with COVID-19 depends primarily on their awareness of the loss they are experiencing rather than whether others are aware of their intimate relationship with the patient.

We excluded subscale 3 (including the griever) from the final model in this study. In addition, hospital death has not been considered a good death, which is called "Gaeksa; death outside of the house." Koreans have traditionally viewed dying at home with family watching as a good death (26). Grief support includes more than

social support. This can also include letting individuals participate in rituals or allowing them to mourn privately. Because medical professionals are people who live in cultures before they become medical professionals, there are differences in how they view the loss of patients in cultures that view funerals differently. As a natural process of life, death is not easy to talk about in Korea and is considered unacceptable by patients and their families as well. It is said that American Koreans and Hispanics are forbidden from discussing death with patients because they could negatively affect them (27).

We also examined the convergent validity of the GSHCS for viral anxiety during the pandemic. The death of a COVID-19 patient always occurs in a hospital that requires isolation. Until December 2021, if infected patients died during COVID-19, burials were forbidden, and funerals were mandatory within 24 h after cremation in Korea. Family members could not have direct contact with the deceased and were just allowed to watch their bodies enter the crematorium in an isolated or remote location. Consequently, HCWs or professional funeral directors handled most of the funeral procedures originally handled by the bereaved family. When a patient dies during the COVID-19 pandemic, the medical staff has no choice but to be semi-compulsively exposed to the death and mourning processes of more patients than usual. In addition, a medical professional who shares the same culture would suffer great psychological stress if it led to an unavoidable situation that might lead to disenfranchised grief in bereaved families.

Grieving was often incomplete in this COVID-19 pandemic (28), and mourning was insufficient even before the COVID-19 pandemic because the death of patients was regarded as a failure by HCWs (29). The excessive workload of HCWs often results in insufficient mourning of long-term patients. A mourning reaction combined with the excessive work of these medical staff members can cause severe burnout or even major psychiatric disorders. During the severe acute respiratory syndrome (SARS) era, Rober et al. reported that HCWs in Toronto were significantly vulnerable to burnout or post-traumatic stress disorder 13–26 months after the SARS breakout (30). During the COVID-19 pandemic, critically ill patients faced high mortality rates, and HCWs did not have time to grieve about the loss of their individual patients. Due to the longer duration of the pandemic, many of these imperfect mourning events might have continuously accumulated. Moreover, medical staff are often forcibly assigned to related tasks in COVID-19 situations, allowing them to be exposed to unintentional losses in emergency situations. Lastly, it was difficult for medical staff to share their condolences with their friends when caring for COVID-19 patients. The medical staff in charge of COVID-19 were often isolated from their interpersonal relationships because of the risk of spreading the disease to others. For this reason, they were also in a difficult position to inform family and friends about work-related facts and to comfort them about carrying out COVID-19-related tasks. Furthermore, the medical staff felt the survivor's guilt when their patients died, but they survived (28). During this rapid pandemic, medical staff have continued to work in an environment where there is an inadequate psychological support system for the death of a patient.

This study has several limitations. First, this study was conducted among HCWs working in COVID-19 inpatient units. As all participants experienced the death of infected patients, the results of this study may not be generalizable to other situations where HCWs can experience the death of patients regardless of whether they are infected with COVID-19. Second, this study was conducted as an anonymous online survey rather than face-to-face interview, to prevent viral transmissions. Psychological stress may be underreported because self-report responses are subject to bias. Third, the survey was conducted in three tertiary-level hospitals in Korea; however, there might be differences in the hospital environment. Furthermore, the sample size was not large, even though we completed the survey in three hospitals. However, this sample was homogeneous, since all participants were working in COVID-19 inpatient units.

In conclusion, we confirmed that the 10-item GSHCS is a reliable and valid measure of psychological support for frontline nursing professionals' grief. Psychological support is needed for nursing professionals who experience death while working in COVID-19 inpatient units, and it is important to assess whether they can provide psychological support for the grief that they experience. Equally important is the development and application of resources to support healthy grieving among nurses and other healthcare professionals. Fortunately, there are existing programs to support grief in these settings, including resources that were developed specifically to address grief during the COVID-19 pandemic (27). It is also critically important that we augment the training on grief and grief support for students in the healthcare professions. In training and supporting both current and future healthcare professionals, we may see improved scores on the GSHCS and higher levels of emotional well-being in our healthcare workforce.

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 study protocol was approved by the Institutional Review Boards (IRBs) of the Asan Medical Center (2022–0323), Ulsan University Hospital (UUH 2022–02–016-003), and GangNeung Asan Hospital (2022–03–003-001), which waived the requirement for written informed consent. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SC, YH, and JA: conceptualization, investigations, resources, and project administration. SC, JA, YB, EC, and YH: data curation. SC, OA, YB, and JA: formal analysis. YB, JK, and OA: methodology. EC: visualization. JA, YB, EC, OA, JK, YH, and SC: writing—original draft. All authors: writing—review and editing. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1097022/full#supplementary-material

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*CORRESPONDENCE
Jun Liu
✉ liujun_zmc@sina.com
Zhizhong Wang
✉ wzhzh_lion@126.com

†These authors have contributed equally to this
work and share first authorship

Prevalence and correlators of burnout among health professionals during different stages of the COVID-19 pandemic in China

Zhengshan Qin[1†], Zhehao He[2†], Qinglin Yang[1], Zeyu Meng[1], Qiuhui Lei[2], Jing Wen[3], Xiuquan Shi[4], Jun Liu[1]* and Zhizhong Wang[2,5]*

[1]Department of Preventive Medicine, School of Public Health at Zunyi Medical University, Zunyi, China, [2]Department of Epidemiology and Health Statistics, School of Public Health at Guangdong Medical University, Dongguan, China, [3]Department of Epidemiology and Health Statistics, School of Public Health and Management, Ningxia Medical University, Yinchuan, China, [4]Department of Epidemiology and Health Statistics, School of Public Health, Zunyi Medical University, Zunyi, Guizhou, China, [5]The First Dongguan Affiliated Hospital, Guangdong Medical University, Dongguan, China

Background: Persistently increased workload and stress occurred in health professionals (HPs) during the past 3 years as the COVID-19 pandemic continued. The current study seeks to explore the prevalence of and correlators of HPs' burnout during different stages of the pandemic.

Methods: Three repeated online studies were conducted in different stages of the COVID-19 pandemic: wave 1: after the first peak of the pandemic, wave 2: the early period of the zero-COVID policy, and wave 3: the second peak of the pandemic in China. Two dimensions of burnout, emotional exhaustion (EE) and declined personal accomplishment (DPA), were assessed using Human Services Survey for Medical Personnel (MBI-HSMP), a 9-item Patient Health Questionnaire (PHQ-9), and a 7-item Generalized Anxiety Disorder (GAD-7) to assess mental health conditions. An unconditional logistic regression model was employed to discern the correlators.

Results: There was an overall prevalence of depression (34.9%), anxiety (22.5%), EE (44.6%), and DPA (36.5%) in the participants; the highest prevalence of EE and DPA was discovered in the first wave (47.4% and 36.5%, respectively), then the second wave (44.9% and 34.0%), and the third wave had the lowest prevalence of 42.3% and 32.2%. Depressive symptoms and anxiety were persistently correlated with a higher prevalence risk of both EE and DPA. Workplace violence led to a higher prevalence risk of EE (wave 1: OR = 1.37, 95% CI: 1.16−1.63), and women (wave 1: OR = 1.19, 95% CI: 1.00−1.42; wave 3: OR =1.20, 95% CI:1.01−1.44) and those living in a central area (wave 2: OR = 1.66, 95% CI: 1.20−2.31) or west area (wave 2: OR = 1.54, 95% CI: 1.26−1.87) also had a higher prevalence risk of EE. In contrast, those over 50 years of age (wave 1: OR = 0.61, 95% CI: 0.39−0.96; wave 3: OR = 0.60, 95% CI: 0.38−0.95) and who provided care to patients with COVID-19 (wave 2: OR = 0.73, 95% CI: 0.57−0.92) had a lower risk of EE. Working in the psychiatry section (wave 1: OR = 1.38, 95% CI: 1.01−1.89) and being minorities (wave 2: OR = 1.28, 95% CI: 1.04−1.58) had a higher risk of DPA, while those over 50 years of age had a lower risk of DPA (wave 3: OR = 0.56, 95% CI: 0.36−0.88).

Conclusion: This three-wave cross-sectional study revealed that the prevalence of burnout among health professionals was at a high level persistently during the

different stages of the pandemic. The results suggest that functional impairment prevention resources and programs may be inadequate and, as such, continuous monitoring of these variables could provide evidence for developing optimal strategies for saving human resources in the coming post-pandemic era.

