Thank you very much for giving us the opportunity to revise and resubmit our article. You will find our revised manuscript attached. We are grateful for all of the valuable comments. We have thoroughly reviewed all of them and considered each of them very seriously. We present our responses to each of the comments below.

SCIENTIFIC QUALITY

Please resolve all issues in the manuscript based on the peer review report and make a point-by-point response to each of the issues raised in the peer review report. Note, authors must resolve all issues in the manuscript that are raised in the peer-review report(s) and provide point-by-point responses to each of the issues raised in the peer-review report(s); these are listed below for your convenience:

Reviewer #1:

Scientific Quality: Grade C (Good)

Language Quality: Grade B (Minor language polishing)

Conclusion: Minor revision

Specific Comments to Authors: Please address the suggested changes (edited copy of the manuscript is attached).

EDITORIAL OFFICE'S COMMENTS

Authors must revise the manuscript according to the Editorial Office's comments and suggestions, which are listed below:

(1) Science editor:

This is a good study, well designed and well analyzed about a very important current theme. I only suggest authors take some more care in the final presentation of their manuscript. This version still contains a couple of typewriting errors. Otherwise, the manuscript reveals a considerable academic importance. A relevant aspect is the fundamental importance of social support in preventing psychological damage to the first line nurses (and certainly to all medical staff) in charge of attention to SARS-COVID 19 patients.

(2) Company editor-in-chief:

We have revised the manuscript as the reviewer suggested. We believe that this manuscript has been improved.

A cross-sectional study of traumatic stress disorder in frontline nurses 6 months after the outbreak of the covid-19 in Wuhan

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Abstract

BACKGROUND

Front-line nurses in Wuhan directly fighting SARS-CoV-2 are at a high risk of infection and are extremely susceptible to psychological stress, especially during the global coronavirus disease 2019 (COVID-19) pandemic. The psychological after-effects of public health emergencies on front-line nurses will last for years.

AIM

This study sought to assess factors influencing post-traumatic stress disorder (PTSD) among front-line nurses in Wuhan 6 months after the COVID-19 pandemic.

METHODS

A total of 757 front-line nurses from five hospitals in Wuhan, China, participated in an online survey from July 27 to August 13, 2020. This cross-sectional online study used a demographic information questionnaire, the Post-traumatic Stress Disorder Checklist for the DSM-5 (PCL-5), the Connor-Davidson Resilience Scale (CD-RISC 10), and the Patient Health Questionnaire-4 (PHQ-4). The chi-square test and logistic regression were used to analyze the association of demographics, COVID-19-related variables, and PTSD. Logistic regression was also conducted to investigate which variables were associated with PTSD outcomes.

RESULTS

A total of 13.5%, 24.3%, and 21.4% of the front-line nurses showed symptoms of PTSD, depression, and anxiety, respectively. The multivariate logistic regression analysis showed that the following factors were strongly associated with PTSD: having a relative, friend, or colleague who died of COVID-19;

experiencing stigma; having psychological assistance needs; having depression symptoms, and having anxiety symptoms. Showing resilience and receiving praise after the COVID-19 outbreaks were protective factors.

CONCLUSION

Front-line nurses still experienced PTSD (13.5%) six months after the COVID-19 outbreak. Peer support, social support, official recognition, reward mechanisms, exercise, better sleep, timely provision of information (such as on vaccine research progress) by the government via social media, and adequate protective supplies could mitigate the level of PTSD among nurses responding to COVID-19. Stigmatization, depression, and anxiety might be associated with a greater risk of PTSD among nurses.

Key words: Post-traumatic stress disorder (PTSD); front-line nurses; Coronavirus disease (COVID-19); mental health; pandemic

Core Tip: The mental health of first-line nurses in Wuhan has been significantly affected by the coronavirus disease (COVID-19). This study aims to evaluate the influencing factors of post-traumatic stress disorder (PTSD) among first-line nurses in Wuhan 6 months after the COVID-19 pandemic and implement a mental health plan. The prevalence rates of PTSD, depression and anxiety among first-line nurses were 13.5%, 24.3%, and 21.4%, respectively. The risk factors for nurses to develop PTSD are the death of a relative, friend, or colleague from COVID-19, stigma, depression, and anxiety. Resilience and reward mechanisms are protective factors to prevent PTSD.

INTRODUCTION

Novel coronavirus disease (COVID-19) was first reported in December 2019 in Wuhan, China. The WHO Director-General announced that the COVID-19

outbreak was a public health emergency of international concern on 30 January 2020[1]. As of 14 August 2020, 20 439 814 confirmed cases and 744 385 confirmed deaths were reported by the World Health Organization, and the disease eventually affected more than 216 countries, areas, or territories[2]. Increasing demand for care of COVID-19 patients and high morbidity and mortality are challenging the global health system.

Wuhan was considered a high-risk area for the COVID-19 outbreak. According to the daily report of the COVID-19 pandemic released by the National Health Commission (NHC) of China, as of 24:00 on February 24, 2020, Wuhan had a total of 47 071 confirmed cases and a total of 2 043 deaths[3]. To efficiently stop the spread of COVID-19, medical staff fought the disease. However, there were a total of 3 387 cases of COVID-19 infection among medical staff in mainland China. More than 90% of medical staff infections came from Hubei Province, mainly in Wuhan[4]. While rescuing lives, front-line medical staff witnessed the clinical reactions and deaths of a large number of patients with severe cases of COVID-19.

