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Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic

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Abstract

Aims: To investigate the work stress among Chinese nurses who are supporting Wuhan in fighting against Coronavirus Disease 2019 (COVID-19) infection and to explore the relevant influencing factors.

Background: The COVID-19 epidemic has posed a major threat to public health. Nurses have always played an important role in infection prevention, infection control, isolation, containment and public health. However, available data on the work stress among these nurses are limited.

Methods: A cross-sectional survey. An online questionnaire was completed by 180 anti-epidemic nurses from Guangxi. Data collection tools, including the Chinese version of the Stress Overload Scale (SOS) and the Self-rating Anxiety Scale (SAS), were used. Descriptive single factor correlation and multiple regression analyses were used in exploring the related influencing factors.

Results: The SOS (39.91 ± 12.92) and SAS (32.19 ± 7.56) scores of this nurse group were positively correlated ($r = 0.676$, $p < .05$). Multiple regression analysis showed that only children, working hours per week and anxiety were the main factors affecting nurse stress ($p = .000, .048, .000$, respectively).

Conclusions: Nurses who fight against COVID-19 were generally under pressure.

Implications for Nursing Management: Nurse leaders should pay attention to the work stress and the influencing factors of the nurses who are fighting against COVID-19 infection, and offer solutions to retain mental health among these nurses.

KEYWORDS

a cross-sectional survey, Chinese nurses, COVID-2019 epidemic, work stress, Wuhan

Yuanyuan Mo and Lan Deng contributed equally to this work.

1 | INTRODUCTION

In December 2019, patients with pneumonia of unknown cause were emerged in Wuhan, China (Catton, 2020; Huang, Wang, & Li, 2020; Li et al., 2020). Local works and those conducted by the experts from WHO confirmed that the pathogen causing this novel pneumonia is SARS-CoV-2, and this type of pneumonia is called the Coronavirus Disease 2019 (COVID-19). The COVID-19 epidemic has posed a remarkable threat to public health (Pan et al., 2020). On 11 March 2020, WHO Director-General Dr. Tedros Adhanom Ghebreyesus said that there was deep concern about the extent and severity of the COVID-19 epidemic, which the World Health Organization (WHO) assessed to be characterized as a pandemic (e.g., social network or clinical setting; The novel coronavirus pneumonia outbreak has acquired pandemic characteristics, 2020). As of 23:59 on 19 March 2020, a total of 234,073 confirmed cases and 9,840 deaths have been reported globally. In Europe, the cumulative number of cases reached 104,591, with 4,899 deaths. COVID-19 has been reported in 176 countries and regions, and more than 150,000 cases have been confirmed outside China (e.g., social network or clinical setting; Coronavirus Disease 2019 (COVID-19) Situation Report-60, 2020). As of this date, the number of confirmed and suspected cases outside China is increasing dramatically, as is the number of deaths. COVID-19 presents a vast public health challenge, not only to China but also around the world.

Nurses have always played an important role in infection prevention, infection control, isolation, containment and public health (Graeme, 2020). As of 1 March, a total of 28,679 nurses had been sent to Hubei Province to fight against COVID-19 infection (e.g., social network or clinical setting; The white coat went out to battle, 2020). Nurses on the front line in this event are showing the commitment and compassion that nurses do everywhere, but the truth is they are putting their lives at risk in the course of their duties (Catton et al., 2020). One third of all fatalities during the 2003 SARS outbreak in China were health care professionals (Hung, 2003). In the early days of the outbreak, more than 3,000 medical workers in Hubei Province were infected, 40% in hospitals and 60% in communities (e.g., social network or clinical setting; National support Wuhan medical staff 'zero infection' novel coronavirus pneumonia, 2020).

The unfolding emergency caused by the COVID-19 in Wuhan is putting nursing services under intense pressure. When nurses are exposed to working environments with high job demands and low resources, higher job stress and greater physical and psychological stress symptoms may adversely affect health and well-being (Chou, Li, & Hu, 2014; Khamisa, Oldenburg, Peltzer, & Ilic, 2015; Lin, Liao, Chen, & Fan, 2014; Malinauskiene, Leisyte, Romualdas, & Kirtiklyte, 2011). Maintaining the mental health of nursing staff is essential to control infectious diseases (Kang et al., 2019; Xiang et al., 2020).