1. Introduction

Burnout is characterized by emotional and mental exhaustion due to long-term workplace stress and negative job perception and is officially classified as an occupational health syndrome in the 11th revision of the International Classification of Diseases (ICD-11) (1). Conceptionally, it consists of three interrelated dimensions: emotional exhaustion (EE), depersonalization (DP), and declined personal accomplishment (DPA) (2, 3). EE manifests through the loss of enthusiasm for work, feeling helpless, trapped, and defeated; DP is the negative response to other people; DPA refers to inefficiency or the lack of personal achievement (4). Heavy psychological burdens among health professionals (HPs) during outbreaks of SARS-CoV-1, H1N1, MERS-CoV, or Ebola have been reported (5). The prolonged duration of the COVID-19 pandemic has placed unprecedented pressure on HPs who directly participated in procedures including the diagnosis, treatment, and care of patients with COVID-19 (6, 7). It was reported that more than half of HPs had high-stress levels and poor work–family balance during the COVID-19 pandemic (8). Systematic reviews reflected the increase in the prevalence of psychological distress, insomnia, anxiety, depression, and symptoms of post-traumatic stress disorder among health professionals during the current pandemic (7). Several studies have investigated the prevalence of burnout and associated factors among HPs (9–12). A study reported that over one-third of the HPs experienced severe burnout symptoms during the early stage of the pandemic in China (13). It reported age, family income, daily working hours, workload, insufficient protection working in a high-quality hospital, having more years of work experience, having more night shifts and fewer paid vacation days, etc. were associated with burnout among HPs during the pandemic in China (14–16). Although studies observed a positive association between workplace violence and burnout (17, 18), no study reported whether workplace violence affected burnout differently during COVID-19 in China. In brief, most of those studies were conducted at the early stage of the pandemic. It is unclear whether the stressful impact persisted as the pandemic continued.

Although strenuous efforts have been made to control the pandemic worldwide, the situation had no signs of improving until early 2022 (19). In the past 3 years, China adopted lockdown, zero-COVID strategy, and prolonged anti-pandemic measures to fight COVID-19 (20). However, until now, no large studies have been conducted to consistently investigate different phases of the pandemic in burnout among health professionals, as well as modifiable correlators and mitigators of it in mainland China. Moreover, there have been no targeted recommendations put forward for organizations to develop human resource-saving

programs and preparedness for future spikes. However, prior research has highlighted emotional exhaustion (EE) as the most sensitive dimension of burnout, with high levels of EE being associated with DP and DPA (20–22). Some studies have suggested that the original three-factor model of the Maslach Burnout Inventory (MBI) can be replaced with one- or two-factor models (23). Hence, we extracted the items of EE and DPA from the MBI in the present investigation to enhance the robustness and feasibility.

Therefore, with the two dimensions of EE and DPA, the current research monitored burnout changes in prevalence and correlators among HPs during the three different stages of the pandemic through a three-wave cross-sectional study.

2. Methods

2.1. Study design

This study included three repeated online surveys. The first wave of the survey was proceeded 1 month after the first peak of the pandemic in China (27 March and 26 April 2020). The second wave survey was repeated between 27 March and 26 April 2021, when the zero-COVID policy and regular epidemic prevention and control rules were applied nationally. The third wave survey was repeated between 1 April and 30 April 2022, when the second peak of the pandemic happened in China.

2.2. Participants and procedure

This online survey was developed following the guidelines of the Checklist for Reporting Results of Internet E-Surveys (12). Individuals who served as physicians, nurses, or medical technicians in any hospitals in mainland China were included. The exclusion criteria were those who were absent from their position for more than 6 months in the past year, cannot access the Internet for any reason, or were unlicensed practitioners. The potentially qualified HPs were invited to join the study through several ways, including social media platforms, such as WeChat, Tencent QQ, and Sina Weibo (tweet in China). Those who responded to the invitation were encouraged to forward the questionnaire link to their colleagues and post it on their own social media networks. Second, an invitation letter was sent to an email list generated by the medical journal association when the email addresses were published with the article.

A total of 51,685 potential participants received the invitation to participate (Figure 1). Of them, 12,411 responded and completed the online questionnaire (a response rate of 24.0% in total;

FIGURE 1
Flow chart of participants' enrollment.
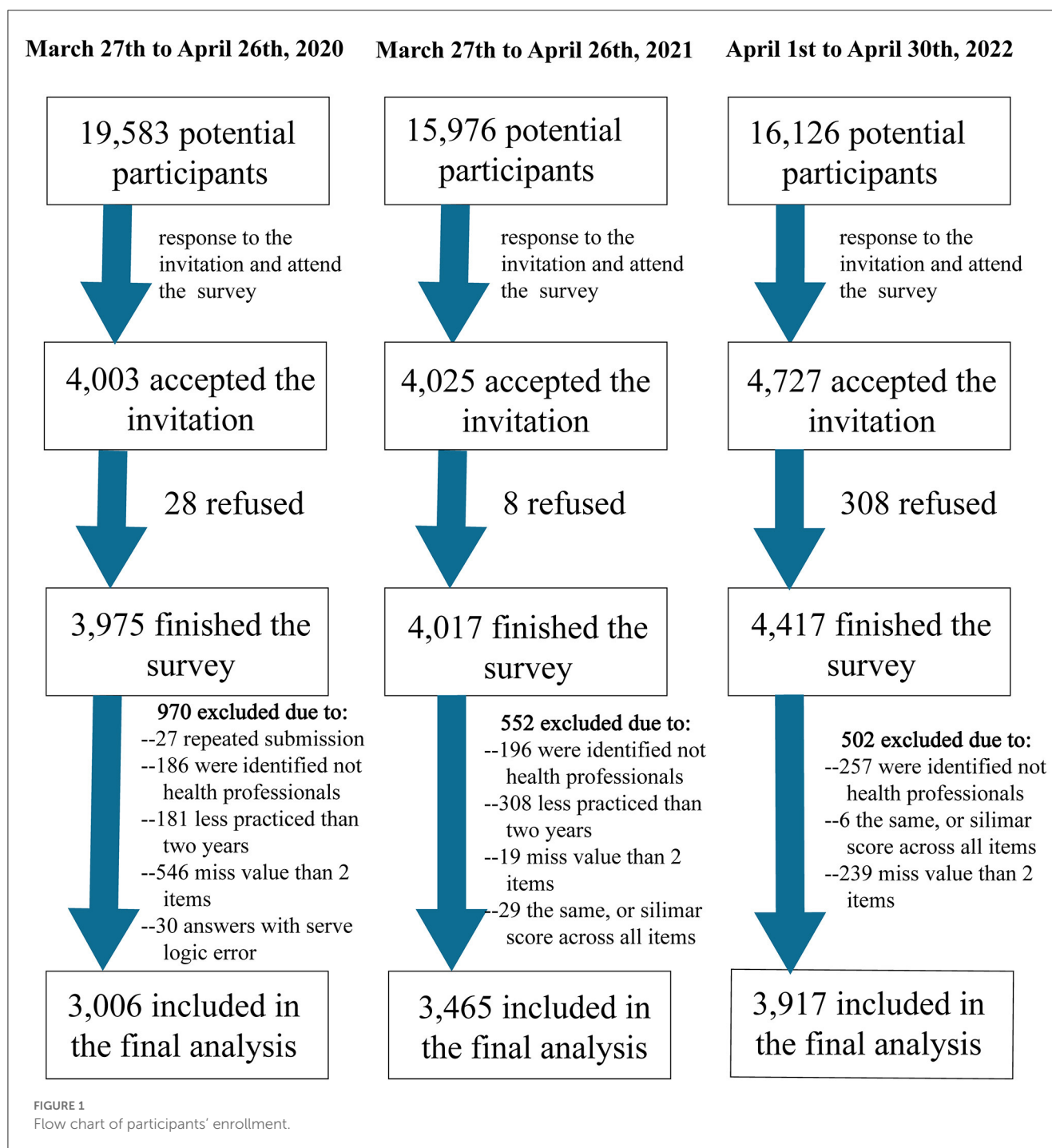
20.2%, 25.1%, and 27.4% in wave 1, wave 2, and wave 3, respectively). Finally, 2,023 participants were excluded during the data cleaning process due to missing values, being identified as non-health professionals, having less than 2 years of practice, and so on, resulting in a sample of 10,388 participants in the analysis.

The survey was conducted on "Wenjuanxin", an online survey solution provider. The survey link was compatible with multiple devices (including smartphones, laptops, and computers). The survey was anonymous, and online informed consent was acquired by asking participants to tick a box on the device screen. The study was approved by the institutional review board of the Ningxia Medical University (approval #2020-112).

2.3. Measurements

Sociodemographic data were collected and included the following variables: age, sex, marital status, educational

TABLE 1 Epidemiological distribution of the prevalence of emotional exhaustion.