An overwhelming workload, shortage of medical supplies, insufficient rest, high risk of infection, stigma, and fear of infection of family members or friends increase the risk of PTSD among front-line nurses. PTSD[5,6] is a mental disorder characterized by intrusive thoughts, avoidance, cognitive and mood disturbances, and arousal symptoms that may be experienced after traumatic life events, such as threats of severe injury, death, war, sexual offenses, and terrible catastrophes.

Due to the COVID-19 pandemic, front-line nurses were considered susceptible to PTSD. Studies on the COVID-19 outbreak from China[7], Spain[8], Italy[9], Jordan[10] and the United States[11] have discussed how the battle against COVID-19 caused anxiety, depression and PTSD symptoms among front-line

nurses.

Studies on the impact of severe acute respiratory syndrome (SARS) [12], Middle East respiratory syndrome (MERS) [13] and influenza A (H7N9) [14] found that one to two years after the outbreak, front-line nurses endured symptoms of anxiety, depression and PTSD. However, there is little information available on the long-term impact of front-line nurses who treated SARS patients during the COVID-19 outbreak.

This study aims to investigate the influencing factors of PTSD 6 months after the COVID-19 outbreak among front-line nurses who were exposed to COVID-19. It is imperative to support the mental health of front-line nurses, which would facilitate their recovery from the COVID-19 pandemic.

MATERIALS AND METHODS

Ethical considerations

This study was approved by the Nursing Ethics Committee of The First Affiliated Hospital to Wannan Medical College (protocol number: 20200201). This study was conducted according to the principles of the Declaration of Helsinki.

Design and participants

2.2.1 Design

The research team assessed the traumatic stress disorder of front-line nurses who worked in Wuhan during the outbreak through a cross-sectional survey using social media (such as WeChat and QQ) 6 months after the outbreak, from July 27 to August 13, 2020. Before starting the investigation, all participants had to give their informed consent, and the purpose of the study was explained.

The participants could exit the survey at any time.

2.2.2 Participants

The study recruited 822 first-line medical staff from six tertiary general hospitals. After those who met the exclusion criteria were excluded, 92.1% (757 out of 822) of the staff were included in the statistical analyses. A total of 274 participants (36.2%) were from Zhongnan Hospital of Wuhan University (ZNWU); 149 (19.7%) were from Tongji Hospital, Tongji Medical College, Huazhong University of Science & Technology; 39 (5.2%) were from Wuhan Central Hospital; 150 (19.8%) were from Wuhan Jin Yin Tan Hospital (Wuhan Medical Treatment Center); 104 (13.7%) were from Wuhan Third Hospital; and 41 (5.4%) were from Renmin Hospital of Wuhan University (RHWU). The participants worked in Wuhan during the height of the epidemic period from January to February 2020.

The inclusion and exclusion criteria are presented in Figure 1.

Figure 1. The inclusion and exclusion criteria of online questionnaire survey

The demographics of the study participants are presented in Table 1.

Traumatic stress disorder of front-line nurses in Wuhan 6 months after the outbreak

N=822

Inclusion criteria
1. They understand the questions completely;
2. They are voluntarily participating in the study.
3. They were in close contact with patients, and there was a risk of infection at any time. (They were front-line nurses in Wuhan)

Online questionnaire survey of Chinese front-line nurses recruited through snowball sampling