At present, studies on the epidemic situation of COVID-2019 mostly focused on epidemiological investigation, prevention and control, diagnosis and treatment. Fewer studies have investigated the mental health problems of clinical medical workers during the epidemic of COVID-19. The purpose of the present study was to investigate the work stress load among Chinese nurses who support Wuhan in fighting against COVID-19 infection and to explore the relevant influencing factors for the development of psychological interventions for Chinese nurses in order that they can adjust to public health emergencies.

2 | MATERIALS AND METHODS

2.1 | Participants and sampling

A cross-sectional survey. By means of convenient sampling, nurses from Guangxi supporting Wuhan were selected to carry out the survey. The inclusion criteria were as follows: nurses from Guangxi who are involved in fighting against COVID-19, those who have entered the clinical front line to participate in the rescue work and those who volunteered to participate in this study. As of 21 February 2020, all the nurses (around 210) were invited to participate in this study. The response rate was 85.71%, which resulted in a sample of 180 nurses.

2.2 | Measurements

2.2.1 | Basic situation survey form

According to literature review and expert consultation, self-made general information and demographic questionnaires, including gender, age, nursing age, education, professional qualifications, marital status, fertility status, whether the participants are the only child in their families, whether their family supports them, whether they have been trained in SARS-CoV-2 prevention and control knowledge, self-assessment of the mastery of COVID-19 prevention and control knowledge, whether they participate in protective skills training, self-assessment of the mastery of the protection skills, experience in related departments (e.g., fever clinic, infection department, respiratory and critical medicine department, critical medicine department and emergency department), whether they volunteer to participate in the support work, whether they regret participating in the support work, whether they have completed the support work with confidence, the name of the hospital where they are working in, the time they participated in support and working hours per week, were completed.

2.2.2 | Chinese version of the stress overload scale

Amirkhan (2012) developed a SOS, and Qian & Leilei (2014) introduced it and conducted cultural commissioning. The Chinese version of the SOS has good reliability and validity. The Cronbach's α value is 0.936, and the content validity is 0.860. The scale consists of two dimensions: event load (12 entries) and individual vulnerability

(10 entries), with 22 entries using a 5-point scoring method, 'never before' scores 1 point and 'always there' scores 5 points, with the total score in the range of 22–110 points. The higher the score is, the greater the pressure load will be.

2.2.3 | Self-rating anxiety scale

SAS was developed by Professor William W. K. Zung in 1971 and is a simple clinical tool in analysing subjective anxiety. A total of 20 items are present in SAS, with a 4-point scale, which evaluates the frequency of symptoms. The standard of SAS is as follows: '1' indicates no or limited time, and '4' indicates most or all the time. The Cronbach's α value is 0.777, and the half-coefficient is 0.757, which has good reliability and validity (Tian, Wang, Li, Wang & Dang, 2019). The total score of SAS is the cumulative score of each item. The higher the score is, the more severe the anxiety will be.

2.3 | Survey methods and data collection

Online survey (via a questionnaire website platform) was send to the heads of each batch of nurses from Guangxi who are supporting in Wuhan, whom were asked to send on to nurses. The participants could complete the questionnaire via computer or smartphone that can open a website link or scan a quick response code. The online survey was sent to the potential participants with an invitation letter containing information regarding purpose, anonymity and confidentiality. Consent was implied if participants connected to the website link and completed the questionnaire.

2.4 | Statistical methods

Counting data were expressed by frequency and percentage, and the measurement data were expressed by $\bar{x} \pm s$. Comparisons between two groups were performed using two independent-sample t tests, and comparisons between multiple groups were performed using single-factor ANOVA. The correlation between stress load and anxiety was analysed using the Pearson correlation analysis, and multiple linear regression analysis was used for multivariate analysis. All statistical analyses were performed with SPSS for Windows 22.0, with two-tailed $p < .05$ to be considered statistically significant.

