Psychological impact of COVID-19 outbreak on frontline nurses: A cross-sectional survey study

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Abstract

Aims and objectives: This study aimed to portray the prevalence and associated factors of psychological distress among frontline nurses during COVID-19 outbreak.

Background: The COVID-19 outbreak has posed great threat to public health worldwide. Nurses fighting against the epidemic on the frontline might be under great physical and psychological distress. This psychological distress was predominantly described as sleep disturbance, symptoms of anxiety and depression, post-traumatic stress, inability to make decisions and even somatic symptoms.

Design: Cross-sectional study.

Methods: Frontline nurses from designated hospitals for COVID-19 patients were invited to complete an online survey by convenience sampling, and the survey included six main sections: the General Health Questionnaire, the Perceived Social Support Scale, the Simplified Coping Style Scale, the Impact of Event Scale-Revised, sociodemographic, occupation and work history. Multiple logistic analysis was used to identify the potential risk factors of psychological distress. The study methods were compliant with the STROBE checklist.

Results: Of the 263 frontline nurses, 66 (25.1%) were identified as psychological distress. Multiple logistic analysis revealed that working in emergency department, concern for family, being treated differently, negative coping style and COVID-19-related stress symptom were positive related to psychological distress. Perceived more social support and effective precautionary measures were negatively associated with psychological distress.

Conclusions: The study demonstrated that COVID-19 had a significant psychological impact on frontline nurses. Early detection of psychological distress and supportive intervention should be taken according to the associated factors to prevent more serious psychological impact on frontline nurses.

Relevance to clinical practice: This study highlighted that the frontline nurses were suffering from varying degrees of psychological distress, which needed early screening and supportive intervention for preventing more serious psychological impact on frontline nurses. Beside, more specific measurement should be combined with the GHQ-12 to assess the varying degrees of psychological distress in frontline nurses.

1 | INTRODUCTION

The current outbreak of the severe acute respiratory syndrome novel coronavirus (SARS-CoV-2) primary reported by Hubei Province of China has spread to the whole China and almost every country around the world. Base on the growing case of 2019-novel coronavirus disease (COVID-19), World Health Organization Emergency Committee declared a global health emergency on 30 January. By mid-March, about 80,000 people had been diagnosed with COVID-19 in China (National Health Commission of the People's Republic of China, 2020), and a total of 1,716 healthcare providers were diagnosed with COVID-19 (The Central People's Government of China, 2020). The coronavirus could be transmitted by many ways, direct transmission, contact transmission, aerosol transmission and even faecal-oral transmission (Peng et al., 2020). Its powerful transmission speed has caused many infections among healthcare workers and has had a huge impact on the whole country (Nishiura et al., 2020; Wu et al., 2020). The huge increase in the number of COVID-19 patients has posed a great challenge to hospitals and resulted in a severe shortage of medical supplies and medical staff, especially in the COVID-19 designated hospitals. The shortage of medical supplies during the epidemic also increased the risk of infection of COVID-19 among nursing staff (Wang, Zhang, & He, 2020). During the current outbreak of COVID-19, nurses working in the frontline [emergency department (ED), intensive care unit (ICU), infection department and other departments receiving COVID-19-infected patients] sometime needed to work overtime. Moreover, wearing a full set of protective equipment brought some inconvenience to drinking water, breathing and vision, which made the frontline feel a higher level of work intensity and easier to feel tired. The increased workload and physical burden of wearing personal protective equipment was threatening the health of nurses.

2 | BACKGROUND

Previous studies (Li et al., 2015; Maunder et al., 2003; Ulrich, 2014) carried out during the outbreak of SARS or Ebola described increased mental burden on nursing staff. Nurses assigned to deal with SARS or Ebola were significantly stressed because they had the important responsibility of disease gatekeeper. These frontline nurses were reported to have a high risk of psychological distress, such as sleep disturbance, loss of self-confidence and inability to make decisions, as well as physical health problem (Nickell et al., 2004; Tham et al., 2004).

Psychological distress was reported to occur in nurses during the similar crisis, and it exacerbated the shortage of nurses due to mental illness, sick leave or resignation (Li et al., 2015). More importantly,

What does this paper contribute to the wider global clinical community?

- The psychological distress among frontline nurses during the COVID-19 outbreak deserves attention.
- The psychological health of frontline nurses was influenced by internal factors and external factors, such as work environment, social support, coping strategy and precautionary measures.
- In the context of the global spread of the epidemic, the results could help nurse managers to find out nurses with psychological distress and take supportive strategies to improve their psychological health.

poor psychological health among nurses might not only be detrimental to individual but also hinder professional performance and, in turn, the quality of nursing patients (Li et al., 2017; Sonoda, Onozuka, & Hagihara, 2018). Nursing for COVID-19 patients was a high-risk work, and any mistake in the process might lead to serious consequences, such as transmission of the novel coronavirus from patients to others in the hospital or disease condition deterioration of the COVID-19 patients. Thus, it was important for nurses working in frontline to maintain a good physical health as well as psychological health. For a long time, the physical health of nurses has been paid more attention, but the psychological health was usually neglected (Ghawadra, Abdullah, Choo, & Phang, 2019).