Exclusion criteria
1. Response time<160s;
2. They are not front-line nurses.
3. They have previously been diagnosed with a mental disorder.
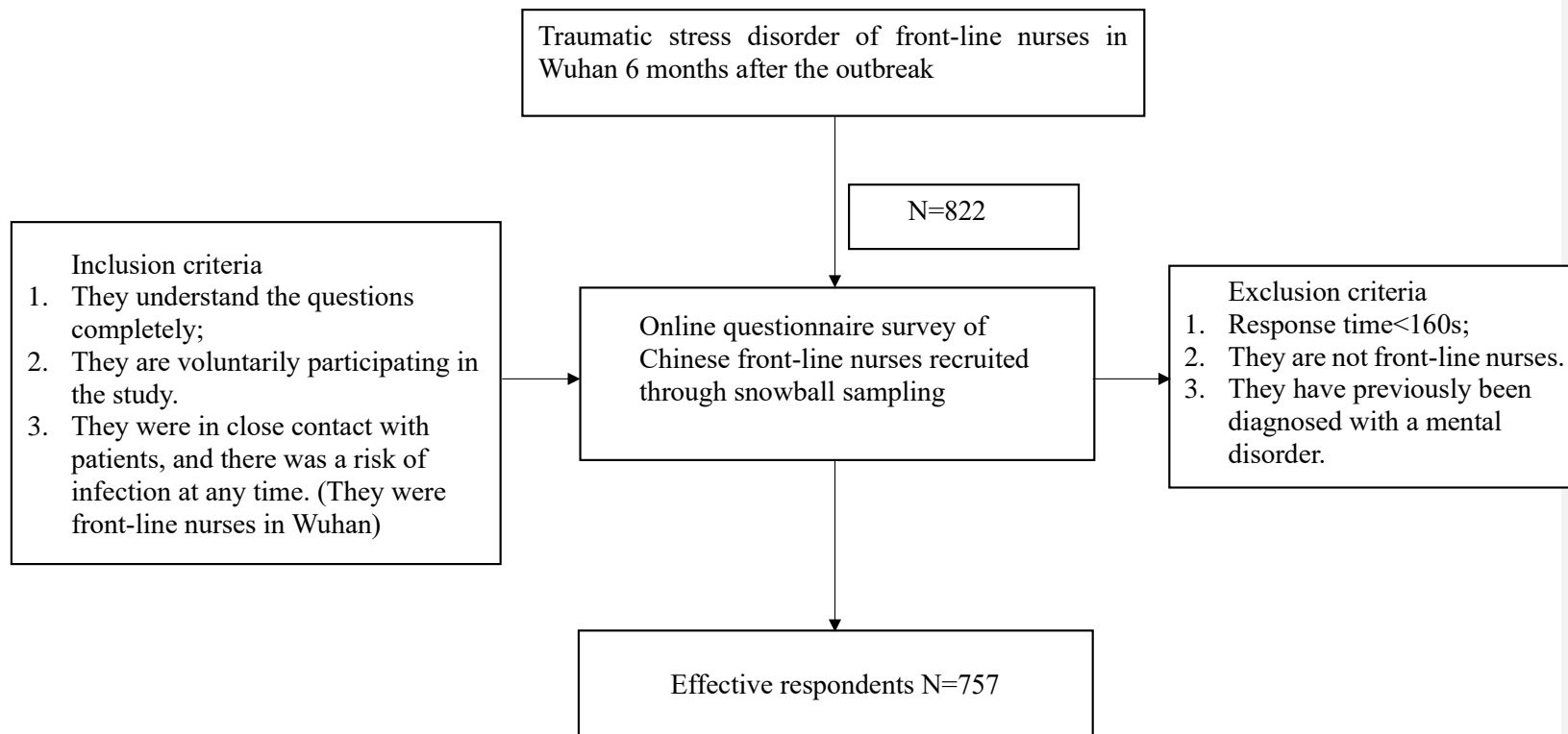
Effective respondents N=757

Figure 1. The inclusion and exclusion criteria of online questionnaire survey

Assessment and evaluation

2.3.1 Demographic questionnaire

This questionnaire collected information on the participants' general characteristics, including their age, gender, job-related information and COVID-related information.

2.3.2 Posttraumatic stress disorder

The DSM-5 scale (PCL-5) [15] was used to measure the posttraumatic stress disorder of front-line nurses in Wuhan 6 months after the outbreak. This scale has been widely and commonly used in previous studies [16]. The 20 items of the scale are scored on a Likert-type scale ranging from 0 = "not at all" to 4 = "extremely". The total scores range from 0 to 80, with higher scores indicating more severe symptoms (cutoff score ≥ 33). These statements are classified into four distinct domains: re-experiencing (5 items, score 0 to 20); avoidance (2 items, score 0 to 8); negative alteration in cognition and mood (6 items, score 0 to 24) and arousal (7 items, 0 to 28).

2.3.4 Resilience

The psychometric properties of the CD-RISC 10 are well documented. The Connor-Davidson Resilience Scale (CD-RISC 10)[17], in its Chinese version[18], was used to assess psychological resilience, especially the ability to cope with adversity. The 10 self-report items scale a scored on a Likert-type scale from 0= "not true at all" to 4 = "true nearly all the time". The total score ranges from 0 to 40, and higher scores indicate better resilience (cutoff score ≥ 30).

2.3.3 Anxiety and depression

The Patient Health Questionnaire-4 (PHQ-4) [19], including the Patient Health Questionnaire-2 (PHQ-2) and Generalized Anxiety Disorder-2 (GAD-2), was used to assess both depression and anxiety disorders, respectively. The Chinese

versions[20] have been validated and widely used. The PHQ-2 and GAD-2 use two core criteria to assess the levels of major depressive disorder and anxiety, respectively. Each item is scored on a 4-point Likert-type scale from 0= "not at all" to 3 = "nearly every day". The total score ranges from 0 to 6, and higher scores indicate greater levels of depression and anxiety (cutoff score ≥3).

Statistical analysis

Data analyses were analyzed in IBM SPSS version 21.0 (Chicago, IL, USA). Frequencies and percentages were calculated for the categorical data. The chi-square test was used to verify differences in the categorical variables between groups. Binary logistic regression analyses were used to explore the factors impacting posttraumatic stress, such as demographics, anxiety, depression, and resilience. The test level was α=0.05; that is, a p-value of ≤0.05 was considered statistically significant.

RESULTS

Demographic characteristics

A total of 757 participants were included in this investigation. The mean age was 32.60 years (SD = 7.64). The mean working time was 10.16 years (SD = 8.28). The study sample consisted of 688 women (86.4%) and 69 men (13.6%). The demographics of the participants are presented in Table 1.