Variable	Wave 1 (N = 3,006/EE = 1,425)				Wave 2 (N = 3,465/EE = 1,556)				Wave 3 (N = 3,917/EE = 1,655)				Total (N = 10,388/EE = 4,636)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P
Age group (year)			9.97	0.019			13.47	0.004			19.48	<0.001			37.38	<0.001
≤ 30	526	48.48			490	43.63			579	44.47			1,595	45.44		
30–40	595	47.22			710	47.78			726	43.42			2,031	46.54		
40–50	248	43.36			272	43.66			283	39.25			803	41.91		
≥50	56	39.16			84	36.05			67	30.18			207	34.62		
Sex			0.95	0.330			3.61	0.058			0.06	0.800			3.79	0.051
Male	510	48.62			407	47.71			481	42.57			1,398	46.11		
Female	915	46.76			1,149	43.99			1,174	42.12			3,238	44.02		
Area			23.57	<0.001			39.02	<0.001			3.01	0.222			33.46	<0.001
East	325	45.71			283	35.33			448	43.58			1,056	41.57		
Central	254	58.12			134	49.63			122	45.86			510	52.42		
West	846	45.53			1,139	47.58			1,085	41.36			3,070	44.65		
Marital status			10.01	0.007			2.25	0.324			16.88	<0.001			22.03	<0.001
unmarried	345	52.59			343	46.48			438	48.08			1,126	48.85		
married	1,037	45.76			1,167	44.71			1,144	40.63			3,348	43.53		
div/wid	43	51.19			46	39.32			73	38.42			162	41.43		
Education			42.69	<0.001			13.57	0.001			12.63	0.001			68.50	<0.001
Bachelor	879	43.32			1,221	43.42			1,243	40.86			3,343	42.41		
Master	460	56.58			280	51.76			356	48.30			1,096	52.42		
Ph.D	86	52.44			55	49.11			56	40.58			197	47.58		
Religious affiliation			0.03	0.856			0.01	0.931			2.25	0.133			0.74	0.390
No	1,272	47.46			1,409	44.93			1,504	41.89			4,185	44.49		
Yes	153	46.97			147	44.68			151	46.18			451	45.93		
Length of practice (year)			5.82	0.055			3.73	0.155			7.94	0.019			8.82	0.012
≤5	484	49.39			410	46.12			498	44.95			1,392	46.76		
5–10	259	50.00			271	41.56			320	44.08			850	44.83		
≥10	682	45.23			875	45.48			837	40.18			2,394	44.41		

(Continued)

TABLE 1 (Continued)

Variable	Wave 1 (N = 3,006/EE = 1,425)				Wave 2 (N = 3,465/EE = 1,556)				Wave 3 (N = 3,917/EE = 1,655)				Total (N = 10,388/EE = 4,636)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P
Ethnicity			0.43	0.514			0.03	0.860			3.74	0.053			3.05	0.081
Han	1,225	46.49			1,263	44.83			1,360	43.00			3,878	45.01		
Minorities	170	45.82			293	45.22			295	39.12			758	42.75		
Department			1.36	0.244			20.89	<0.001			3.29	0.070			19.07	<0.001
Other	1,283	47.07			1,358	43.61			1,473	41.78			4,114	43.92		
ICU/emer	142	50.71			198	56.41			182	46.55			522	51.08		
Nurses			15.32	<0.001			5.01	0.025			3.77	0.052			23.94	<0.001
Yes	234	40.14			663	42.80			582	40.25			1,479	41.34		
No	1,191	49.15			893	46.61			1,073	43.42			3,157	46.36		
Psychiatry			2.14	0.144			0.91	0.341			19.78	<0.001			15.39	<0.001
Yes	88	42.51			239	43.06			115	31.34			442	39.15		
No	1,337	47.77			1,317	45.25			1,540	43.38			4,194	46.30		
COVID-19 care			1.59	0.208			4.90	0.027			0.34	0.562			0.06	0.800
Yes	331	49.55			185	40.13			251	43.35			767	44.91		
No	1,094	46.72			1,371	45.64			1,404	42.06			3,869	44.57		
Medical error			19.40	<0.001			23.91	<0.001			36.36	<0.001			86.76	<0.001
Yes	769	51.44			671	50.11			666	48.76			2,106	50.14		
No	656	43.41			885	41.63			989	38.77			2,530	40.89		
WPV			54.21	<0.001			43.12	<0.001			57.97	<0.001			163.42	<0.001
Yes	1,012	52.41			924	50.11			953	48.20			2,889	50.23		
No	413	38.42			632	38.99			702	36.19			1,747	37.69		
Witness WPV			32.47	<0.001			54.38	<0.001			32.94	<0.001			126.82	<0.001
Yes	1,199	50.02			1,119	49.45			1,144	45.65			3,462	48.31		
No	226	37.11			437	36.36			511	36.22			1,174	36.44		
Depression			473.31	<0.001			728.15	<0.001			778.11	<0.001			1,892.80	<0.001
Yes	1,084	65.22			770	82.44			817	79.01			2,671	73.58		
No	341	25.37			786	31.05			838	29.07			1,965	29.08		

(Continued)

TABLE 1 (Continued)

Variable	Wave 1 (N = 3,006/EE = 1,425)				Wave 2 (N = 3,465/EE = 1,556)				Wave 3 (N = 3,917/EE = 1,655)				Total (N = 10,388/EE = 4,636)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^{2*}	P
Anxiety			479.36	<0.001			577.38	<0.001			626.56	<0.001			1,689.57	<0.001
Yes	678	78.93			604	84.83			630	82.35			1,912	81.85		
No	747	34.79			952	34.58			1,025	32.52			2,724	33.83		

WPV, workplace violence; EE, emotional exhaustion.

Chi-square for the comparison among wave 1, wave 2, and wave 3 is 18.44, P < 0.001.

attainment, ethnicity (Han vs. minorities), ICU/emergency room, physicians/nurses, length of practice, and whether they were direct care providers for patients with COVID-19.

Two dimensions of burnout were assessed using a modified version of the Maslach Burnout Inventory-Human Services Survey for Medical Personnel (MBI-HSMP) (24). As mentioned earlier, we focused on EE and DPA in order to bring more psychometrical robustness and increased feasibility to the present study. Items were scored on a 7-point Likert scale from 0 (never) to 6 (daily), and summed to total scores—higher scores indicate a higher level of burnout. The MBI-HSMP has been shown to have a good validity in HPs previously (25). Cronbach's alpha for this sample was 0.85.

Mental health conditions were assessed by the 9-item Patient Health Questionnaire (PHQ-9) for depressive symptoms and the 7-item Generalized Anxiety Disorder (GAD-7) for anxiety. The Chinese version of the PHQ-9 and GAD-7 scales have excellent psychometrical properties in medical patients (26, 27). Each item on the PHQ-9 and GAD-7 is rated on a 4-point scale indicating the frequency of each symptom in the past 2 weeks, on a scale of 0 (none at all) to 3 (almost daily) (28). We categorized the depressive symptoms as dichotomies depending on the overall score ≥10 and the same with anxiety. Cronbach's alpha in the present sample was 0.91 for PHQ-9 (26) and 0.94 for GAD-7 (27).

Workplace violence (WPV) including the experience of WPV and witnessing WPV was measured using the Chinese version of the Workplace Violence Scale, a scale with proven good reliability and validity to measure violence including physical, mental, and verbal violence that was experienced in the past 12 months (29). The survey provided specific definitions of each type of violence. The individuals who reported any type of violence at least once were defined as violence positive (yes).

2.4. Missing values

The mean replacement method was used to replace missing values of sociodemographic variables. We substituted the average of items answered on the scale for the score of missing items when computing scale scores. Those records were deleted when the missing value was more than two items for specific scales and no substitutions were made.

2.5. Data analysis

Descriptive statistics were performed by calculating means, standard deviations (SD), and proportions. The chi-square test was employed to test the prevalence of burnout, depression, and anxiety between categorical variables. An unconditional logistic regression model was used to identify the correlators of EE and DPA in different stages of the pandemic. Odds ratios (ORs) with 95% confidence intervals (95% CIs) were calculated under IBM SPSS 23.0. The alpha level was 0.05, with a two-tailed test.

TABLE 2 Epidemiological distribution of the prevalence of declined personal accomplishment.

Variable	Wave 1 (N = 3,006/DPA = 1,098)				Wave 2 (N = 3,465/DPA = 1,178)				Wave 3 (N = 3,917/DPA = 1,252)				Total (N = 10,388/DPA = 3,528)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P
Age group (year)			28.33	<0.001			13.03	0.005			42.79	<0.001			76.42	<0.001
≤30	451	41.57			407	36.24			475	36.48			1,333	37.98		
30–40	438	34.76			522	35.13			549	32.83			1,509	34.58		
40–50	167	29.20			177	28.41			186	25.80			530	27.66		
≥50	42	29.37			72	30.90			42	18.92			156	26.09		
Sex			0.15	0.701			2.77	0.096			2.33	0.127			0.18	0.673
Male	388	36.99			310	36.34			341	30.18			1,039	34.27		
Female	710	36.28			868	33.23			911	32.69			2,489	33.84		
Area			0.39	0.822			9.26	0.010			4.05	0.132			6.95	0.031
East	263	36.99			239	29.84			307	29.86			809	31.85		
Central	164	37.53			87	32.22			79	29.70			330	33.92		
West	671	36.11			852	35.59			866	33.02			2,389	34.75		
Marital status			10.64	0.005			0.88	0.643			5.73	0.057			12.13	0.002
unmarried	275	41.92			258	34.96			319	35.02			852	36.96		
married	795	35.08			877	33.60			879	31.21			2,551	33.16		
div/wid	28	33.33			43	36.75			54	28.42			125	31.97		
Education			0.48	0.785			1.02	0.601			13.99	0.001			7.59	0.023
Bachelor	749	36.91			967	34.39			1,016	33.40			2,732	34.66		
Master	292	35.92			175	32.35			204	27.68			671	32.09		
Ph.D	57	34.76			36	32.14			32	23.19			125	30.19		
Religious affiliation			0.93	0.335			0.40	0.529			0.65	0.419			0.36	0.548
No	971	36.23			1,061	33.83			1,154	32.14			3,186	33.87		
Yes	127	38.96			117	35.56			98	29.97			342	34.83		
Length of practice (year)			25.87	<0.001			6.70	0.035			21.04	<0.001			49.60	<0.001
≤ 5	406	41.43			332	37.35			395	35.65			1,133	38.06		
5–10	208	40.15			223	34.20			258	35.54			689	36.34		
≥10	484	32.10			623	32.38			599	28.76			1,706	30.93		