The psychological health of nurse was influenced by many factors. Previous studies reported that personal factors such as gender, age, educational level, marital status, having children or not, and personality might be correlated with the mental health among nurses (Cañadas-De la Fuente et al., 2018; Sadati, Hemmati, Rahnavard, Lankarani, & Heydari, 2016; Tehrani, Rakhshani, Shojaee Zadeh, Hosseini, & Bagheriyan, 2013). Additional, external factors including workload, work stress, work environment and training also played important role in influencing the mental health of nurse (Maharaj, Lees, & Lal, 2018; Molina-Praena et al., 2018). Some studies highlighted the positive influence of social support and family support on psychological health (Hamaideh, 2012; Kutluturkan, Sozeri, Uysal, & Bay, 2016). However, in previous public health crisis, a study reported that frontline nurses received intense stigmatisation from family, coworkers and the community (Hewlett & Hewlett, 2005). In addition, coping style was also reported to be related to mental health among nurses (Ilić, Arandjelović, Jovanović, & Nešić, 2017).

The psychological health status of nurses has been studied in previous studies, but has not been adequately explored among

nurses working on the frontline. Therefore, this study aimed to portray the prevalence and the risk factors of psychological distress among nurse working in the frontline during the outbreak of COVID-19. It was expected the results of this study to provide some useful information for making supportive strategies to improve the mental health of nurses in frontline during the epidemic.

3 | METHOD

3.1 | Study design and participant

This study was a cross-sectional study, and it was approved by the Medical Ethic Committee. The survey begun with an informed consent of the study, participants needed to read the informed consent and chose the "agree" option to start filling out the questionnaire, otherwise the questionnaire could not be filled out. All procedures performed in the study involving human participants were in accordance with the ethical standards of the hospital, national research committee and the 1964 Helsinki Declaration. The study methods were compliant with the strengthening the reporting of observational studies in epidemiology checklist (Appendix S1).

Nurses who were directly in contact with infected or suspected COVID-19 patients on the frontline were invited to participate in this online study by convenience sampling method. Frontline nurses were defined as working on the frontline department such as ED, fever clinic, isolation ward, ICU and infection department where infected or suspected patients stayed. The online survey was conducted in seven designated hospitals for COVID-19 patients in Guangdong Province. The nurse infected by novel coronavirus was excluded from the study, because there was few infected nurse in the designated hospitals and the inclusion of them might affect the consistency of the result.

3.2 | Variables and measurement

The online survey consisted of six main sections: social-demographic information, occupation and work history, the 12-item version of the General Health Questionnaire (GHQ-12), the Simplified Coping Style Questionnaire (SCSQ), the revised version of the Impact of Event Scale (IES-R) and the Perceived Social Support Scale (PSSS). Social-demographic characteristics included gender, age, educational level, marital status, working department and working years. Work-related information included changes of regular job duties or not, working overtime or not, precautionary measures effective or not, whether being treated differently because of working in hospital. The extent of concern about whether their own self and their family might be infected with COVID-19 was also investigated.

Psychological distress within the past few weeks was evaluated using the 12-item version of the General Health Questionnaire (GHQ-12) (Goldberg & Williams, 1991), which has been used frequently to measure recent psychological distress. The Chinese version (Yang, Huang, & Wu, 2003) of GHQ-12 has been proved to be a screening tool for psychological disturbance. A pilot study was conducted among nurses to assess the validity of the instrument. Participants were asked to rate the 12 symptom (e.g. nervous, distress, insomnia) they experienced recently, using a 4-point Likert scale (1 = not at all, 2 = same as usual, 3 = somewhat more than usual, and 4 = much more than usual). The response categories were coded by using the original scoring method. According to a previous study (Goldberg et al., 1997), a score >3 was used to identify the presence of psychological distress manifested as a break from normal functioning, such as anxiety or depression, loss of self-confidence and inability to make decisions. The Cronbach alpha coefficient for the GHQ-12 in this study was 0.81.

Coping style was assessed by the SCSQ developed by Xie (1998). The scale consists of 20 coping cognitive and behavioural patterns relating to two domains: positive coping patterns (item 1 to item 12) and negative coping patterns (item 13 to item 20). Each item scores on a 4-point Likert scale from "not used" (0) to "used a great deal" (3). Participants with a higher positive coping score/negative coping score were more likely to take positive/negative coping patterns. The Cronbach alpha coefficient for positive coping dimension and negative coping dimension was 0.903 and 0.753, respectively.

The Impact of Event Scale: Revised version (IES-R) was used to evaluate intrusive thoughts related to COVID-19 and consequent avoidance behaviour (Daniel & Weiss, 2007). The Chinese version of IES-R (Wu & Chan, 2003) consists of 22 items dividing into three dimension: intrusion, avoidance and hyper arousal. Simple 5-point Likert method (scores 0–4) was adopted to assess the impact of life event in the past 7 days. Participants with a score greater than or equal to 20 were interpreted to be affected by traumatic event COVID-19 as suggested by previous studies (Hawryluck et al., 2004; Wu et al., 2009). The Cronbach alpha coefficient of the IES-R was 0.950 in this study.

The PSSS was developed by Zimet in 1988 (Zimet, Dahlem, Zimet, & Farley, 1988). The Chinese version revised by Jiang (2001) was used to evaluate the social support perceived by the frontline nurses. The scale is comprised of 12 items relating to support from family, friends and others. Each item scores on a 7-point Likert scale from "extremely disagree" (1) to "extremely agree" (7). A higher score indicated more social support the participants perceived. The Cronbach alpha coefficient of the PSSS was 0.957 in this study.

3.3 | Data collection and quality control

This was an online survey. First, the research group was in touch with the head nurses of the frontline department in the seven designated hospitals in Guangdong Province. The main researchers explained the procedure of the study to the head nurses and then send them a link to the electronic questionnaire by WeChat. The head nurses send the link to the nurses working in frontline by convenience sampling. Each participant completed the survey anonymously.