3 | RESULTS

3.1 | Basic information of aid nurses

Of the 180 nurses who participated in the survey, 18 were male (10%) and 162 were female (90%). The age of these nurses ranged from 21 to 48 (32.71 ± 6.52) years, with years of working ranging from 2 to 32 (8.45 ± 3.86) years. The education profile of the participants is as

follows: 34 (18.89%) junior college students, 143 (79.44%) undergraduates and 3 (1.67%) masters. The professional qualification is as follows: 7 (3.89%) primary nurses, 102 (56.67%) senior nurses, 59 (32.78%) supervisors and 12 (6.67%) deputy chief nurses. The marital status of the participants is as follows: 89 (49.44%) married, 86 (47.78%) unmarried and 5 (2.78%) divorced. The fertility status of the participants is as follows: 82 (45.56%) nurses are fertile, and 98 (54.44%) have no children.

3.2 | Stress load and anxiety of nurses

The survey showed that the total stress load score of 180 nurses who assisted in combating the COVID-19 was 39.91 ± 12.92, with a score rate of 39.91%, of which the event load score was 19.32 ± 6.52 points, and the individual vulnerability score was 20.59 ± 6.61 points. The total SAS score was 32.19 ± 7.56 points, which was higher than the national standard points (29.78 + 0.46), and the difference was statistically significant ($t = 4.27$, $p < .001$).

3.3 | Correlation between stress burden and anxiety among nurses

According to the Pearson correlation analysis, the total stress load score and each dimension were positively correlated with SAS (the r values were 0.676, 0.667 and 0.663); that is, the higher the stress load is, the higher the total anxiety score is, and the more evident the anxiety mood will be.

3.4 | Single-factor analysis of pressure on nurses

The results showed that different professional qualifications, whether the participants are the only child in their families, the severity of patients, working hours per week, diet and sleep status had impacts on nurses' stress load scores ($p < .05$), as shown in Table 1.

3.5 | Multiple-factor analysis of stress load on nurses

When the total stress load was used as a dependent variable, the single-factor analysis of the stress load that had statistically significant titles (primary nurse = 1, senior nurse = 2, nurse in charge = 3 and deputy chief nurse = 4), whether the participants are the only child in their families (yes = 1, no = 2), the severity of patients (suspected = 1, mild = 2, common = 3, severe = 4 and critically ill = 5), working hours per week (<20 hr = 1, 20–25 hr = 2, 26–30 hr = 3, 31–35 hr = 4, and >35 hr = 5), whether they adapted to daily diet (yes = 1, no = 2), sleep status (very good = 1, good = 2, average = 3, not very good = 4 and very bad = 5) and SAS total score (substituting the actual value) were used as independent variables for multiple linear regression analysis. The results showed that whether the participants are the only child

TABLE 1 Single-factor analysis of the stress load of nurses ($\bar{x} \pm s$, $n = 180$)

Items	Classification	Number (%)	SOS total points	Statistics	p-Value
Professional qualification	Primary nurse	7 (3.89)	26.57 ± 4.721	F = 2.833	.04
	Senior nurse	102 (56.67)	40.34 ± 12.70		
	Supervisor	59 (32.78)	41.07 ± 14.08		
	Deputy chief nurse	12 (6.67)	38.25 ± 7.24		
Whether they are the only child in their family	Yes	15 (8.33)	50.87 ± 10.47	t = 3.541	.001
	No	165 (91.67)	38.91 ± 12.68		
Severity of patients	Suspected	8 (4.44)	37.38 ± 7.82	F = 2.638	.036
	Mild	88 (48.89)	41.02 ± 13.27		
	Common	44 (24.44)	36.05 ± 11.16		
	Severe	30 (16.67)	39.83 ± 12.33		
	Critically ill	10 (5.56)	49.30 ± 17.27		
Working hours per week	<20 hr	58 (32.22)	39.91 ± 12.92	F = 3.679	.007
	20–25 hr	54 (30.00)	36.15 ± 9.38		
	26–30 hr	52 (28.89)	40.96 ± 13.53		
	31–35 hr	7 (3.89)	47.57 ± 14.21		
	>35 hr	9 (5.00)	50.89 ± 17.58		
Diet	Adapt	137 (76.11)	38.72 ± 11.79	t = −2.216	.028
	Inadaptation	43 (23.89)	43.68 ± 15.57		
Sleep	Great	17 (9.44)	32.65 ± 12.44	F = 4.818	.01
	Good	48 (26.67)	35.83 ± 10.43		
	General	89 (49.44)	41.80 ± 12.37		
	Not good	18 (10.00)	44.50 ± 12.74		
	Bad	8 (4.44)	48.38 ± 20.01		

Note: Only statistically significant results are listed.