(Continued)

TABLE 2 (Continued)

Variable	Wave 1 (N = 3,006/DPA = 1,098)				Wave 2 (N = 3,465/DPA = 1,178)				Wave 3 (N = 3,917/DPA = 1,252)				Total (N = 10,388/DPA = 3,528)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P
Ethnicity			0.40	0.528			10.19	0.001			1.70	0.192			7.54	0.006
Han	957	36.32			923	32.77			996	31.49			2,876	33.38		
Minorities	141	38.01			255	39.35			256	33.95			652	36.77		
Department			0.03	0.868			3.47	0.063			0.84	0.359			2.32	0.128
Other	997	36.57			1,043	33.49			1,119	31.74			3,159	33.73		
ICU/emer	101	36.07			135	38.46			133	34.02			369	36.11		
Nurse			13.29	<0.001			4.80	0.028			26.73	<0.001			31.06	<0.001
Yes	251	43.05			557	35.96			535	37.00			1,343	37.53		
No	847	34.96			621	32.41			717	29.02			2,185	32.09		
Psychiatrist			0.01	0.954			0.83	0.362			0.01	0.935			0.33	0.569
Yes	76	36.71			198	35.68			118	32.15			392	34.72		
No	1,022	36.51			980	33.68			1,134	31.94			3,136	33.87		
COVID-19 care			1.87	0.172			2.76	0.097			1.59	0.207			4.53	0.033
Yes	229	34.28			141	30.59			172	29.71			542	31.73		
No	869	37.19			1,037	34.52			1,080	32.35			2,986	34.40		
Medical error			4.16	0.041			2.34	0.126			0.07	0.795			5.51	0.019
Yes	573	38.33			476	35.55			433	31.70			1,482	35.29		
No	525	34.75			702	33.02			819	32.11			2,046	33.06		
WPV			0.43	0.51			0.32	0.570			5.40	0.02			2.71	0.100
Yes	697	36.10			619	33.57			598	29.94			1,914	33.16		
No	401	37.30			559	34.48			654	33.71			1,614	34.81		
Witness WPV			9.41	0.002			13.27	<0.001			13.25	<0.001			28.76	<0.001
Yes	843	35.17			721	31.86			750	36.48			2,314	34.46		
No	255	41.87			457	38.02			502	35.58			1,214	37.68		
Depression			99.49	<0.001			45.51	<0.001			76.47	<0.001			230.19	<0.001
Yes	738	44.40			401	42.93			443	42.84			1,582	43.58		
No	360	26.79			777	30.70			809	28.06			1,946	28.80		

(Continued)

TABLE 2 (Continued)

Variable	Wave 1 (N = 3,006/DPA = 1,098)				Wave 2 (N = 3,465/DPA = 1,178)				Wave 3 (N = 3,917/DPA = 1,252)				Total (N = 10,388/DPA = 3,528)			
	N	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P	n	%	χ^2	P
Anxiety			58.52	<0.001			44.24	<0.001			39.24	<0.001			148.58	<0.001
Yes	405	47.15			317	44.52			317	41.44			1,039	44.48		
No	693	32.28			861	31.27			935	29.66			2,489	30.91		

WPV, workplace violence; DPA, declined personal accomplishment.
Chi-square for the comparison among wave 1, wave 2, and wave 3 is 15.80, P < 0.001.

3. Results

3.1. Epidemiological distribution of the prevalence of burnout

The average age of participants was 35.5 (SD = 8.1) years with a range of 20 to 60 years (In China, a technical secondary nurse can have 2 years of experience at 20 years of age). The average length of practice was 11.0 years (SD = 8.4), ranging from 2 to 40 years. The overall prevalence of depression was 34.9%, and the prevalence of anxiety was 22.5%. As shown in Table 1, the prevalence of EE was 44.6% (4,636/ 10,388), the highest prevalence of EE was found in the first wave (47.4%, 1,425/ 3,006) and then the second wave (44.9%, 1,556/ 3,465), and the third wave had the lowest prevalence of 42.3% (1,655/ 3,917). Those who were aged <40 years, living in the central areas of China, unmarried, and with a master's degree, and those with a length of practice of <5 years had a higher prevalence of EE. Similarly, those who work in ICUs or emergency rooms had a higher prevalence of EE ($P < 0.001$), except in wave 1, while those who played a role in psychiatry and nurses had a lower prevalence than other HPs. No statistical significance of the prevalence of EE was found between those directly providing healthcare to patients with COVID-19 and others. Health professionals who reported medical errors, workplace violence, and witnessing workplace violence had a higher prevalence of EE ($P < 0.001$). Furthermore, those with depressive symptoms and anxiety had a much higher prevalence of EE.

As shown in Table 2, the overall prevalence of DPA was 34.0% (3,528/ 10,388); the highest prevalence of DPA was found in the first wave (36.5%, 1,098/ 3,006) and then the second wave (34.0%, 1,178/ 3,465), and the third wave had the lowest prevalence of 32.2% (1,252/ 3,917). Similar correlators were found for the prevalence of declined personal accomplishment. In contrast with EE, those with a bachelor's degree and minorities had a higher prevalence of declined personal accomplishment ($P < 0.05$).

3.2. Multivariate logistic regression

As shown in Figure 2, slight heterogeneity among the three separate samples was identified in the correlators of burnout. In wave 1 and wave 3 samples, the logistic regression model revealed ages over 50 years had a lower prevalence risk of EE (wave 1: OR = 0.61, 95% CI: 0.39–0.96; wave 3: OR = 0.60, 95% CI: 0.38–0.95). Women had a higher prevalence risk (wave 1: OR = 1.19, 95% CI: 1.00–1.42; wave 3: OR =1.20, 95% CI: 1.01–1.44). In the wave 2 sample, the logistic regression model revealed that living in the central areas (OR = 1.66., 95% CI: 1.20–2.31) and west areas (OR = 1.54, 95% CI: 1.26–1.87) had a higher prevalence risk of EE. Health professionals who directly provide care to patients with COVID-19 had a lower prevalence risk of EE (OR = 0.73, 95% CI: 0.57–0.92). Furthermore, workplace violence led to a higher risk of EE (wave 1: OR = 1.37, 95% CI: 1.16–1.63). Holding a master's degree, depression, and anxiety persistently correlated with a higher risk of EE in all three samples.

The correlators of DPA are shown in Figure 3. Working in the psychiatry section had a higher risk of DPA (OR = 1.38, 95% CI:
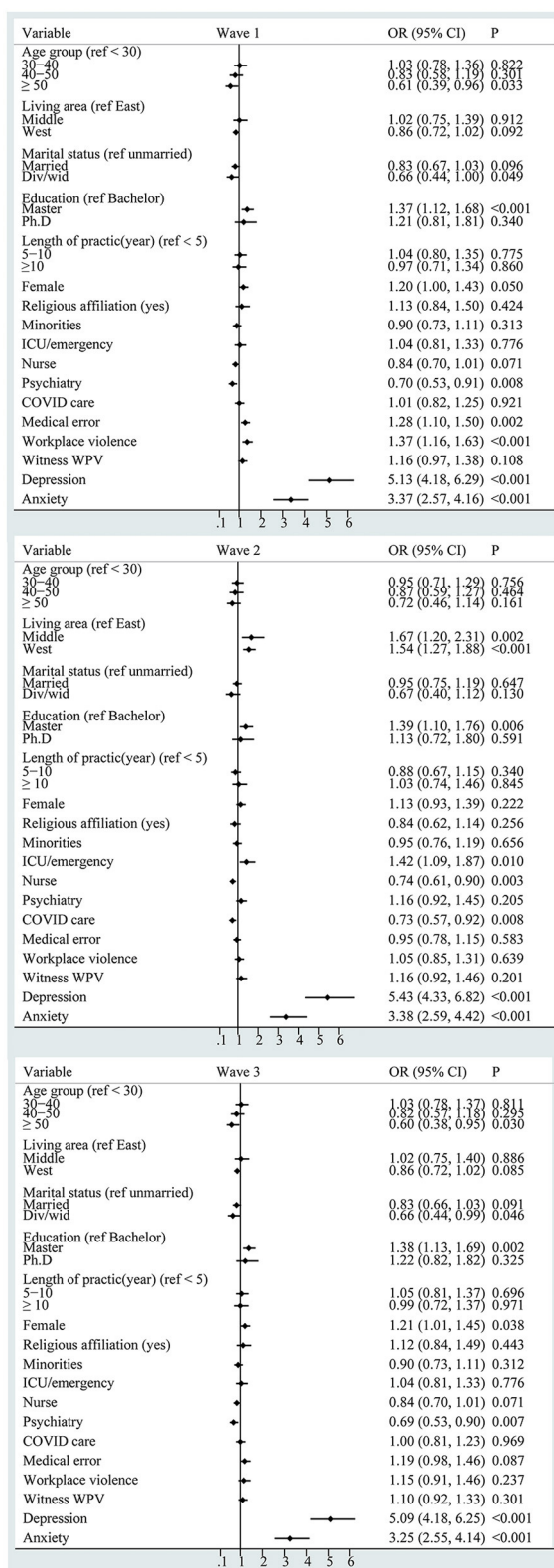
Forest plot of the correlators of emotional exhaustion (WPV: workplace violence).