A restriction was set in the e-questionnaire link that a WeChat IP could only be used to fill out the questionnaire once to avoid repeating questionnaire. Meanwhile, a common-sense question that had nothing to do with the study purpose was placed in the survey to eliminate the possibility that the question might be answered unserious. The questionnaire with a wrong answer of the common-sense question, and the whole answer time <240 s (the time was recorded automatically by the electronic questionnaire) was excluded.

3.4 | Data analysis

All the analyses were conducted using SPSS 23.0 (International Business Machines Corporation). Descriptive statistics were presented as frequency and constituent ratio, mean and standard deviation (*SD*) according to the data type. Psychological distress and the impact of COVID-19 were coded as dichotomous variables according to the evaluation method of the scale. Thus, the relationship between psychological distress and categorical variables (age, educational level, etc.) was analysed by chi-square test, the comparisons of coping styles and social support among nurses with different psychological status were used independent sample *t* test. Multiple logistic regression analysis was used to explore the potential associated factors of post-traumatic symptom and psychological distress, while adjusting for other identified explanatory variables. A *p* value <.05 was considered to be statistically significant.

4 | RESULT

From 03 February–11 February 2020, a total of 273 electronic questionnaires were collected, of which 10 questionnaires were excluded because of the wrong answer of the common-sense question or the answer time <240 s. Finally, 263 valid questionnaires were included in the analyses, the validity rate was 96.3%, and the response rate was estimated to be about 30% to 40%.

4.1 | The characteristics of the participants

Of the 263 participants, 202 (76.7%) were female and the majority (*n* = 236, 89.7%) were younger than 39 years of age. The most common (*n* = 189, 71.9%) educational qualification was undergraduate or above and the majority (*n* = 196, 74.5%) worked in the ED (Table 1).

TABLE 1 Socio-demographic characteristics of the frontline nurses and univariate analysis

Variable	Total *n* (%)	n (%) of participants		χ^2	*p*
		Without distress	With distress		
Gender					
Male	61 (23.3)	5 (82.0)	11 (18.0)	2.107	.147
Female	202 (76.7)	147 (72.8)	55 (27.2)		
Age, years					
<30	95 (36.1)	71 (74.7)	24 (25.3)	9.713	.010
30–39	141 (53.6)	112 (79.4)	29 (20.6)		
40–59	27 (10.3)	14 (51.9)	13 (48.1)		
Educational level					
College or below	74 (28.1)	53 (71.6)	21 (28.4)	0.591	.442
Undergraduate or above	189 (71.9)	144 (76.2)	45 (23.8)		
Marital status					
Never married	99 (37.7)	80 (80.8)	19 (19.2)	5.292	.071
Married[a]	164 (61.2)	117 (71.3)	47 (28.7)		
Department					
Emergency department	196 (74.5)	142 (72.4)	54 (27.6)	2.469	.116
Nonemergency department	67 (25.5)	55 (82.1)	12 (17.9)		
Working years					
<1 year	27 (10.3)	25 (92.6)	2 (7.4)	5.824	.120
1–3 years	33 (12.5)	26 (78.8)	7 (21.2)		
4–9 years	89 (33.8)	65 (73.0)	24 (27.0)		
≥10 years	114 (43.3)	81 (71.1)	33 (28.9)		

Note: Without distress: GHQ-12 ≤ 3, with distress: GHQ-12 > 3.
[a]Includes three divorced or widowed respondents.

4.2 | Work-related characteristics and concerns about COVID-19

In this study, 75.7% (*n* = 199) frontline nurses reported that the outbreak of COVID-19 changed their regular job duties and about half of them (*n* = 135, 51.3%) reported they were working overtime, fewer than half of the frontline nurses believed that the protective equipment provided by hospitals could offer them any effective protection, and 40.3% (*n* = 106) reported being treated differently during the current outbreak of COVID-19 because of working in hospital. Most of the participants showed varying degree of concern about themselves or their families being infected with COVID-19 (Table 2).

4.3 | Coping styles, social support, the impact of COVID-19, and psychological distress

In this study, the score of positive coping style and negative coping style among all frontline nurses was 1.68 ± 0.60 and 0.97 ± 0.51, respectively. The PSSS score was 58.76 ± 13.41. The IES-R score was 28.05 ± 14.79, with 73.8% of the frontline was experiencing stress symptoms because of COVID-19 outbreak. Of the 263 frontline nurses, 66 (25.1%) were identified as psychological distress according to the GHQ-12 score.

4.4 | Univariate analysis

Chi-square test revealed that age, working overtime, precautionary measures effective, being treated differently because of working in hospital, concern for themselves or their families being infected with COVID-19 were correlated with psychological distress (Tables 1 and 2). Independent sample *t* test demonstrated that coping styles, social support and the impact of COVID-19 between frontline nurses with and without psychological distress were different (Table 3).

4.5 | Multiple logistic regression model

The multiple logistic regression model of the impact of COVID-19 on frontline nurses was listed in Table 4. Participants with a IES-R score greater than or equal to 20 were interpreted to be affected by COVID-19, whether affected by COVID-19 was set as dependent variable, the variables associated with IES-R in chi-square test and the practical significant variables were selected to performed a multiple logistic regression analysis. Working years (OR = 1.536, 95% CI 1.120–2.106), concern for own (OR = 4.481, 95% CI 2.383–8.427), positive coping style (OR = 0.3850, 95% CI 0.220–0.673) and negative coping style (OR = 5.400, 95% CI 2.544–11.462) were the risk factors of COVID-19 related stress symptom.