TABLE 2 Multiple-factor analysis of stress load on nurses

Dependent variable	Regression coefficient	SE	Standardized Regression coefficient	t-Value	p-Value
Constant	16.855	7.020		2.401	.017
Whether the participants are the only child in their families	−11.245	2.432	−0.241	−4.625	.000
Working hours per week	0.841	0.408	0.106	1.994	.048
Total SAS points	1.181	0.108	0.664	10.905	.000

Note: $R^2 = 0.542$, adjusted $R^2 = 0.521$, $F = 25.307$, $p < .001$.

in their families, working hours per week and anxiety were the main factors influencing the stress load of nurses assisting in the fight against COVID-19, which can explain 52.1% of the total variation, as shown in Table 2.

4 | DISCUSSION

4.1 | General perceived stress on nurses assisting in Wuhan to fight against COVID-19

The results of this study showed that the total stress load of nurses who assisted in fighting against COVID-19 was 39.91 ± 12.92

points, with a score rate of 39.91%, and those with a score > 50 were 22.22%. This result showed a widespread pressure on nurses in Hubei who helped fight against COVID-19. COVID-19 was severe and coincided with the large-Scale cross-regional population movement during the Chinese Lunar New Year. This epidemic has spread to the entire country, with Wuhan as the epicentre, and the number of confirmed and suspected patients has increased rapidly in a short period of time (e.g., social network or clinical setting; Epidemic situation of new coronavirus infection on 21 January 2020 and Pneumonia situation of new coronavirus infection as of 24:00 on 13 February 2020). This phenomenon has resulted in huge challenges in disease prevention and control. All localities have actively responded to the national call and quickly formed a

nursing team to assist in Hubei. Given unknown and uncontrollable nature of the epidemic rescue work, coupled with being far away from their hometown and loved ones, the nurses helping in Hubei had certain psychological pressure.

The pressure load of the nurses in Hubei who participated in this study was at a moderately low level, which was slightly lower than that in the study of Wu et al. (2020) and other studies (Kane, 2009; Lin et al., 2014), which may be attributed to the high level of conscientiousness and preparation for nurses in Hubei in this study. A total of 180 (100%) nurses took the initiative to ask for participation in support and treatment and received support and encouragement from their loved ones. A total of 156 (86.67%) nurses have working experience in related departments (e.g., fever clinic, infection department, respiratory and critical medicine department, critical medicine department and emergency department). A total of 180 (100%) nurses have been trained in the prevention and control of COVID-19 in the hospital. As Bruce Aylward said that Chinese medical workers in the fight against COVID-19 epidemic exude a sense of responsibility and collective action. They all have a mindset of fighting to complete the task (Kupferschmidt & Cohen 2020).

Conscientiousness is the strongest driving force of the work role performance (Ellershaw, Fullarton, & Mcwiliams, 2016). Strengthening specialist training and preparation is the only effective measure to alleviate the psychological pressure of the medical staff (Wong, Wong, Lee, & Goggins, 2007). Thus, in public health emergencies, it is very important to mobilize the enthusiasm and conscientiousness of nurses. The government should try the best to provide safe working conditions for nurses, while offering financial subsidies and rewards.

The knowledge of COVID-19 is limited, but it is highly contagious. In order to better care for patients and protect nurses, the training of the nursing team's business capabilities should be strengthened, training plans of the COVID-19 epidemic should be formulated, the training content should be rationally set, and multimedia network platforms should be used to promote the participation of all staff in training and improve the knowledge and skills reserve of the nursing staff and epidemic response ability.