1.01–1.89) in wave 1, minorities had a higher risk of DPA (OR = 1.28, 95% CI: 1.04–1.58) in wave 2, and being aged over 50 years had a lower risk of DPA (OR = 0.56, 95% CI: 0.36–0.88) in wave 3. Overall, being a nurse, depression, and anxiety persistently correlated with a higher risk of DPA in all three samples.

4. Discussion

During the COVID-19 pandemic, the workload and work stress of health professionals increased dramatically (30). Burnout as a key indicator of functional impairment has been reported repeatedly in the past 3 years (30, 31). To the best of our knowledge, this is one of the first studies that monitored this functional impairment during three stages of COVID-19 among Chinese HPs. This study found high levels of EE and DPA among health professionals during three different stages of the pandemic. There are several possible explanations for the increased risk of burnout. First, the early stage of the COVID-19 pandemic, the lack of resources, and the rapidly increasing cases overloaded health professionals, leading to an increased risk of burnout. Second, 1 year after the pandemic, uncertainty around available resources and the evolution of the virus variants continued to challenge the health system (32). At this stage, strict restrictive measures were adopted in line with the zero-COVID policy (33). Health professionals experienced acute staffing shortages due to the huge efforts on the citywide test-trace-isolate, and following energy-exhausting protocols intended to keep everyone safe (34). In addition, people's daily lives had been disrupted by the long-term control measures against virus spreading, health professionals who had endured emotional and physical exhaustion for more than 2 years, and pandemic fatigue arose at this stage (35).

Adverse mental health outcomes surged during the pandemic (36), leading to functional impairment like burnout. We found that participants with depressive symptoms and anxiety had a higher prevalence of burnout (both EE and DPA) during the different stages of the pandemic. These results are consistent with the findings of other studies. A study conducted in France found a correlation between depression and EE (37). First, burnout and anxiety or depression were mutually influencing, representing that HPs suffering from burnout had a higher level of anxiety or depression, with a remarkable positive correlation between them, and vice versa (1, 38). COVID-19, as a source of stress, inevitably caused anxiety and depression among HPs, leading to their increased risk of EE and DPA, while no association of depression and anxiety was found with DPA in Piedmont's study (39), which in our view might be considered to be influenced by COVID-19 that huge failure in duty by failing to treat patients cause anxiety and depression.

There was an increase in reports of workplace violence attacks against HPs, especially in the early stage of the pandemic. The International Committee of the Red Cross (ICRC) reported 611 incidents of COVID-19-related workplace violence in more than 40 countries during the first 6 months of the pandemic (40). Other studies also found an increase in workplace violence against
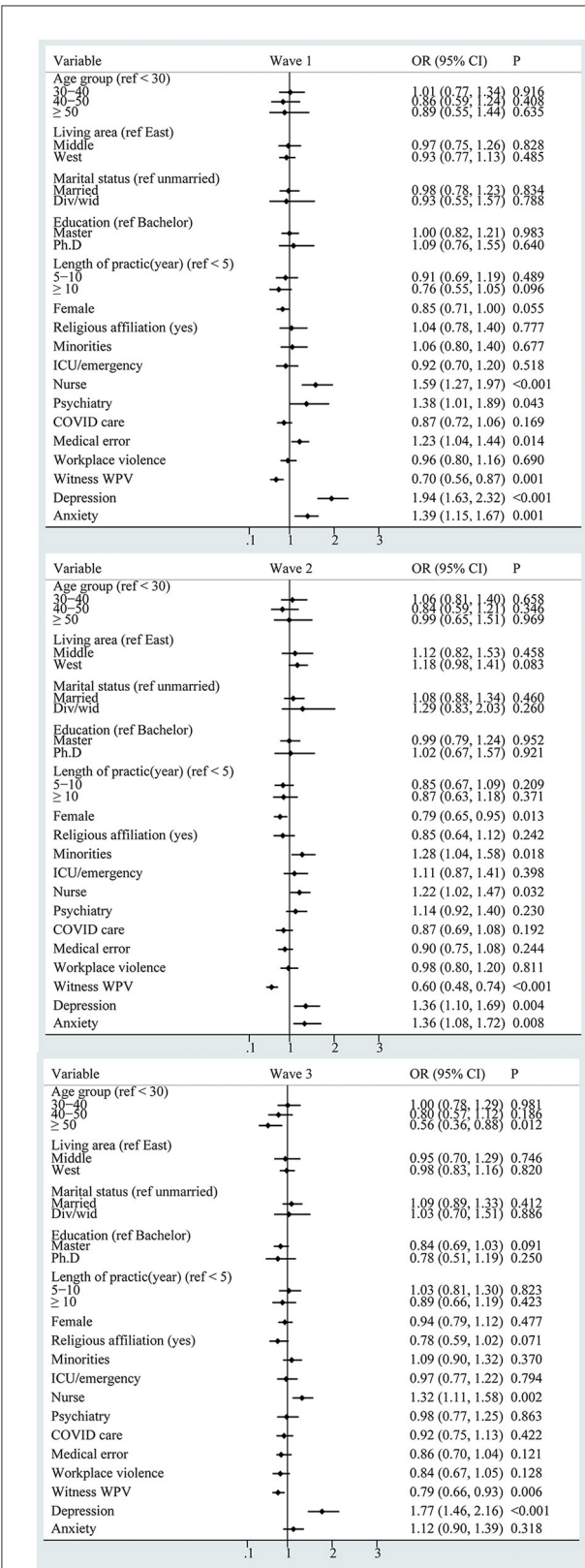
HPs during the COVID-19 pandemic (41, 42). In the present study, the prevalence of workplace violence was at a high level and was 64.2%, 53.2%, and 50.5% for wave 1, wave 2, and wave 3, respectively. A previous study found that workplace violence against health professionals decreased as the pandemic continued in mainland China (29). Studies have found that workplace violence triggered burnout among HPs (29, 43). Saifur also found workplace violence-exposed nurses were at a greater risk of burnout during the COVID-19 pandemic (44). We also observed a positive association between workplace violence and burnout.

Workplace violence may pose a threat to the life, safety, and dignity of HPs, deteriorating mental health (18). In addition, many studies have also indicated that workplace violence is related to a series of mental health problems, such as depression and anxiety (45, 46), which are relevant to burnout. While no statistical correlation was found in samples of wave 2 and wave 3, not surprisingly, varied correlators were identified in different waves due to the decreased possible exposure in different stages.

However, it was worth noting that the experience of witnessing workplace violence negatively correlated with DPA in all three samples. While several studies conducted among teachers have suggested that witnessing workplace violence is associated with both EE and DPA positively (47–49), differences between teachers and healthcare workers have emerged. Even though experiencing or witnessing workplace violence was prevalent among teachers and healthcare workers (47, 50), workplace violence was mostly perpetrated by students and their parents in the former group (48), whereas in the latter group, most violence was perpetrated by patients or patients' families (50). Furthermore, it should be noted that witnessing workplace violence physically or emotionally, which has not been distinguished in our study, could have a different psychological impact on healthcare workers which indicates that emotional workplace violence could be accepted or normalized by nurses (51). Moreover, a study administered at a medical center found no significant association of ever witnessed workplace violence with burnout (52), indicating that witnessing workplace violence, as an indirect experience where sufferers do not physically get hurt, may have less impact on mental health than experiencing it directly (53).

Those over 50 years old were less likely to suffer from burnout (both EE and DPA), and the reasonable explanation may be senior HPs with extensive experience are more competent in their duties and are likely to receive more respect and adequate rewards while experiencing fewer role conflicts. Furthermore, they are more likely to successfully pace their work, relieve stress, and minimize the risk of job burnout (54). In addition, consistent with many research results (55–59), women showed a higher prevalence risk of EE. Generally, women spent more time on their housework and children than men (60). Moreover, several studies indicated that female HPs were more likely to report having a part-time job (61), and they were more likely to suffer work–family conflict leading to mental problems (62). Additionally, the pressure of HPs increased sharply during the prevalence of COVID-19 (30). Chalhub RÁ (58) and Pappa S (63) reported that female HPs had a higher risk of psychological distress and sleep disruption under stressful

situations. This is also true for Chinese female HPs during the current public health crisis (6). The combination of all these factors contributed to a higher level of stress in female HPs. Therefore, more care and support should be given to female HPs.

While, in the wave 2 sample, the logistic regression model revealed that living in central and western areas had a higher prevalence risk of EE, health professionals who directly provide care to patients with COVID-19 had a lower prevalence risk of EE. The pandemic has spread throughout the country since 2019 (62). However, due to the unequal distribution of medical resources, HPs in the central and western regions faced greater difficulties (64, 65). That may be the reason why HPs in central and western regions had a higher risk of EE. Compared with 2020 (the outbreak period of COVID-19) and 2022 (the re-explosion period), HPs involved in COVID-19 work had a higher job satisfaction because of the better control of the pandemic and the use of effective means in 2021. Compared with other professions, nurses were more likely to suffer from DPA (66, 67). For one thing, the shortage of HPs has been a global health system concern in recent years (68). Similar to other nations, China faced the challenge of a nurse resources shortage (17), which inevitably caused an overload of nurses and this problem was significantly magnified during the pandemic. For one thing, the increase in workload made nurses more prone to burnout (69). For another thing, nurses had more direct contact with patients in their daily work. The intensive patient–healthcare worker relationship in China has burdened the nurses with increased workload (68). Furthermore, nurses are overburdened by excessive demands and claim that their work is often stressful, leading to physical and mental exhaustion (70). As a result, some findings call for actions to strengthen communication and organizational support to increase the accomplishment of nurses (71, 72).