TABLE 2 Work-related characteristics and concerns about COVID-19 of the frontline nurses and univariate analysis

Variable	Total *n* (%)	n (%) of participants		χ^2	*p*
		Without distress	With distress		
Changes of regular job duties					
Yes	199 (75.7)	147 (73.9)	52 (26.1)	0.467	.495
No	64 (24.3)	50 (78.1)	14 (21.9)		
Working overtime					
Yes	135 (51.3)	92 (68.1)	43 (31.9)	6.737	.009
No	128 (48.7)	105 (82.0)	23 (18.0)		
Precautionary measures effective					
No or don't know	142 (54.0)	94 (66.2)	48 (33.8)	12.450	<0001
Yes	121 (46.0)	103 (85.1)	18 (14.9)		
Being treated differently because of working in hospital					
Yes	106 (40.3)	67 (63.2)	39 (36.8)	12.925	<0001
No	157 (59.7)	130 (82.8)	27 (17.2)		
Concern for own					
Not concerned	45 (17.1)	43 (95.6)	2 (4.4)	30.922	<0001
A little concerned	174 (66.2)	134 (77.0)	40 (23.0)		
Very concerned	44 (16.7)	20 (45.5)	24 (54.5)		
Concern for family					
Not concerned	21 (8.0)	21 (100.0)	0 (0.0)	21.326	<0001
A little concerned	154 (58.5)	124 (80.5)	30 (19.5)		
Very concerned	88 (33.5)	52 (59.1)	36 (40.9)		

Note.: Without distress: GHQ-12 ≤ 3, with distress: GHQ-12 > 3.

Variable	Without distress	With distress	t	p
Positive coping style	1.72 ± 0.61	1.53 ± 0.58	2.276	.024
Negative coping style	0.92 ± 0.51	1.10 ± 0.50	−2.397	.017
IES-R score	24.12 ± 12.57	39.80 ± 14.78	−8.386	<.001
Intrusion	7.36 ± 3.71	12.33 ± 4.12	−9.161	<.001
Hyper arousal	8.16 ± 5.09	14.11 ± 6.40	−6.859	<.001
Avoidance	8.60 ± 5.13	13.36 ± 5.87	−5.885	<.001
PSSS score	60.60 ± 13.15	53.27 ± 12.76	−6.296	<.001
From family	20.37 ± 4.98	17.94 ± 5.13	3.408	.001
From friends	20.29 ± 4.56	17.85 ± 4.62	3.761	<.001
From others	19.93 ± 4.55	17.48 ± 4.70	3.750	<.001

TABLE 3 Comparison of coping styles, social support and stress responses among nurses with different psychological health status[a]

Note: Without distress: GHQ-12 ≤ 3, with distress: GHQ-12 > 3; IES-R: measured by the Impact of Event Scale-Revised; PSSS: measured by the Perceived Social Support Scale.

[a]Psychological health status was measured by the 12-item version of the General Health Questionnaire.

Variables	B	SE	Wald	p	OR	95% CI for OR
Working years	0.429	.161	7.101	.008	1.536	1.120–2.106
Concern for own	1.500	.322	21.662	<.001	4.481	2.383–8.427
Positive coping style	−0.956	.285	11.220	.001	0.3850	0.220–0.673
Negative coping style	1.686	.384	19.281	<.001	5.400	2.544–11.462

TABLE 4 Multiple logistic regression analysis of factors associated with COVID-19 related stress symptom[a]

Note: CI, confidence interval; Model parameter: χ^2 = 68.333, p < .001, Cox and Snell R^2 = 22.9%, Nagelkerke R^2 = 33.5%.

[a]Stress symptom was measured by the Impact of Event Scale-Revised.

The multivariate model of psychological distress was displayed in Table 5. Participants with a GHQ-12 score >3 were identified as the presence of psychological distress, with or without psychological distress was set as dependent variable, the variables associated with psychological distress in chi-square test were selected to performed a multiple logistic regression analysis. The multiple logistic regression analysis identified seven factors associated with the presence of psychological distress: working in ED (OR = 3.378, 95% CI 1.404–8.130), concern for family (OR = 2.171, 95% CI 1.294–3.643), being treated differently (OR = 2.045, 95% CI 1.072–3.891), the impact of event (OR = 1.084, 95% CI 1.052–1.117), negative coping style (OR = 1.587, 95% CI 0.712–3.538), perceived social support (OR = 0.960, 95% CI 0.936–0.984), precautionary measures effective (OR = 0.469, 95% CI 0.235–0.933).

5 | DISCUSSION

The study result revealed that 25.1% of the frontline nurses experienced psychological distress, evidenced by their score on the GHQ-12. Frontline nurses working on the ED, concern for family, being treated differently, affected by COVID-19 and tend to take negative coping style were more likely to have psychological distress. More

social support and effective precautionary measures were helpful for avoiding psychological distress.