4.2 | Factors affecting stress load of nurses assisting in Wuhan to fight against COVID-19

4.2.1 | Being a nurse who is the only child in their family was highly stressful

The stress load score of nurses who are the only child in their families in the present study was 50.87 ± 10.47 points and that of nurses who are the non-only child in their families was 38.91 ± 12.68 points ($p < .05$), which indicated that nurses who are the only child in their families were more stressful. This result may be correlated with role conflict and social support system. They worry about the health of their family members and fear that if they died of COVID-19, their

parents will lose their only child. When multiple roles are in conflict, certain psychological pressure will be present.

Social support is an important protective factor for psychological resilience that alleviates mental stress and lifts psychological barriers (Su & Guo 2015). Strengthening social support among nurses could also mitigate the effect of job strain on health, as has been mentioned in the literature (Garcia-Rojas, Choi, & Krause, 2015; Schmidt, 2013). Thus, the social support system of nurses should be actively mobilized. Nurses should keep in touch with their families and friends so as to achieve spiritual support. At the same time, nurses should encourage one another, discuss and share our feelings and experiences with their colleagues in a timely manner, and vent negative emotions. Hu, Hu, Yang , Han, Yanmei (2014) reported that the social support of the nurses who are the only child in their families maintains their mental health.

Furthermore, the worries of the front-line nurses should be relieved. The government has implemented policies to care for medical workers (e.g., social network or clinical setting; Measures of Guangxi health commission to care for medical team members in Hubei, 2020). For example, community staff visit nurses' families provide help to families in need so that nurses can concentrate on their work in Wuhan.

4.2.2 | Long working time per week increased stress

Consistent with other studies (Huang et al., 2019; Triana-Palencia et al., 2019; Wu et al., 2020), long working time per week increased stress, which may be correlated with the fear of infection, excessive physical consumption, etc. COVID-19 infection is caused by respiratory droplet and close contact transmission; this infection is highly contagious (e.g., social network or clinical setting; Notice on Issuing a New Coronary Virus Pneumonia Diagnosis and Treatment Plan [Trial Version 6], 2020). Nurses are at high risk of occupational exposure while caring for patient with COVID-19.

After wearing a full set of protective clothing, nurses' breathing will be limited to a certain extent. To save the use of isolation clothing during work, nurses do not drink water or go to the toilet, thereby increasing the difficulty of nursing work. In this case, the longer the working time per week is, the higher the consumption of body and mind will be. Hence, the body is in a state of tension and fatigue. If tension cannot be released for a long time, then the nurse is prone to burnout. Burnout is correlated with the physical and mental health of nurses and affects the quality and safety of nurses. Stress from work moderately affects burnout (Liu & Aungsuroch, 2019).

Thus, nurse managers should strengthen the allocation and management of human resources, scientifically arrange shifts, reduce the work intensity of nurses and decrease work pressure. In the case of sufficient human resources, nurses' participation in the treatment of COVID-19 is for less than 1 month. At the same time, the support of medical protective equipment and other related materials should be increased, and conditions to provide medical staff with shower and bath facilities should be actively created, thereby ensuring that

the staff can thoroughly bathe when leaving the isolated ward after work and reducing the possibility of infection.

4.2.3 | Anxiety was important factor affecting nurses' stress load

Anxiety is a negative emotional state perceived by individual subjectively and one of the most common psychological obstacles of nurses (Gao et al., 2012; Dongbo et al., 2018). In this survey, the average score of SAS was 32.19 ± 7.56, which was significantly higher than the national standard anxiety level ($p < .05$). This result showed that nurses had evident anxiety, which was similar to the results of Wu et al. (2020) and Zhang, Li, Zheng, Zhang, (2020). The results of a multifactor analysis showed that anxiety is an important factor affecting nurses' stress load. The correlation analysis also shows that anxiety is positively correlated with stress load. The more evident the anxiety is, the more intense the pressure that the nurses will feel. Many previous studies have also shown that nurses with high stress lead to anxiety, frustration, depression and other psychological disorders and emotions (Malinauskiene et al., 2011; Teles, Barbosa, & Vargas, 2014).