4.1. Limitations

Several limitations exist in the present study. First, a consequence of the cross-sectional design is that it prevents causal inference; therefore, prospective studies are needed to identify predictors of burnout among health professionals. Second, the convenience sample here requires cautious generalization to service members in the whole nation and other areas outside of China. Third, other potential factors, including the type of hospital, social support, media publicity, and workloads, were not evaluated when exploring the correlators of burnout, which may lead to overestimation or underestimation of the differences between the three stages. Finally, the accuracy of self-reported measures cannot be guaranteed in cases where external factors may influence reporting (even though the survey was anonymous).

5. Conclusion

In conclusion, this three-wave cross-sectional study revealed the prevalence of burnout among health professionals at a high level persistently during the different stages of the pandemic. The correlators of burnout varied in dimensions and in stages of the pandemic. These results suggest that current health professionals'

functional impairment prevention resources and programs may be inadequate. Considering the high level of uncertainty of the pandemic, continuous monitoring of these variables could provide evidence for developing optimal strategies for saving human resources in the coming post-pandemic era.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Committee of Ningxia Medical University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

ZW and JL: conceptualization and methodology. ZW: data curation and project administration. ZQ and ZH: writing—original draft. JL, XS, and ZW: funding acquisition and writing–reviewing and editing. ZQ, QY, and ZM: formal analysis. JL, JW, and XS: data collection and visualization. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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

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Acute stress reaction, depression anxiety stress, and job withdrawal behavior in non-frontline pediatric nurses during the pandemic: a cross-sectional study

Xu Yi[1], Cao Jing[1], Ma Meimei[1], Xie Jianhui[2], Hu Jihong[1], Xiang Ding[3] and Zhu Lihui[2]*

[1]Department of Rehabilitation, Hunan Children's Hospital, Hunan, China, [2]Department of Nursing, Hunan Children's Hospital, Hunan, China, [3]International Affairs Department, Hunan Children's Hospital, Hunan, China

Backgrounds: The COVID-19 pandemic has brought an unprecedented healthy crisis to people worldwide. It is crucial to assess the psychological status of non-frontline nurses. More attention to the mental and physical health of non-frontline nurses during a public health emergency is necessary for a full understanding of the implications. Therefore, this study aims to investigate the factors that influence the acute stress reaction of non-frontline pediatric nurses during the COVID-19 pandemic.

Methods: This study aimed to explore factors associated with acute stress reactions of non-frontline pediatric nurses in Hunan province during the COVID-19 pandemic. This was a cross-sectional design. Five hundred eighteen pediatric nurses from Hunan province, China, completed the Stanford Acute Stress Reaction Questionnaire (SASRQ), Depression Anxiety Stress Scales-21 (DASS-21), and Job Withdrawal Behavior Scales (JWB). Multiple linear regression analyses and Pearson's correlation were used to analyze the results.

Results: The mean scores of DASS-21, JWB, SASRQ were 1.443 ± 0.500, 1.601 ± 0.544, and 1.858 ± 0.805, respectively. Stress, anxiety, depression (three sub-dimensions of DASS-21), JWB, monthly income and department were the major predictive factors for SASRQ (Adjusted $R^2=0.579$, $p< 0.001$). Pearson's correlation showed that the mean score of SASRQ was positively correlated with JWB, DASS-21, and all its dimensions ($p<0.01$).

Conclusion: The study indicated that the SASRQ was greater with higher levels of DASS-21 and JWB. It revealed an acute stress reaction in non-frontline pediatric nurses and recommends more focus on the factors influencing the SASRQ.

KEYWORDS

pediatric nurses, COVID-19, acute stress reaction, depression, anxiety, stress, job withdrawal behavior

Introduction

Acute stress reaction refers to individuals who have a physical and psychological reaction that occurs 2–28 days after experiencing or witnessing a traumatic event (1).

When this reaction exceeds a certain intensity and/or duration, it will have a negative impact on the individual's social functioning, interpersonal interactions, and emotions, and will develop into an acute stress disorder (2). It is undeniable that there has been a great effort to develop guidelines for the treatment of acute stress disorder and post-traumatic stress disorder in countries around the world (3). However, according to relevant research data (4) around 65% of men and 50% of women reported having experienced at least one traumatic event. Notably, relatively high rates of non-remission were reported among some special populations (e.g., military populations, firefighters) (3). Increasing attention is being paid to the impacts of public health disaster on humans as both society and technology develop (5). Like SARS and COVID-19, they have brought about an unprecedented health crisis.

Nurses, as the largest group of healthcare providers, play a crucial role in reducing the spread of the virus and caring for severely-ill patients during the COVID-19 pandemic (6). At the same time, nurses exposed to stressful factors related to the high-risk working environment, such as contact with patients and heavy workload, may also exhibit physical and psychological stress. Pediatric nurses, in particular, have a significantly more stressful and difficult job than nurses in other departments due to the young age of children, poor expressive skills and the rapid changes of disease. A study by Jin and Hu (7) found that a series of acute stress responses occurred in nurses during the COVID-19 pandemic, including cognitive changes, altered mood, physical changes, or behavioral changes. Many previous studies have focused on the related effects of acute stress events on the mental and physical health of frontline nurses during the COVID-19 pandemic (8, 9), studies have rarely addressed non-frontline pediatric nurses. During the pandemic, the frontline staff is defined as those participants who support fever clinics, isolation units, or Wuhan city. Compared with frontline, non-frontline nurses are not in contact with COVID-19 patients or their body fluid, nor were they isolated in a hotel. Yet, they need to undertake a huge nursing workload which put them at potential risk of infection. For example, before the highly suspected patients were diagnosed, non-frontline nurses could only take secondary protection for patients according to hospital infection standards. Undoubtedly, this phenomenon has increased non-frontline nurses' fear and psychological burden of getting risk of infection. Previous reports have shown high rates of adverse mental health symptoms among the general population and vulnerable groups during past outbreaks of infectious diseases. In a literature meta-analysis by Krishnamoorthy Y et al. (10), the pooled prevalence of mental disorders such as post-traumatic stress disorder (27%), depression (26%), anxiety (26%), and stress (34%) in the Chinese population during the covid-19 pandemic was shown. According to the psychological stress theory of Lazarus and Folkman (11), individuals will generate a series of cognitive, emotional, and physiological responses to respond to sudden crises after experiencing major stressful events. If coping styles fail, corresponding physiological dysfunction and psychological distress will occur. Although job withdrawal behavior among nurses has been underreported in the studies available to date, the results of a previous study (12) by a

research team showed that under a major public health event, a sudden increase in stressors at work tends to elicit various stress responses in nurses, which in turn further motivate individuals to become dissatisfied with their work environment and ultimately lead to withdrawal behaviors. Moreover, there are few studies on the relationship between anxiety, depression, stress, job withdrawal behavior and stress reactions, yet it is necessary to explore the nature of the association between these factors and acute reactions for researchers and medical policy makers to identify future research needs and drive policy decisions. Therefore, we used the cross-sectional survey to assess the relationship between acute stress reaction, depression anxiety stress and job withdrawal behavior among the non-frontline pediatric nurses in China.

Methods

Study population

A total of 518 pediatric nurses from three districts in Hunan province in central China completed online questionnaires. Participants were not able to skip sections or individual items. To protect their privacy, all data was anonymized. The inclusion criteria were: to volunteer for the study and sign the informed consent form, and registered nurses engaged in clinical work for ≥1 year. The exclusion criteria included nurses from the COVID-19 unit and nurses on leave or study leave for more than 1 month during the survey period.

Instruments

Four questionnaires were used to collect the data:

(1) Demographic information, including gender, age, marital status, hospital level, frequency of night shifts each month, monthly income, education (highest), and department.

(2) The Stanford Acute Stress Reaction Questionnaire (SASRQ) was used to evaluate the acute stress response. It was compiled by Cardeña (13), and the Chinese version was translated by Jia (14). It has been widely used in the nursing population. The scale involves 30 items (5 dimensions) including the dissociative symptoms (10 items), avoidance symptoms (6 items), re-experiencing symptoms (6 items), hyper-arousal symptoms (6 items), and impairment in social functioning (2 items). Each item was assessed with a six-point Likert scoring system (1–Never to 6–Always). The range of scores is from 0 to 150 with higher scores indicating a more severe symptom (cut off score 40). More than 40 as moderate, and more than 57 as severe. Cronbach's α of the scale was 0.974. This study investigated the acute stress level of individuals during the pandemic. Therefore, the 'acute stress event' of the original scale was changed to 'COVID-19'.