The prevalence of psychological distress among frontline nurses in this study was higher than the 6.7%–16.6% rate in general population in China (Yueqin et al., 2019; Zhang et al., 2020). A study on the impact of SARS on the mental health among hospital staff conducted in Canada showed that 29% of the hospital staff experienced psychological distress, with nurses having a higher prevalence of 45% (Nickell et al., 2004). It could be seen that the public health crisis, whether SARS or COVID-19, would cause great psychological impact on hospital staff, especially the frontline nurses. The frontline nurses were usually the main force in the battle against public health emergencies, and their psychological health was crucial to overcoming the epidemic. Moreover, the COVID-19 epidemic has spread to every country in the world now, all hospital staff around the world were fighting against the epidemic. Therefore, the relative high prevalence of psychological distress among frontline nurses during COVID-19 outbreak should attract the attention of nursing managers.

Social support has been usually considered as the important resource to alleviate mental distress and psychological barrier for nurses (Gu, Hu, Hu, & Wang, 2016; Karaca, Yildirim, Cangur, Acikgoz, & Akkus, 2019). The same result was also detected in the present study. Social support played a substantial role in improving

TABLE 5 Multiple logistic regression on correlates of psychological distress[a] among frontline nurses during the outbreak of COVID-19

Variable	B	SE	Wald	p	OR	95% CI for OR
Department						
Nonemergency department					Reference	
Emergency department	1.217	0.447	7.400	.007	3.378	1.404–8.130
Concern for family	0.775	0.264	8.613	.003	2.171	1.294–3.643
Being treated differently because of working in hospital						
No					Reference	
Yes	0.714	0.329	4.719	.030	2.045	1.072–3.891
IES-R score	0.081	0.015	28.364	<.001	1.084	1.052–1.117
PSSS score	−0.041	0.013	10.436	.001	0.960	0.936–0.984
Precautionary measures effective						
No or don't know					Reference	
Yes	−0.758	0.351	4.657	.031	0.469	0.235–0.933
Negative coping style	0.462	0.409	3.276	.049	1.587	0.712–3.538

Note: CI: confidence interval; Model parameter: $\chi^2 = 163.220$, $p < .001$, Cox and Snell $R^2 = 29.5\%$, Nagelkerke $R^2 = 43.6\%$.

[a]Psychological distress was measured by the 12-item version of the General Health Questionnaire; IES-R: measured by the Impact of Event Scale-Revised; PSSS: measured by the Perceived Social Support Scale.

psychological health by helping individual to reduce perceived severity of the problem and the adverse effects of stress (Fu et al., 2018). Social support includes spiritual and material support from family and outside the family. However, to avoid the potential risk of infection among family members, frontline nurses were quarantined or asked not to go home after work during the current epidemic. As a result, frontline nurses might perceive less support from their family, and workplace became a more important resource of social support during COVID-19 outbreak. Maunder et al. (2003) advised clinical psychologist to engage the frontline nurses in informal individual contacts, and provide nurses with some support and advice, such as relaxing skills and sleep tips. The use of technology, such as online peer support and social media was also recommended to provide social or emotional support to nurses (Webster, Oyebode, Jenkins, & Smythe, 2019).

As a material support, precautionary devices were crucial for the protection of frontline nurses. This study revealed that nurses were more likely to have psychological distress if they thought that the protective device could not protect them well. In the early stage of COVID-19 outbreak, there was a shortage of emergency medical supplies to some extent, especially the protective equipment such as protective clothing and masks (Wang et al., 2020). The lack of protective equipment supplies exacerbated the frontline nurses' concern and thus affected their mental health. However, it was not easy to provide adequate protective equipment in the short term because of insufficient production capacity. For improving the psychological health problem caused by inadequate protective equipment among frontline nurses, some hospitals have adjusted the schedule for nurses shift system, reducing the length of one shift to 4 or 6 hr, and arranging 4–6 shifts of nurses per day. In this way, the work intensity, psychological pressure of nurses and consumption of protective equipment were reduced to some extent.

In this study, nurses working in ED had a higher prevalence of psychological distress than nurses working in other departments. Emergency department is a rapidly changing and critical environment where patients have changing and unpredictable disease conditions (Lu et al., 2015). Due to the dynamic environment, ED nurses usually perceived higher level of work stress. Previous study reported that 7%–10% of emergency service personnel experienced distress and post-traumatic stress disorder (Rybojad, Aftyka, & Milanowska, 2019). During the current outbreak of COVID-19, ED nurses had to face an unpredictable number of potential or suspected patients. In such a high-risk environment, the ED nurse were more likely to experience psychological distress. In additional, 40.3% of the frontline nurses were treated differently in this study because of working in hospital where staff were at a higher risk of potential infection. It was also reported in another study that people were afraid to meet with nurse or doctor because they thought medical personnel would carry virus to them (Hewlett & Hewlett, 2005). To avoid potentially infecting, most of the frontline nurses were shunned by their families, friends and colleague. Thus, frontline nurses had to deal with not only the epidemic of COVID-19 but also their concern for their family and stigmatisation from public. It could also lead to psychological distress.

Frontline nurses in this study were more likely to take positive coping behaviour, which was consistent with previous studies (Isa et al., 2019; Zhou & Gong, 2015). Moreover, the frontline nurses who were more likely to take negative coping behaviours were more likely to present psychological distress. Due to the increased workload and the psychological burden during the epidemic, frontline nurses might take some negative coping behaviour, such as hoping the problem would disappear, fantasying a miracle happen, using alcohol or drug. Some nurses might even take avoidance behaviours, such as avoiding verbal, physical, and social contact with infected of suspected infected patients, to minimise the severity of the situation. However, negative coping behaviours might provide stress reduction in the immediate or short term but it did not address the cause of stress (Laranjeira, 2012; Schreuder et al., 2011). Thus, nurse managers should pay more attention to the negative emotion and behaviour among frontline nurses, take target intervention (workplace intervention, stress handling and consultation with psychologist) to improve the coping style for reducing psychological distress.