COVID-19 is highly infectious and spread rapidly, with suspected and confirmed patients increasing daily. Nurses feel anxiety and helplessness due to so many patients. The government of China has implemented policies to address these mental health problems. Medical workers infected with COVID-19 due to the performance of their duties, they shall be identified as industrial injury and enjoy the benefits of industrial injury insurance according to law (e.g., social network or clinical setting; Occupational injury insurance supports occupational injury 'protection umbrella' for prevention and rescue personnel in the fight against new coronavirus pneumonia, 2020). Online platforms with medical advice have been provided to share information on how to decrease the risk of transmission between the patients in medical settings, which aims to eventually reduce the anxiety and pressure on medical workers (Kang et al., 2019). Nurses should maintain their psychological health to ensure the quality of care for patients (Hsiao & Tseng 2020). Nurse managers should guide the nurses to adjust their psychological state scientifically. Leisure activities and training on how to relax should be properly arranged to help staff reduce stress.

5 | LIMITATIONS

Several limitations should be considered. First, this study only investigated the nurses from Guangxi who are supporting in Wuhan to fight against COVID-19 without additional data from nurses who came from other provinces. Thus, the results cannot be generalized to all Chinese nurses. Second, as a cross-sectional design, this study could only evaluate the work stress at the time without the longitudinal observation of the subjects. Third, due to time constraints, we only conducted a questionnaire survey and did not carry out an intervention. Finally, in addition to the factors concerned in this study, there may be other factors that affect the work stress of nurses. Consequently, future research can expand the region and increase the sample size.

6 | IMPLICATIONS FOR NURSING MANAGERS

The results of this study showed a widespread pressure on nurses who are supporting in Wuhan to fight against COVID-19. Maintaining the mental health of nursing staff is essential to control COVID-19. Nurse leaders should pay attention to the work stress and the related factors of the clinical nurses. Nurse managers should try the best to provide safe working conditions for nurses, while offering financial subsidies and rewards, so as to mobilize the enthusiasm and conscientiousness of nurses.

The knowledge of COVID-19 is limited, but it is highly contagious. Nurses who received COVID 19 epidemic training had higher mental health levels than those who did not (Wu et al., 2020). Thus, nursing managers should make the study plans of the COVID-19 epidemic, and multimedia network platforms should be used to promote the participation of all staff in training and improve the epidemic response ability.

Different from the past, because of the strong transmission power of virus, in order to reduce cross-infection, the nurse had to stay alone in the room after finishing the work (e.g., social network or clinical setting; Notice on Issuing a New Coronary Virus Pneumonia Diagnosis and Treatment Plan [Trial Version 6], 2020). They may feel lonely, anxious and so on. Thus, nursing managers should help nurses actively mobilize their social support systems.

Furthermore, nurse leaders should guide nurses to adjust their psychological state scientifically. Leisure activities and training on how to relax should be properly arranged to help staff reduce stress.

7 | CONCLUSIONS

COVID-19 presents a vast public health challenge all around the world. The outbreak of COVID-19 is complicated, infectious and generally susceptible. COVID-19 brings remarkable challenges to social prevention and control and front-line treatment. In public health emergencies, the psychological stress of the nurses should be focused. Nurses who supported COVID-19 treatment in Wuhan were generally under pressure. Whether the participants are the only child in their families, working hours per week and anxiety were the main factors that affected nurses' stress load. This study investigated the work stress among nurses who are supporting Wuhan in fighting against COVID-19 infection and analysed the influencing factors, and shared and proposed some methods to relieve the stress, which may provide reference for nurses in other countries in mental health maintenance.

AUTHORS' CONTRIBUTIONS

HH and MQ conceived the study. YM created and performed the literature search strategy. LD and QL built the data extraction file. YM and LZ performed the data extraction. HH and MQ supervised the process. YM performed the results. All authors contributed extensively to this work, interpreted the data and contributed substantially to the writing and revision of the manuscript, and read and approved the final version of the manuscript.

ETHICAL APPROVAL

The procedures of this study were reviewed and approved by the Institutional Review Board of The Second Affiliated Hospital of Guangxi Medical University (No.2020--KY0005). The participation was voluntary; the informed consent, including the permission to publish the results of the research, was obtained.

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