Levels of PTSD, anxiety and depression

The mean PTSD, resilience, depression, and anxiety scores were 17.74±11.87, 25.29±6.95, 1.75±1.43, and 1.70±1.43, respectively. A total of 13.5% of the sample met the symptom criteria for PTSD. The prevalence of depression was 24.3%, and 21.4% of the participants had anxiety symptoms. The proportion of front-

批注 [AM1]: It is important to know if any of the participants initially enrolled for the study were dropped out or excluded.

批注 [A2R1]: Yuan T, Liu H performed the statistical analysis

批注 [AM3]: Why this gender difference? Please explain.

批注 [A4R3]: Chinese nurses are mostly women, so there are gender differences in the sample

line nurses in Wuhan enrolled in this survey who scores above the established cutoff for resilience was 28.7%.

Factors associated with posttraumatic stress disorder

Six items were significantly associated with PTSD among nurses, including having a relative, friend or colleague who died of COVID-19; experiencing stigma; receiving praise; showing resilience; having depression symptoms; and having anxiety symptoms (all $p<0.05$). No differences were observed between groups in gender, age, marital status, education, working years, or previous anti-epidemic experience(p >0.05) (Table 1).

批注 [AM5]: This should be p>0.05 as they were not significant.

批注 [A6R5]: I have changed，Thank you

TABLE 1 Sociodemographic characteristics and subscale scores of the study participants. (N=757)

Variables	Characteristics	Total N(%)	PTSD N(%)		χ^2	P value
			No	Yes		
Gender	Male	69(9.1)	64(8.5)	5(0.7)	2.526	0.112
	Female	688(90.9)	591(78.1)	97(12.8)		
Age	<25	132(17.4)	116(15.3)	16(2.1)	3.859	0.452
	26-30	232(30.6)	205(27.1)	27(3.6)		
	31-35	183(24.2)	156(20.6)	27(3.6)		
	36-40	88(11.6)	71(9.4)	17(2.2)		
	>40	122(16.1)	107(14.1)	15(2.0)		
Marital status	Married	492(65.0)	422(55.7)	70(9.2)	0.684	0.408
	Single/Divorced/Other	265(35.0)	233(30.8)	32(42.2)		
Education	Secondary Education	98(12.9)	82(10.8)	16(2.1)	0.842	0.656
	Bachelor's Degree	585(77.3)	508(67.1)	77(10.2)		
	Postgraduate/Doctoral Degree	74(9.8)	65(8.6)	9(1.2)		

Working years	0~2	114(15.1)	101(13.3)	13(1.7)	1.289	0.863
	3~5	148(19.6)	128(16.9)	20(2.6)		
	6~10	219(28.9)	191(25.2)	28(3.7)		
	11~20	178(23.5)	150(19.8)	28(3.7)		
	≥20	98(12.9)	85(11.2)	13(1.7)		
Previous anti-epidemic experience	No	694(97.1)	600(79.3)	94(12.4)	0.035	0.851
	Yes	63(8.3)	55(7.3)	8(1.1)		
Nurse infected by COVID-19	No	732	634	98	0.141	0.707
	Yes	25	21	4		
A relative, friend or colleague died of COVID-19	No	611(80.7)	542(71.6)	69(9.1)	12.929	0.000**
	Yes	146(19.3)	113(14.9)	33(4.4)		
Experienced stigma	No	596(78.7)	536(70.8)	60(7.9)	27.902	0.000**
	Yes	161(21.3)	119(15.7)	42(5.5)		
Received praise	No	504(66.6)	425(56.1)	79(10.4)	6.262	0.012*
	Yes	253(33.4)	230(30.4)	23(3.0)		
Resilience (CD-RISC-10)	<30	540(71.3)	442(58.4)	98(12.9)	35.297	0.000**
	≥30	217(28.7)	213(28.1)	4(0.5)		
Depression	<3	573(75.7)	541(71.5)	32(4.2)	125.861	0.000**

(PHQ-2)					
	≥3	184(24.3)	114(15.1)	70(9.2)	
Anxiety (GAD-2)	<3	595(78.6)	558(73.7)	37(4.9)	125.549 0.000**
	≥3	162(21.4)	97(12.8)	65(8.6)	

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

Regression analyses of posttraumatic stress disorder

As shown in Table 2, several variables were found to be associated with a higher risk of PTSD, such as having a relative, friend or colleague who died of COVID-19 (OR: 2.226, $p < 0.01$); experiencing stigma (OR: 3.038, $p < 0.01$); not receiving praise (OR: 0.442, $p < 0.01$); lacking resilience (OR: 0.190, $p < 0.01$); having depression symptoms (OR: 3.625, $p < 0.01$); and having anxiety symptoms (OR: 3.849, $p < 0.01$).