(3) The Depression Anxiety Stress Scales-21 (DASS-21) was used to screen the general population or nurses' psychological status. It was compiled by Lovibond (15) and the Chinese version was translated and revised by Taouk et al. (16). The scale is comprised of three separate subscales, involving 21

items, with seven items each for depression, anxiety, and stress subscales. Each item was assessed by a four-point Likert scoring system (1–Never to 4–Always). The total score is calculated from the sum of the scores of the 21 items and then multiplied by two. Higher scores indicate stronger negative emotions. Cronbach's α of each dimension was 0.910, 0.913, and 0.921, respectively.

(4) The Job Withdrawal Behavior (JWB) scale was used in this study Lehman and Simpson [17]. It includes 12 items. Each item is rated on a five-point Likert scoring system (1–Never to 5–Always). Higher scores indicated more severe withdrawal behavior. Cronbach's α of the scale was 0.902.

Data collection

Data were collected using the online questionnaires platform Questionnaire Star Platform (Changsha Ranxing Information Technology Co., Ltd). The questionnaire was distributed through the social platform WeChat. The collection was between March 2 to April 1, 2020. This period was the early stage of the COVID-19 epidemic. The questionnaire was available at https://www.wjx.cn/wjx/design/previewmobile.aspx?activity=66301334, and issued by the primary researcher, with instructions regarding the aim and significance on the first page. Informed consent was requested on the first question: 'Do you agree to participate in this investigation voluntarily?'. Participants were required to click 'Yes' to the next question. Participants scanned the two-dimensional code using their smartphones and filled out the questionnaires online; the time for answering was 15 min. To ensure the quality of the questionnaire and the data quality, a WeChat username was restricted to answer only once and each questionnaire was reviewed by two trained investigators. A convenience sample was available and used for this study. Thus, no sample size calculations were made [18].

Data analysis

Prior to hypothesis testing, all data were examined to determine missingness, identify extreme values, and confirm that the data structure met analytic assumptions. All analyses were conducted using IBM SPSS Statistics version 23.0. Continuous data were categorized into categorical variables. For the descriptive statistics, the number, percentage, mean and standard deviation were calculated. Independent samples t-test was used for independent group comparisons. Differences among group means were tested by t-test or ANOVA F-test. Pearson's correlation test was used to define the relationship between variables (SASRQ, DASS-21, and JWB), and multiple linear regression analysis was performed for multivariate analysis. All tests were two tailed, and $p < 0.05$ was considered significant.

Results

Test of common method bias

Harman's one-factor test was used to assess the common method bias of the data. The results showed that the maximum factor variance

interpretation rates was 34.56%, which is below the cut-off value of 40% [19]. Hence, common method bias was not a serious problem in this study.

Subject data and univariate analysis of SASRQ

A total of 518 subjects completed the questionnaires. These included 15 males and 503 females, with an age range 19–58 years. The majority (59.3%) of subjects were in the age range 26–35 years, 18.0% were aged 19–25 years, 20.1% aged 36–45 years, and 2.7% aged 45–58 years. Marital status was categorized into single (25.7%), married (71.4%), and divorced (2.9%). Hospital level included primary hospital (9.1%), secondary hospital (2.1%), tertiary hospital (85.9%), and others (2.9%). Monthly income was divided into 3 groups (<4,000 RMB, 4,000–8,000 RMB, and >8,000 RMB). In total, 13.9% of subjects had monthly incomes of less than 4,000 RMB, 59.7% had monthly incomes of 4,000–8,000 RMB, and 26.4% had monthly incomes of more than 8,000 RMB. The overall incidence of SASRQ was 68.7%. Of these, 11% at age below 25, 41.9% at age 26–35, 14.5% at age 36–45, and 1.4% at age 45 or over. Details are summarized in Table 1.

Significant differences were found among nurses in different levels of hospitals, night shifts, monthly income, and departments on the level of acute stress response (Table 1). Specifically, SASRQ scores (1.909 ± 0.829) were the highest among nurses working in the tertiary hospital ($p < 0.01$). The scores (2.058 ± 0.902) for nurses who worked ≥5 night shifts were significantly higher than other nurses ($p < 0.05$). Moreover, the SASRQ scores (1.940 ± 0.832) of nurses with high income were significantly higher than other nurses ($p < 0.05$). For different departments, the scores (2.050 ± 0.924) of nurses who worked in emergency and intensive care departments had significantly higher scores compared with nurses working in other departments ($p < 0.01$).

Correlation between SASRQ, DASS-21, and JWB and its scores

Table 2 shows that all the correlations among variables were at significant levels (rs = 0.60–0.93, $p < 0.01$). The scores of SASRQ, DASS-21, and JWB were 1.858 ± 0.805, 1.443 ± 0.500, 1.490 ± 0.544, 1.429 ± 0.512, 1.410 ± 0.489, and 1.601 ± 0.544, respectively.

Multivariate analyses of SASRQ scores

A multiple regression analysis was conducted to examine whether demographic variables including hospital level, frequency of night shifts/month, monthly income, and department predicted SASRQ scores. The dummy variables setting was used for unordered classification variables in independent variables (see Table 3).

Table 4 shows the results of the multiple linear regression analysis. The results suggest that monthly income of 4,000–8,000 RMB yuan and departments of emergency and intensive system are the major predictive factors for SASRQ.

TABLE 1 Subject data and univariate analysis of SASRQ (*n*=518).

Demographic variables	Group	*n* (%)	Mean±SD	*t/F*	*P*
Gender	Male	15 (2.9)	1.878 ± 0.947	0.098	0.922
	Female	503 (97.1)	1.857 ± 0.801		
Age (year)	~25	93 (18.0)	1.805 ± 0.859	0.733	0.533
	~35	307 (59.3)	1.879 ± 0.803		
	~45	104 (20.1)	1.879 ± 0.786		
	>45	14 (2.7)	1.593 ± 0.594		
Marital status	Single	133 (25.7)	1.842 ± 0.831	0.197	0.821
	Married	370 (71.4)	1.858 ± 0.793		
	Divorced/Separated	15 (2.9)	1.980 ± 0.914		
Hospital level	Primary hospitals	47 (9.1)	1.583 ± 0.544	4.662	0.003**
	Secondary hospital	11 (2.1)	1.349 ± 0.520		
	Tertiary hospital	445 (85.9)	1.909 ± 0.829		
	Others	15 (2.9)	1.564 ± 0.585		
Frequency of night shifts/Month	1 ~ 2 night shifts/month	42 (8.1)	1.712 ± 0.826	2.532	0.040*
	3 night shifts/per month	20 (3.9)	1.827 ± 0.716		
	4 night shifts/month	179 (34.6)	1.818 ± 0.787		
	≥5 night shifts/month	117 (22.6)	2.058 ± 0.902		
	Non-night shift	160 (30.9)	1.798 ± 0.735		
Monthly income	<4,000 RMB	72 (13.9)	1.643 ± 0.721	3.342	0.036*
	4,000–8,000 RMB	309 (59.7)	1.871 ± 0.805		
	>8,000 RMB	137 (26.4)	1.940 ± 0.832		
Education (Highest)	Technical secondary school and below	5 (1.0)	1.533 ± 0.549	1.077	0.358
	College degree	90 (17.4)	1.745 ± 0.706		
	Bachelor degree	403 (77.8)	1.889 ± 0.830		
	Master's degree and above	20 (3.9)	1.817 ± 0.745		
Departments	Emergency & intensive system	143 (27.6)	2.050 ± 0.924	4.578	0.004**
	Surgical system	102 (19.7)	1.714 ± 0.783		
	Internal system	161 (31.1)	1.768 ± 0.698		
	Out-patient system	112 (21.6)	1.871 ± 0.766		

*p < 0.05, **p < 0.01.

TABLE 2 Correlation between SASRQ, DASS-21 (*n*=518).

	SASRQ	Stress	Anxiety	Depression	JWB
SASRQ	1				
Stress	0.736**	1			
Anxiety	0.731**	0.927**	1		
Depression	0.722**	0.922**	0.899**	1	
JWB	0.539**	0.604**	0.611**	0.620**	1

**p < 0.01.

Discussion

Related research from SARS in 2003 showed that medical staff not only experienced more stress during the epidemic but also posttraumatic stress after the outbreak [20]. Therefore, mental health issues among nurses arising from fighting COVID-19 are also a huge challenge. Interestingly, a study in China showed that the traumatization scores of non-frontline nurses were higher than frontline nurses [21]. The possible reason is that most frontline nurses volunteered and were provided with additional professional training.

TABLE 3 Variables assignment.

Independent variables	Assignments
Hospital level	Primary hospitals = 1; Secondary hospitals = 2; Tertiary hospital = 3; Others = 4
Frequency of night shifts/Month	1 ~ 2 night shifts/month = 1; 3 night shifts/month = 2; 4 night shifts/month = 3; ≥5 night shifts/month = 4; Non-night shift = 5
Monthly income	<4,000 RMB = 1; 4,000–8,000 RMB = 2; >8,000 RMB = 3
Departments	Emergency & intensive system = 1; Surgical system = 2; Internal system = 3; Out-patient system = 4

Another cross-sectional study from China compared the frontline nurses and non-frontline showed that the non-frontline nurses were more stressed than the front-line nurses (22). The reasons might lie in several aspects. For example, a unit of non-frontline nurses is used to prepare for receiving new infectious diseases. However, they are not provided with separate accommodations to ensure that lived separately from their families. The majority of nurses are concerned that their families and friends would be infected. Therefore, we should pay attention to the psychiatric status of non-frontline nurses. The study measured the socio-demographic characteristics of SASRQ, as well as the relationship between JWB and DASS-21 with SASRQ among non-frontline pediatric nurses in China. To our knowledge, few studies have investigated the relationship between DASS-21, JWB, and SASRQ among non-frontline pediatric nurses during the COVID-19 pandemic. Our main findings showed that a positive correlation was found between SASRQ, JWB, DASS-21, and all its sub-dimensions ($p < 0.01$). In addition, monthly income and departments were the major predictive factors for SASRQ (Adjusted $R^2 = 0.579$, $p < 0.001$).