Previous research found that individuals were more likely to exhibit the event-associated stress symptom if they perceived a greater threat of the life event (Rybojad et al., 2019). In this study, it was found that the increased COVID-19 related stress symptom was linked to psychological distress among the frontline nurses. It was worth mentioning that 73.8% of the frontline nurses in this study felt subject stress resulting from COVID-19 according to the IES-R score, which indicated higher impact than SARS epidemic (Wu et al., 2009). Previous studies suggested that when the traumatic event caused impact on a person more than 6 months after an event, the impact was more likely to exist for long term (Anderson, Ziedonis, & Najavits, 2014; Blanco et al., 2013). Therefore, for frontline nurse fighting against COVID-19, early detection of post-traumatic symptom and effective intervention were very crucial to prevent further psychological distress.

It was worth mentioning that 73.9% of the frontline nurses reported changes of regular job duties and 68.1% of them reported working overtime. However, the result of logistic regression analysis found no impact of these factors on psychological distress among frontline nurses. During the epidemic, almost all hospital staff in the country were engaged in the intense fighting against the epidemic. Everyone wanted to contribute to the fighting, the overtime work or changes of regular job duties was acceptable to them and it was what they thought they should do (Jenaro, Flores, Orgaz, & Cruz, 2011). This might be the reason why working overtime or changes of work duties did not impact the psychological status among frontline nurses. Further research might be needed to understand the perception of frontline nurses about working overtime of overload.

5.1 | LIMITATION

The study had several limitations. First, the sample size was relatively small and the estimated response rate was relatively low (30%–40%),

which might add to the possibility of response bias. Second, the main variables reported in this study were based on self-administered questionnaire. Third, the impact of COVID-19 on the psychological status among frontline nurses might be continuous, changeable and long term, the prevalence of psychological distress in current study might be underestimated, as the statistics were collected in the early stage of the epidemic. Finally, this study was a cross-sectional design, the interpretation of causal relationships between risk factors and the psychological distress was limited. Longitudinal study was needed to investigate the predictors of psychological distress among frontline nurses in the future.

6 | CONCLUSION

The study results demonstrated that a significant psychological impact of COVID-19 on frontline nurses in China. Working on ED, concern for family, being treated differently, affected by COVID-19 and negative coping style were the risk factors of psychological distress. Perceived more social support and effective precautionary measures were the protective factors of psychological health. Hence, it is important for hospitals and health care institutions to provide psychosocial support and intervention for the frontline nurses early to avoid further impact of the epidemic.

7 | RELEVANCE FOR CLINICAL PRACTICE

This study highlighted that the frontline nurses were suffering from varying degrees of psychological distress. It was influenced by internal factors and external factors, such as work environment, social support, and coping strategy. To avoid further psychological impact of COVID-19, early screening and supportive strategies were necessary for frontline nurses. Beside, more specific measurement should be combined with the GHQ-12 to assess the varying degrees of psychological distress in frontline nurses.

CONFLICT OF INTEREST

Anliu Nie, Xiangfen Su, Shuzeng Zhang, Wenjie Guan and Jianfeng Li declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

SX, GW and NA designed the study. ZS, GW and SX collected the data.NA and GW analysed the data. ZS, NA and SX wrote the manuscript.

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REFERENCES

Anderson, M. L., Ziedonis, D. M., & Najavits, L. M. (2014). Posttraumatic stress disorder and substance use disorder comorbidity among individuals with physical disabilities: Findings from the National Comorbidity Survey Replication. *Journal of Traumatic Stress*, 27(2), 182–191.

Blanco, C., Xu, Y., Brady, K., Pérez-Fuentes, G., Okuda, M., & Wang, S. (2013). Comorbidity of posttraumatic stress disorder with alcohol dependence among US adults: Results from National Epidemiological Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence*, 132(3), 630–638. https://doi.org/10.1016/j.drugalcdep.2013.04.016

Cañadas-De la Fuente, G. A., Ortega, E., Ramirez-Baena, L., De la Fuente-Solana, E. I., Vargas, C., & Gómez-Urquiza, J. L. (2018). Gender, marital status, and children as risk factors for burnout in nurses: A meta-analytic study. *International Journal of Environmental Research and Public Health*, 15(10), 2102. https://doi.org/10.3390/ijerph15102102

Daniel, S., & Weiss, P. D. (2007). The Impact of Event Scale: Revised. *Cross-cultural assessment of psychological trauma and PTSD* (219–238). New York: Springer.

Fu, C. Y., Yang, M. S., Leung, W., Liu, Y. Y., Huang, H. W., & Wang, R. H. (2018). Associations of professional quality of life and social support with health in clinical nurses. *Journal of Nursing Management*, 26(2), 172–179.

Ghawadra, S. F., Abdullah, K. L., Choo, W. Y., & Phang, C. K. (2019). Mindfulness-based stress reduction for psychological distress among nurses: A systematic review. *Journal of Clinical Nursing*, 28(21), 3747–3758. https://doi.org/10.1111/jocn.14987

Goldberg, D. P., Gater, R., Sartorius, N., Ustun, T. B., Piccinelli, M., Gureje, O., & Rutter, C. (1997). The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychological Medicine*, 27(1), 191–197.

Goldberg, D., & Williams, P. (1991). *A user's guide to the General Health Questionnaire*. London: NFER-Nelson Publishing.