TABLE 2 Logistic regression analyses for posttraumatic stress disorder (N=757)

	B	S.E,	Wald	Sig.	Exp (B)	95% Confidence	
						Lower Bound	Upper Bound
A relative, friend or colleague died of COVID-19 (No)	0.800	0.283	7.969	0.005	2.226	1.277	3.879
Experienced stigma (No)	1.111	0.270	16.974	0.000	3.038	1.791	5.154
Received praised (No)	-0.816	0.288	8.042	0.005	0.442	0.252	0.777
Resilience<30	-1.662	0.540	9.475	0.002	0.190	0.066	0.547
Depression<3	1.288	0.322	15.962	0.000	3.625	1.927	6.818
Anxiety<3	1.348	0.321	17.678	0.000	3.849	2.053	7.214
Constant	-5.010	0.999	25.134	0.000	0.007		

批注 [AM7]: This should be Wald

F=177.144, *P*=0.000, *Cox Snell R ^{2} =0.209, Nagelkerke R ^{2}=0.382*

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

DISCUSSION

Key findings

This study found that six months after the COVID-19 outbreak in Wuhan, China, the prevalences of PTSD, depression and anxiety among front-line nurses were 13.5%, 24.3% and 21.4%, respectively. The following factors were associated with a greater likelihood of having PTSD: having relative, friend or colleague who died of COVID-19; experiencing stigma; having depression symptoms; and having anxiety symptoms. Showing resilience and receiving praise after the COVID-19 outbreak were helpful for preventing PTSD.

The prevalence of PTSD

The incidence of PTSD among front-line nurses was lower than that at the initial stage of the COVID-19 outbreak (16.83-71.5%) [21-25]. A possible reason might be that the nurses may have been under less psychological stress 6 months after the outbreak than they were during the initial period, which was also found in Zhong-Xiang Cai's research.

Factors influencing PTSD

It is important to note that the participants who had a relative, friend or colleague who died of COVID-19 were more likely to report high levels of PTSD. In contrast, no differences in history of personal infection were observed between those who did not have PTSD. This study highlights that exposure to high-risk work environments (such as directly caring for infected patients) was not the main determinant of adverse psychological outcomes. This result was also found 13 to 26 months after the SARS outbreak[26] among medical staff at Toronto hospitals that treated SARS patients. A previous study[27] showed that during the SARS outbreak, the death of colleagues created a stressful

批注 [AM8]: Revise as follows: Factors influencing PTSD

atmosphere in the hospital. It is also possible that the death of a relative, friend or colleague places a heavy psychological burden on nurses[28]. These trends may be explained by peer support promoting adaptive coping.

Stigmatization was found to be predictive of a high level of PTSD. Front-line nurses at hospitals are vulnerable to stigmatization, loneliness and exclusion due to working in areas with the highest incidence of COVID-19. COVID-19-related fear may have led the nurses to be isolated from other individuals, which may also have had different effects on their social support. Experience of stigma can have long-term adverse effects on nurses' mental health. Such effects were examined by Liu[29], Atefeh Zandifar[30] and Susanne Röhr[31].

The logistic regression analysis showed that the nurses who had received praise from government agencies were less likely to report high levels of PTSD. Front-line nurses who are officially recognized, which is common in Chinese society, have a strong sense of being protected and supported by organizations. Such recognition may play an important role in experiencing satisfaction through continued working in these settings. Previous studies[32,33] reported that people with severe PTSD symptoms performed better than those without PTSD symptoms in reward trials. In response to the ongoing psychological effects among nurses after the COVID-19 outbreak, official recognition and reward mechanisms appear to be needed.

Psychological resilience was a significant protective factor for PTSD among the front-line nurses 6 months after the COVID-19 outbreak. Resilience[34] refers to an individual's ability to positively adjust after trauma and respond to adverse experiences. Psychological resilience research [35] during the COVID-19 epidemic showed that more frequent exposure to the outdoors and sunlight, more exercise, greater perceived social support, better sleep, and more frequent prayer may contribute to greater psychological resilience.

Personal depression and anxiety contributed to adverse outcomes.

One study[37] conducted in China during the COVID-19 outbreak showed that increased distress, decreased sleep quality and increased self-efficacy could cause anxiety among medical staff, which could affect their mental health. Making difficult ethical decisions regarding the distribution of medical supplies, the lack of personal equipment and progress in vaccine research for COVID-19 made medical staff particularly vulnerable to mental health problems. Therefore, reasonable rest time and shifts, a safe working environment, the satisfaction of basic needs and the availability of information on vaccine research progress may help reduce stress among nurses. Previous studies[36-39] also found that anxiety could lead to posttraumatic stress disorder, with effects of a higher frequency of social media exposure. Notably, having up-to-date authoritative and true information about COVID-19 on social media may reduce the rate of PTSD.

Limitations

Several limitations of this survey must be mentioned. First, since the COVID-19 pandemic has had a long-term negative psychological impact on nurses, longitudinal research should be conducted in the future. Second, the research may have been biased because the participants were not recruited randomly. Third, due to the endpoint of the study, the challenges and opportunities of vaccination remain unknown.

CONCLUSION

Six months after the COVID-19 outbreak, front-line nurses still experienced pandemic-related distress, which could lead to long-term PTSD. Our findings indicated that peer support, social support, exercise, better sleep, official recognition and reward mechanisms should be prioritized to alleviate

the negative psychological responses of nurses in dealing with the pandemic. Our study further shows that the timely provision of information (such as on vaccine research progress) by the government on social media and adequate protective supplies might mitigate the level of PTSD among nurses responding to COVID-19. Stigmatization, depression and anxiety might be associated with a greater risk of PTSD among nurses.