Acute stress reaction of non-frontline pediatric nurses during the COVID-19 pandemic

Our findings show that the majority of nurses are experiencing SASRQ. In the study of Shahrour et al. (23) from Jordan, incidence of SASRQ among nurses was 64%. This is roughly consistent with the specific observation collected herein.

However, there is a systematic review across 19 studies showed that the prevalence of acute stress was 31% (24). The reason may be that the majority of our sample are women (97.1%). Some scholars pointed out that a higher prevalence of SASRQ was found among women (25). Also, the mean SASRQ score was 1.858 ± 0.805, which indicates a moderate to severe level of non-frontline nurses in our study. Similar results were found in the past in a meta-analysis study (26). The prevalence of mental health symptoms of participants in Wuhan, the epicenter of the COVID-19 crisis in China, was significantly lower than that in Non-Wuhan samples ($p = 0.038$). This may be due, in part, to the fact that governments and institutions pay more attention to the physical and psychological needs of frontline nurses. Meanwhile, psychological support could help these population-frontline nurses, for instance, in a study by Zhang et al.

(27), psychological support was provided by psychotherapists; normalized training prior to rescue work (6), or some psychosocial support to improve the mood through telephone conversations with family and friends. This notion is also substantiated by a study showing that non-frontline nurses faced with stressful situations without enough psychological support developed various acute stress reactions over time (28). Consequently, hospital managers should pay more attention to this situation in the future. With the various public health emergencies frequently occurring, in order to minimize possible complications, it is necessary to learn from this experience.

Influencing factors of acute stress reaction among non-frontline nurses in Hunan province

The results showed that SASRQ scores had a positive correlation with DASS-21 scores and its three dimensions (stress, anxiety, and depression). This is consistent with findings in a study by Zheng et al. (29). Results of studies by Trautmann et al. (30), Wheaton et al. (31) showed that negative emotions (e.g., stress, anxiety, and depression) were related to the susceptibility of emotional contagion in individuals. This suggests that individuals who experience higher emotion contagion will have a greater stress response to traumatic events, such as the global pandemic. Furthermore, individuals who are prone to negative emotions, such as attention loss and anxiety, have a greater risk of nursing errors and it may affect nurses' and patients' health and the quality of clinical care. These data are similar to the results from certain developing countries, such as Brazil (32). Therefore, it would be beneficial for nurses to control negative emotions, and finding ways to release stress and anxiety will help reduce the level of SASRQ scores. The present study also found a significant moderate correlation between JWB and SASRQ ($r = 0.539$, $p < 0.001$). Previous research has indicated that SASRQ scores have a significant positive relationship with JWB (12). Withdrawal is one of the important concepts in the field of developmental psychology and psychiatry, and it is often manifested as job withdrawal in the workplace. JWB refers to the behavior of avoiding work tasks when individuals face pressure and dissatisfaction with their working conditions and roles, or the hidden negative behavior of flouting work rules (12). Compared with the negative emotional experience of job burnout, job withdrawal places greater emphasis on the negative behavior of individuals at work. Therefore, the substantial consequences of job withdrawal are often more destructive and harmful. Psychological research suggests that positive coping strategies are beneficial to health (33). Therefore, it is essential to encourage individuals to use positive coping mechanisms to deal with acute stress events.

In this study, the univariable analysis revealed significant differences between SASRQ scores ($p < 0.05$) among monthly income and department. The multiple linear regression demonstrated that participants with higher SASRQ scores were significantly more likely to be in the > 8,000 RMB group than in the 4,000 ~ 8,000 RMB groups ($p < 0.05$), which is inconsistent with the results of previous studies. Previous studies (34) found that nurses could alleviate burnout or emotional exhaustion by increasing external available resources (e.g., monthly income). Furthermore, the results of a study from a developing country showed a non-existent relationship between income and emotional exhaustion (23). The reason is that some scholars have pointed out that what affects psychology is the perception of income insufficient, rather than actual income (35). A

TABLE 4 Multiple linear regression analysis of influencing factors of SASRQ (*n*=518).

Independent variables	B	SE	β	t	P
Constant	0.052	0.184	-	0.281	0.779
Hospital level (with 'others' as reference)	-	-	-	-	-
Primary hospitals	0.007	0.160	0.026	0.449	0.653
Secondary hospitals	0.006	0.214	0.001	0.026	0.979
Tertiary hospital	0.087	0.156	0.038	0.557	0.578
Frequency of night shifts/Month (with 'Non-night shift' as reference)	-	-	-	-	-
1~2 night shifts/month	−0.0119	0.092	−0.040	−1.288	0.198
3 night shifts/per month	−0.090	0.062	−0.053	−1.448	0.148
4 night shifts/month	−0.080	0.125	−0.019	−0.639	0.523
≥5 night shifts/month	0.023	0.071	0.012	0.318	0.751
Monthly income (with '>8,000 RMB yuan' as reference)	-	-	-	-	-
<4,000 RMB yuan	−0.151	0.092	−0.065	−1.638	0.102
4,000~8,000 RMB yuan	−0.123	0.055	−0.075	−2.236	0.026
Departments (with 'Out-patient system' as reference)	-	-	-	-	-
Emergency and intensive system	0.198	0.075	0.110	2.620	0.009
Surgical system	0.025	0.077	0.013	0.327	0.744
Internal system	0.010	0.071	0.006	0.135	0.893

In these comparisons, other, non-night shift, >8,000 RMB yuan, and the out-patient system as reference categories for hospital level, frequency of night shifts/month, monthly income, and departments, respectively. B = standardized regression coefficient; B = unstandardized regression coefficient. Multiple linear regression model: $R^2 = 0.592$, adjusted $R^2 = 0.579$, $F = 45.473$, $p < 0.001$.

more reasonable explanation is that nurses in our study were from different hospital. The income of recruited nurses in each hospital depending on the hospital-level. Nurses of some hospitals with a higher grade run a great risk of infection, and thus, a higher SASRQ score for higher paid nurses than for those with lower salaries. According to previous study results, income is an important predictor of the JWB for nurses. Xiong et al. (12) found nurses who reported low levels of income tended to experience more JWB, which also increases the possibility of acute stress reaction. Nevertheless, more research is needed to further explore the nature of the relationship between income, JWB and SASRQ. A study by Li et al. (36) found that department is an important factor affecting the level of acute stress reaction. Nurses in the emergency and intensive care departments are more likely to elicit an acute stress reaction, in comparison with nurses in other departments. This may be due to the pressure faced by nurses in intensive care compared with other departments, as they are dealing with severely ill patients, which makes the nurses anxious and under increased pressure. Besides, this may be due to the high turnover of patients and the increased risk of infection from COVID-19. Therefore, it is critical to study the factors that relate to mental health and emotions with COVID-19 and to understand how nurses respond to the pandemic.

This study showed that the hospital level and the frequency of night shifts do not predict SASRQ scores during the pandemic. As speculated, nurses at different hospital levels have to respond to patients with suspected COVID-19, varying exposure risks and work intensity, as well as different levels of nurses' knowledge, which all affect SASRQ scores. Regarding the frequency of night shifts, frequent night shifts lead to sleep deprivation, which further stimulates the negative emotions of nurses within the working environment according to the previous study (37). However, our findings indicated the opposite. The reasons for this are worth exploring. According to previous researches in many countries, it had been observed that COVID-19 has negatively affected the mental health of individuals. Such as, China (26), Africa (38), Spain (8), Latin America (9), et al. quarantine adherence increased the presence of mental health disorders (32). Similarly, Hawryluck et al. reported that some SARS-exposed quarantines experienced emotional problems (39). Especially for those pediatric nurses who care for children in the hospital, it is also an important factor affecting mental health. This is an interesting possibility worthy of further study.

Limitations of the present study include the small sample size and that the study was conducted in one province of China. Second, a self-designed demographic questionnaire was used for linear regression, which may bring limitations. Besides, since it was a cross-sectional survey, the causal relationship cannot be confirmed. Furthermore, the generalizability of our findings to all nurses is limited since these findings are pertinent to pediatric nurses.

Conclusion

The findings of this study revealed that DASS-21, JWB, departments, and monthly income were predictive factors of SASRQ scores. In addition, the results showed a correlation between SASRQ, JWB, DASS-21, and all its sub-dimensions. Future studies should explore additional underlying factors that cause acute stress reactions, and focus on the psychological status of pediatric nurses to provide better care for patients.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by The ethics committee of Hunan children's hospital

approved the study protocol and the approval number is HCHLL-2021-61. The patients/participants provided their written informed consent to participate in this study.

Author contributions

XY and CJ draft of the manuscript and analysis the data. MM and HJ collect the data and analysis the data. XD and XJ correct the English grammar. ZL design the study and collect the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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