Gu, Y., Hu, J., Hu, Y., & Wang, J. (2016). Social supports and mental health: A cross-sectional study on the correlation of self-consistency and congruence in China. *BMC Health Services Research*, 16, 207. https://doi.org/10.1186/s12913-016-1463-x

Hamaideh, S. H. (2012). Occupational stress, social support, and quality of life among Jordanian mental health nurses. *Issues in Mental Health Nursing*, 33(1), 15–23.

Hawryluck, L., Gold, W. L., Robinson, S., Pogorski, S., Galea, S., & Styra, R. (2004). SARS control and psychological effects of quarantine, Toronto, Canada. *Emerging Infectious Diseases*, 10(7), 1206–1212. https://doi.org/10.3201/eid1007.030703

Hewlett, B. L., & Hewlett, B. S. (2005). Providing care and facing death: Nursing during Ebola outbreaks in central Africa. *Journal of Transcultural Nursing*, 16(4), 289–297. https://doi.org/10.1177/1043659605278935

Huang, Y., Wang, Y. U., Wang, H., Liu, Z., Yu, X., Yan, J., ... Wu, Y. (2019). Prevalence of mental disorders in China: A cross-sectional epidemiological study. *Lancet Psychiatry*, 6(3), 211–224. https://doi.org/10.1016/S2215-0366(18)30511-X

Ilić, I. M., Arandjelović, M. Ž., Jovanović, J. M., & Nešić, M. M. (2017). Relationships of work-related psychosocial risks, stress, individual factors and burnout – Questionnaire survey among emergency physicians and nurses. *Medycyna Pracy*, 68(2), 167–178.

Isa, K. Q., Ibrahim, M. A., Abdul-Manan, H. H., Mohd-Salleh, Z. H., Abdul-Mumin, K. H., & Rahman, H. A. (2019). Strategies used to cope with stress by emergency and critical care nurses. *British Journal of Nursing*, 28(1), 38–42. https://doi.org/10.12968/bjon.2019.28.1.38

Jenaro, C., Flores, N., Orgaz, M. B., & Cruz, M. (2011). Vigour and dedication in nursing professionals: Towards a better understanding of work engagement. *Journal of Advanced Nursing*, 67(4), 865–875. https://doi.org/10.1111/j.1365-2648.2010.05526.x

Jiang, J. Q. (2001). The Perceived Social Support Scale. *Chinese Journal of Behavioral Medical Science*, 10, 41–42.

Karaca, A., Yildirim, N., Cangur, S., Acikgoz, F., & Akkus, D. (2019). Relationship between mental health of nursing students and coping, self-esteem and social support. *Nurse Education Today*, 76, 44–50. https://doi.org/10.1016/j.nedt.2019.01.029

Kutluturkan, S., Sozeri, E., Uysal, N., & Bay, F. (2016). Resilience and burnout status among nurses working in oncology. *Annals of General Psychiatry*, 15, 33. https://doi.org/10.1186/s12991-016-0121-3

Laranjeira, C. A. (2012). The effects of perceived stress and ways of coping in a sample of Portuguese health workers. *Journal of Clinical Nursing*, 21(11–12), 1755–1762. https://doi.org/10.1111/j.1365-2702.2011.03948.x

Li, L., Ai, H., Gao, L., Zhou, H., Liu, X., Zhang, Z., ... Fan, L. (2017). Moderating effects of coping on work stress and job performance for nurses in tertiary hospitals: A cross-sectional survey in China. *BMC Health Services Research*, 17(1), 401. https://doi.org/10.1186/s12913-017-2348-3

Li, L., Wan, C., Ding, R., Liu, Y., Chen, J., Wu, Z., ... Li, C. (2015). Mental distress among Liberian medical staff working at the China Ebola Treatment Unit: A cross sectional study. *Health and Quality of Life Outcomes*, 13, 156. https://doi.org/10.1186/s12955-015-0341-2

Lu, D. M., Sun, N., Hong, S., Fan, Y. Y., Kong, F. Y., & Li, Q. J. (2015). Occupational stress and coping strategies among emergency department nurses of China. *Archives of Psychiatric Nursing*, 29(4), 208–212.

Maharaj, S., Lees, T., & Lal, S. (2018) Prevalence and risk factors of depression, anxiety, and stress in a cohort of Australian nurses. *International Journal of Environmental Research and Public Health*, 16(1), pii: E61.

Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., ... Mazzulli, T. (2003). The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *Canadian Medical Association Journal*, 168(10), 1245–1251.

Molina-Praena, J., Ramirez-Baena, L., Gómez-Urquiza, J. L., Cañadas, G. R., De la Fuente, E. I., & Cañadas-De la Fuente, G. A. (2018). Levels of burnout and risk factors in medical area nurses: a meta-analytic study. *International Journal of Environmental Research and Public Health*, 15(12), 2800. https://doi.org/10.3390/ijerph15122800

National Health Commission of the People's Republic of China (2020). *Update on the statistics of coronavirus disease on March 15*. Retrieved from http://www.nhc.gov.cn/xcs/yqtb/202003/114113d25c1d47aabe68381e836f06a8.shtml

Nickell, L. A., Crighton, E. J., Tracy, C. S., Al-Enazy, H., Bolaji, Y., Hanjrah, S., ... Upshur, R. E. (2004). Psychosocial effects of SARS on hospital staff: Survey of a large tertiary care institution. *Canadian Medical Association Journal*, 170(5), 793–798. https://doi.org/10.1503/cmaj.1031077