ARTICLE HIGHLIGHTS

Research background

The worldwide spread of COVID-19 is an international public health emergency posing challenges for healthcare systems. The mental health of nurses was significantly affected by this crisis, and nurses played a crucial role in successfully fighting the COVID-19 pandemic.

Research motivation

Few studies have focused on the risk of PTSD among front-line nurses 6 months after the COVID-19 outbreak. Our research group aimed to investigate the prevalence of PTSD among nurses and the implementation of mental health programs.

Research objectives

This study aimed to evaluate the factors associated with PTSD, determine what psychosocial support nurses need and identify ways to reduce the level of PTSD among nurses responding to the COVID-19 pandemic in Wuhan, China.

Research methods

A total of 757 front-line nurses from six tertiary general hospitals in Wuhan, China, were recruited. The structured questionnaire included a demographic

information section, the PTSD Checklist for DSM-5 (PCL-5), the Connor-Davidson Resilience Scale (CD-RISC 10), the Patient Health Questionnaire-4 (PHQ-4) and COVID-19-related items. The cross-sectional survey was conducted from July 27 to August 13, 2020 by using social media.

Research results

This study found that six months after the COVID-19 outbreak in Wuhan, China, the prevalences of PTSD, depression and anxiety among front-line nurses were 13.5%, 24.3% and 21.4%, respectively. The following factors were associated with a greater likelihood of having PTSD: having a relative, friend or colleague who died of COVID-19; experiencing stigma; having depression symptoms; and having anxiety symptoms. Showing resilience and receiving praise after COVID-19 outbreak were helpful for preventing PTSD.

Research conclusions

Front-line nurses still experienced long-term pandemic-related distress six months after the COVID-19 outbreak. Peer support, social support, official recognition, reward mechanisms, exercise, better sleep, the timely provision of information (such as vaccine research progress) by the government on social media and adequate protective supplies could mitigate the level of PTSD among nurses responding to COVID-19. Stigmatization, depression and anxiety might be associated with a greater risk of PTSD among nurses.

Research perspectives

Considering the long-term adverse effects on front-line nurses, longitudinal studies should be conducted in the future. Additional research is needed to better understand whether the vaccine could remediate the negative impact on the mental health of nurses and other populations.

References

1   **World Health Organization.** Listings of WHO's response to COVID-19
    https://www.who.int/news/item/29-06-2020-covidtimeline

2   **World Health Organization**. Weekly operational update on COVID-19 -
    14 August 2020. https://www.who.int/publications/m/item/weekly-
    update-on-covid-19---14-august-2020

3   **National Health Commission of the People's Republic of China.** The
    latest situation of the novel coronavirus pneumonia epidemic.
    http://www.nhc.gov.cn/xcs/yqtb/202003/9d462194284840ad96ce75eb8e
    4c8039.shtml

4   **Cao GW**, Zhang BX, Chen XP. Consideration on improving public health
    emergency management ability of current medical health system.
    Zhonghua Liu Xing Bing Xue Za Zhi. 2020;**41**(10):1588-1594. Chinese.
    doi:10.3760/cma.j.cn112338-20200304-00247.   PMID: 32498493.

5   **American Psychiatric Association.** Diagnostic and Statistical Manual of
    Mental Disorders, Fifth Edition (DSM-5). Arlington: American Psychiatric
    Publishing; 2013

6   **Bisson JI,** Cosgrove S, Lewis C, Robert NP. Post-traumatic stress
    disorder.*BMJ*.2015;**351**:h6161.doi:10.1136/bmj.h6161. PMID: 26611143.

7   **Cai Z**, Cui Q, Liu Z, Li J, Gong X, Liu J, Wan Z, Yuan X, Li X, Chen C,
    Wang G. Nurses endured high risks of psychological problems under the
    epidemic of COVID-19 in a longitudinal study in Wuhan China. *J
    Psychiatr Res.* 2020;**131**:132-137. doi: 10.1016/j.jpsychires.2020. 09.007.
    PMID: 32971356.

8   **Alonso J**, Vilagut G, Mortier P, Ferrer M, Alayo I, Aragón-Peña A,
    Aragonès E, Campos M, Cura-González ID, Emparanza JI, Espuga M,
    Forjaz MJ, González-Pinto A, Haro JM, López-Fresneña N, Salázar ADM,

Molina JD, Ortí-Lucas RM, Parellada M, Pelayo-Terán JM, Pérez-Zapata A, Pijoan JI, Plana N, Puig MT, Rius C, Rodríguez-Blázquez C, Sanz F, Serra C, Kessler RC, Bruffaerts R, Vieta E, Pérez-Solà V; MINDCOVID Working group. Mental health impact of the first wave of COVID-19 pandemic on Spanish healthcare workers: A large cross-sectional survey. *Rev Psiquiatr Salud Ment*. 2020:S1888-9891(20)30128-2. doi: 10.1016/ j.rpsm.2020.12.001. PMID: 33309957.

9   **Rossi R,** Socci V, Pacitti F, Mensi S, Di Marco A, Siracusano A, Di Lorenzo G. Mental Health Outcomes Among Healthcare Workers and the General Population During the COVID-19 in Italy. *Front Psychol*. 2020;**11**:608986. doi: 10.3389/fpsyg.2020.608986.   PMID: 33363500.

10   **Shahrour G,** Dardas LA. Acute stress disorder, coping self-efficacy and subsequent psychological distress among nurses amid COVID-19. *J Nurs Manag*. 2020;**28**(7):1686-1695. doi: 10.1111/jonm.13124. PMID: 32767 827.

11   **Sagherian K,** Steege LM, Cobb SJ, Cho H. Insomnia, fatigue and psychosocial well-being during COVID-19 pandemic: A cross-sectional survey of hospital nursing staff in the United States. *J Clin Nurs*. 2020:**10**.1111/jocn.15566. doi: 10.1111/jocn.15566.   PMID: 33219569.

12   **Lancee WJ,** Maunder RG, Goldbloom DS; Coauthors for the Impact of SARS Study. Prevalence of psychiatric disorders among Toronto hospital workers one to two years after the SARS outbreak. *Psychiatr Serv*. 2008;**59**(1):91-5. doi: 10.1176/ ps.2008.59.1.91.   PMID: 18182545.

13   **Oh MD**, Park WB, Park SW, Choe PG, Bang JH, Song KH, Kim ES, Kim HB, Kim NJ. Middle East respiratory syndrome: what we learned from the 2015 outbreak in the Republic of Korea. *Korean J Intern Med*. 2018;**33**(2):233-246. doi: 10.3904/kjim.2018.031.   PMID: 29506344.

14   **Tang L,** Pan L, Yuan L, Zha L. Prevalence and related factors of post-traumatic stress disorder among medical staff members exposed to H7N9 patients. *Int J Nurs Sci*. 2016;**4**(1):63-67. doi: 10.1016/j. ijnss.2016.12.002. PMID: 31406720.

15 **Blevins CA,** Weathers FW, Davis MT, Witte TK, Domino JL. The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): Development and Initial Psychometric Evaluation. *J Trauma Stress.* 2015;**28**(6):489-98. doi: 10.1002/jts.22059.   PMID: 26606250.

16 **Liu N,** Zhang F, Wei C, Jia Y, Shang Z, Sun L, Wu L, Sun Z, Zhou Y, Wang Y, Liu W. Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. *Psychiatry Res.* 2020;**287**:112921. doi: 10.1016/j.psychres.2020.112921. PMID: 32240896.

17 **Connor KM,** Davidson JR. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety.* 2003; **18**(2):76-82. doi: 10.1002/da.10113.   PMID: 12964174.

18 **Meng M,** He J, Guan Y, Zhao H, Yi J, Yao S, Li L. Factorial Invariance of the 10-Item Connor-Davidson Resilience Scale Across Gender Among Chinese Elders. *Front Psychol.* 2019;**10**:1237. doi:10.3389/fpsyg. 2019.01237.   PMID: 31214071.

19 **Löwe B,** Wahl I, Rose M, Spitzer C, Glaesmer H, Wingenfeld K, Schneider A, Brähler E. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *J Affect Disord.* 2010;**122**(1-2):86-95. doi: 10.1016/j.jad.2009.06.019.   PMID: 19616305.

20 **Zhang WR,** Wang K, Yin L, Zhao WF, Xue Q, Peng M, Min BQ, Tian Q, Leng HX, Du JL, Chang H, Yang Y, Li W, Shangguan FF, Yan TY, Dong HQ, Han Y, Wang YP, Cosci F, Wang HX. Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China. *Psychother Psychosom.* 2020;**89**(4):242-250. doi: 10.1159/000507639. PMID: 32272480.

21 **Caillet A,** Coste C, Sanchez R, Allaouchiche B. Psychological Impact of COVID-19 on ICU Caregivers. *Anaesth Crit Care Pain Med.* 2020;**39** (6):717-722. doi: 10.1016/j.accpm.2020.08.006.   PMID: 33007463.

22 **Dobson H,** Malpas CB, Burrell AJ, Gurvich C, Chen L, Kulkarni J, Winton-

Brown T. Burnout and psychological distress amongst Australian healthcare workers during the COVID-19 pandemic. *Australas Psychiatry.* 2021;**29**(1):26-30. doi: 10.1177/1039856220965045. PMID: 33043677.

23 **Wang YX**, Guo HT, Du XW, Song W, Lu C, Hao WN. Factors associated with post-traumatic stress disorder of nurses exposed to corona virus disease 2019 in China. *Medicine (Baltimore).* 2020;**99**(26):e20965. doi:10.1097/MD.0000000000020965. PMID: 32590808;

24 **Si MY,** Su XY, Jiang Y, Wang WJ, Gu XF, Ma L, Li J, Zhang SK, Ren ZF, Ren R, Liu YL, Qiao YL. Psychological impact of COVID-19 on medical care workers in China. *Infect Dis Poverty.*2020;**9**(1):113.doi: 10.1186/ s40249-020-00724-0. PMID: 32787929.