Nishiura, H., Jung, S. M., Linton, N. M., Kinoshita, R., Yang, Y., Hayashi, K., ... Akhmetzhanov, A. R. (2020). The extent of transmission of novel coronavirus in Wuhan, China, 2020. *Journal of Clinical Medicine*, 9(2), 330. https://doi.org/10.3390/jcm9020330

Peng, X., Xu, X., Li, Y., Cheng, L., Zhou, X., & Ren, B. (2020). Transmission routes of 2019-nCoV and controls in dental practice. *International Journal of Oral Science*, 12, 9. https://doi.org/10.1038/s41368-020-0075-9

Rybojad, B., Aftyka, A., & Milanowska, J. (2019). Peritraumatic distress among emergency medical system employees: A proposed cut-off for the Peritraumatic Distress Inventory. *Annals of Agricultural and Environmental Medicine*, 26(4), 579–584. https://doi.org/10.26444/aaem/105436

Sadati, A. K., Hemmati, S., Rahnavard, F., Lankarani, K. B., & Heydari, S. T. (2016). The impact of demographic features and environmental conditions on rates of nursing burnout. *Shiraz E Medical Journal*, 17(Suppl 3), e37882.

Schreuder, J. A., Plat, N., Magerøy, N., Moen, B. E., van der Klink, J. J., Groothoff, J. W., & Roelen, C. A. (2011). Self-rated coping styles and registered sickness absence among nurses working in hospital care: A prospective 1-year cohort study. *International Journal of Nursing Studies*, 48(7), 838–846. https://doi.org/10.1016/j.ijnurstu.2010.12.008

Sonoda, Y., Onozuka, D., & Hagihara, A. (2018). Factors related to teamwork performance and stress of operating room nurses. *Journal of Nursing Management*, 26(1), 66–73. https://doi.org/10.1111/jonm.12522

Tehrani, H., Rakhshani, T., Shojaee Zadeh, D., Hosseini, S. M., & Bagheriyan, S. (2013). Analyzing the relationship between job stress to mental health, personality type and stressful life events of the nurses occupied in Tehran 115 emergency. *Iranian Red Crescent Medical Journal*, 15(3), 272–273. https://doi.org/10.5812/ircmj.1917

Tham, K. Y., Tan, Y. H., Loh, O. H., Tan, W. L., Ong, M. K., & Tang, H. K. (2004). Psychiatric morbidity among emergency department doctors and nurses after the SARS outbreak. *Annals of the Academy of Medicine*, 33(5 Suppl), S78–S79.

The Central People's Government of China (2020). *Press conference on joint defence control mechanism under the State Council*. Retrieved from http://politics.cntv.cn/special/gwyvideo/2019/202002/2020021401/index.shtml

Ulrich, C. M. (2014). Ebola is causing moral distress among African healthcare workers. *BMJ*, 349, g6672. https://doi.org/10.1136/bmj.g6672

Wang, X. U., Zhang, X., & He, J. (2020). Challenges to the system of reserve medical supplies for public health emergencies: Reflections on the outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic in China. *Bioscience Trends*, 14(1), 3–8. https://doi.org/10.5582/bst.2020.01043

Webster, N., Oyebode, J., Jenkins, C., & Smythe, A. (2019). Using technology to support the social and emotional well-being of nurses: A scoping review protocol. *Journal of Advanced Nursing*, 75(4), 898–904. https://doi.org/10.1111/jan.13942

Wu, K. K., & Chan, K. S. (2003). The development of the Chinese version of Impact of Event Scale-Revised (CIES-R). *Social Psychiatry and Psychiatric Epidemiology*, 38(2), 94–98.

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., ... Hoven, C. W. (2009). The psychological impact of the SARS epidemic on hospital employees in China: Exposure, risk perception, and altruistic acceptance of risk. *Canadian Journal of Psychiatry*, 54(5), 302–311. https://doi.org/10.1177/070674370905400504

Wu, P., Hao, X., Lau, E., Wong, J. Y., Leung, K., Wu, J. T., ... Leung, G. M. (2020). Real-time tentative assessment of the epidemiological characteristics of novel coronavirus infections in Wuhan, China, as at 22 January 2020. *Eurosurveillance Weekly*, 25(3), 2000044. https://doi.org/10.2807/1560-7917.ES.2020.25.3.2000044

Xie, Y. N. (1998). A preliminary study on reliability and validity of Simple Coping Style Questionnaire. *Chinese Journal of Clinical Psychology*, 6(2), 53–54.

Yang, T. Z., Huang, L., & Wu, Z. Y. (2003). The application of Chinese health questionnaire for mental disorder screening in community settings in mainland China. *Chinese Journal of Epidemiology*, 24(9), 20–24.

Zhang, Y. S., Rao, W. W., Zeng, L. N., Lok, G., Cui, L. J., Li, J. F., ... Xiang, Y. T. (2020). Prevalence and correlates of bipolar disorder in the adult population of Hebei province, China. *Journal of Affective Disorders*, 263, 129–133. https://doi.org/10.1016/j.jad.2019.11.104

Zhou, H., & Gong, Y. H. (2015). Relationship between occupational stress and coping strategy among operating theatre nurses in China: A questionnaire survey. *Journal of Nursing Management*, 23(1), 96–106. https://doi.org/10.1111/jonm.12094

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, 52, 30–41. https://doi.org/10.1207/s15327752jpa5201_2

SUPPORTING INFORMATION

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