25 **Lai J,** Ma S, Wang Y, Cai Z, Hu J, Wei N, Wu J, Du H, Chen T, Li R, Tan H, Kang L, Yao L, Huang M, Wang H, Wang G, Liu Z, Hu S. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw Open*.2020; **3** (3):e203976.doi:10.1001/jamanetworkopen.2020.3976. PMID: 32202646;

26 **Maunder RG,** Lancee WJ, Balderson KE, Bennett JP, Borgundvaag B, Evans S, Fernandes CM, Goldbloom DS, Gupta M, Hunter JJ, McGillis Hall L, Nagle LM, Pain C, Peczeniuk SS, Raymond G, Read N, Rourke SB, Steinberg RJ, Stewart TE, VanDeVelde-Coke S, Veldhorst GG, Wasylenki DA. Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Emerg Infect Dis*. 2006;**12**(12):1924-32. doi: 10.3201/eid1212.060584. PMID: 17326946.

27 **Phua DH,** Tang HK, Tham KY. Coping responses of emergency physicians and nurses to the 2003 severe acute respiratory syndrome outbreak. *Acad Emerg Med.* 2005;**12**(4):322-8. doi: 10.1197/j.aem. 2004.11.015. PMID: 15805323.

28 **Styra R,** Hawryluck L, Robinson S, Kasapinovic S, Fones C, Gold WL. Impact on health care workers employed in high-risk areas during the Toronto SARS outbreak. *J Psychosom Res*. 2008;**64**(2):177-83. doi:

10.1016/j.jpsychores.2007.07.015.   PMID: 18222131.

29 **Liu X,** Kakade M, Fuller CJ, Fan B, Fang Y, Kong J, Guan Z, Wu P. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr Psychiatry*. 2012; **53** (1):15-23. doi: 10.1016/j.comppsych.2011.02.003.   PMID: 21489421.

30 **Zandifar A,** Badrfam R, Mohammadian Khonsari N, Mohammadi MR, Asayesh H, Qorbani M. Prevalence and Associated Factors of Posttraumatic Stress Symptoms and Stigma among Health Care Workers in Contact with COVID-19 Patients. *Iran J Psychiatry*. 2020;**15**(4): 340-350. doi: 10.18502/ijps.v15i4.4303.   PMID: 33240384.

31 **Röhr S,** Müller F, Jung F, Apfelbacher C, Seidler A, Riedel-Heller SG. Psychosocial Impact of Quarantine Measures During Serious Coronavirus Outbreaks: A Rapid Review. *Psychiatr Prax.* 2020;**47**(4):179-189. German. doi: 10.1055/a-1159-5562.   PMID: 32340047.

32 **Myers C.E.,** Moustafa A., Sheynin J., Vanmeenen K.M., Gilbertson M.W., Orr S.P. Learning to obtain reward, but not avoid punishment, is affected by presence of PTSD symptoms in male veterans: empirical data and computational model. *PLoS One*. 2013;**8**:e72508. doi:10.1371/journal.pone.0072508.   PMID: 24015254;

33 **Boukezzi S**, Baunez C, Rousseau PF, Warrot D, Silva C, Guyon V, Zendjidjian X, Nicolas F, Guedj E, Nazarian B, Trousselard M, Chaminade T, Khalfa S. Posttraumatic Stress Disorder is associated with altered reward mechanisms during the anticipation and the outcome of monetary incentive cues. *Neuroimage Clin*. 2020;**25**:102073. doi: 10.1016/j.nicl.2019.102073.   PMID: 31794925.

34 **Lutha SS,** Cicchetti D. The construct of resilience: implications for interventions and social policies. *Dev Psychopathol*. 2000; **12**(4):857-85. doi: 10.1017/s0954579400004156.   PMID: 11202047.

35 **Killgore WDS,** Taylor EC, Cloonan SA, Dailey NS. Psychological resilience during the COVID-19 lockdown. *Psychiatry Res*. 2020; **291**:113216. doi:

10.1016/j.psychres.2020.113216.   PMID: 32544705.

36 **Xiao H,** Zhang Y, Kong D, Li S, Yang N. The effects of social support on sleep quality of medical staff treating patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit.* 2020;**26**:e923549. doi: 10.12659/MSM.923549.   PMID: 32132521.

37 **Gao J,** Zheng P, Jia Y, Chen H, Mao Y, Chen S, Wang Y, Fu H, Dai J. Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One.* 2020;**15**(4):e0231924. doi: 10.1371/journal. Pone.0231924.   PMID: 32298385.

38 **Hou F,** Bi F, Jiao R, Luo D, Song K. Gender differences of depression and anxiety among social media users during the COVID-19 outbreak in China:a cross-sectional study. *BMC Public Health.* 2020;**20**(1): 1648. doi: 10.1186/s12889-020-09738-7.   PMID: 33148202.

39 **Choi DH,** Yoo W, Noh GY, Park K. The impact of social media on risk perceptions during the MERS outbreak in South Korea. *Comput Human Behav*.2017;**72**:422-431.doi:10.1016/j.chb.2017.03.004. PMID:3228 8176.

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