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Immediate psychological impact on nurses working at 42 government-designated hospitals during COVID-19 outbreak in China: A cross-sectional study

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ABSTRACT

Background: During an epidemic of a novel infectious disease, frontline nurses suffer from unprecedented psychological stress. This study aimed to assess the immediate psychological impact on frontline nurses in China.

Methods: A multicenter, cross-sectional survey of frontline nurses was conducted via online questionnaires. Symptoms of depression, anxiety, somatic disorders, and suicidal ideation were evaluated. Demographic, stress, and support variables were entered into logistic regression analysis to identify the impact factors.

Findings: Of the 4,692 nurses who completed the survey, 9.4% (n = 442) were considered to have depressive symptoms, 8.1% (n = 379) represented anxiety, and 42.7% (n = 2,005) had somatic symptom. About 6.5% (n = 306) respondents had suicidal ideation.

Discussion: The study showed that the overall mental health of frontline nurses was generally poor during COVID-19 outbreak, and several impact factors associated with nurses' psychological health were identified. Further research is needed to ascertain whether training and support strategies are indeed able to mitigate psychological morbidities.

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Introduction

At the end of 2019, the 2019 novel coronavirus (COVID-19) pneumonia emerged in Wuhan, Hubei Province, China (Wang, Horby, Hayden, & Gao, 2020), and has subsequently gained intense attention globally. COVID-19 is an emerging and easily clustering infectious disease. Because of the highly infectious nature of and limited knowledge about COVID-19, health care workers are under extreme physical and psychological pressure while on duty. They are not only at elevated risk of

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getting infected, but also have been reported to experience depression, anxiety, insomnia, stigma, and frustration (Chen et al., 2020; Zhu et al., 2020). Moreover, the fears shared by the families, friends, and neighbors of health care workers lead to disruption of interpersonal relationship, which could be another influence factor that induces psychological morbidity among health care workers. These mental health problems not only affect the health care workers' attention, understanding, and decision-making ability, which might hinder their work performance and long-term overall well-being. Protecting the psychological well-being of these health care workers is thus important for control of the epidemic and their own health. The National Health Commission has issued guiding principles for emergency psychological crisis intervention for people affected by COVID-19, emphasizing the importance of strengthening medical staff's psychological crisis intervention and counseling (National Health Commission of China). To provide better psychosocial support to health care workers and to strike a balance between the personal well-being and professional obligations, it is crucial to understand their psychological status during the outbreak.

In clinical settings, nurses have longer contact time and more frequent physical contacts with the patients, which means heavy workload and high possibility of cross-transmission. To date, studies about psychological status of nurses during COVID-19 outbreak are scant. In this study, staff nurses working in the 42 designated hospitals who were responsible for tackling the local outbreak were recruited for assessment. The purpose of this study was to determine the prevalence and type of psychological morbidity among the frontline nurses in relation to the COVID-19 outbreak and the influence factors.

Methods

Design and Sample

This study was a multicenter, cross-sectional survey, using a convenience cluster sampling method. Chongqing is a municipality bordered by the province of Hubei to the east. During the outbreak, 42 hospitals were designated to treat patients with the COVID-19 in Chongqing. Participants were recruited from these hospitals from February 8 to 14, 2020, 2 weeks after the authority in Wuhan suspended all public transport on January 23. The inclusion criterion was registered nurse working in frontline for the COVID-19, such as isolation wards, intensive care units, emergency departments, respiratory wards, infection-control office, and fever clinics. Those working in departments providing indirect support were excluded. A total of 4,738 nurses participated in this study.

Data Collection
The study was approved by the institutional ethics board of First Affiliated Hospital of Chongqing Medical University. After receiving permission from participated hospitals, data were collected by anonymous online questionnaires which were distributed to all nurses in participated hospitals via WeChat (the most widely used all-in-one messaging app in China). Only one response per account to the questionnaire was permitted. The survey explicitly stated the purposes of the study and notified the participants that they provided informed consent when they accepted filling out the anonymous survey.

Measures

A structured self-administered questionnaire consisted of 4 parts was employed to conduct the survey.

Demographic Information
Seven items were designed to collect participants' basic demographic information, including sex, age, marital status (single/married), educational level, years of working, department (isolation ward/nonisolation ward), exposure to COVID-19 patients (yes/no) was collected.

Perceptions and Attitudes Toward COVID-19
The participants were asked about their perceptions and attitudes toward COVID-19. These included subjective health status assessments during the COVID-19 epidemic (poor/fair/good); the possibility of being infected (none/low/high); willingness to work in a COVID-19 designated ward (yes/no).

COVID-19-Related Experience
Two dichotomous questions (yes/no) were asked about participants' experiences during COVID-19 outbreak, including: whether a family member or neighbor of the participant had been infected; whether the participant had encountered COVID-19 discrimination.

Job-Related Stress
A job-related stress severity scale developed for frontline health care workers in Severe Acute Respiratory Syndrome (SARS) outbreak (Tam, Pang, Lam, & Chiu, 2004) was employed. The scale consisted of 14 dichotomic (yes/no) items regarding subjective job-related stress during COVID-19 outbreak (e.g., risk to own health; interference with home life, etc.). In the current study, Cronbach's alpha was 0.78. The total scores of 4 and 9 represent cutoff for low, medium, and high stress, respectively.

Perceived Adequacy of Social Support
This part consisted of 6 dichotomous questions (enough/not enough) about perceived adequacy of social support, including support from family, colleagues, hospital authority, patients, insurance and compensation, mass media.

Psychological Status and Mental Health Service Needs
Three instruments were employed to evaluated participant's psychological status.

Patient Health Questionnaire-9 (PHQ-9) was used to assess the depression symptoms (Kroenke, Spitzer, & Williams, 2001). Based on a five-point Likert-type scale from "not at all" (0) to "extremely" (4), participants were asked to indicate how often they had been bothered by the symptoms over the past 2 weeks. The Cronbach's alpha of the PHQ-9 is 0.86 (Wang et al., 2014). The total score of the PHQ-9 ranged from 0 to 27. A cutoff total score of 10 has been recommended for diagnosis of major depression, which provides adequate sensitivity (74%) and specificity (91%) (Arroll et al., 2010). The ninth item of PHQ-9 was used as a measure of suicidal ideation (thoughts that you would be better off dead, or thoughts of hurting yourself in some way).

Generalized Anxiety Disorder 7-item Scale (GAD-7) was used to evaluate anxiety disorders (Spitzer, Kroenke, Williams, & Löwe, 2006). The GAD-7 assess the frequency of anxiety symptoms over the past two weeks on a four-point Likert-scale ranging from 0 (never) to 3 (nearly every day). The Cronbach's of the GAD-7 is 0.82 (Wang, Lu, Ding, Hu, & Li, 2014). The total score of GAD-7 ranged from 0 to 21, with increasing scores indicated a more severe functional impairment as a result of anxiety. In this study, a cutoff total score of 10 was defined as the presence of anxiety symptoms (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007).

The Patient Health Questionnaire Somatic Symptom Severity Scale-15 (PHQ-15) was applied to assess somatic symptoms (Kroenke, Spitzer, & Williams, 2002). The Scale consists of 15 items that asks whether somatic symptoms, such as stomach pain or dizziness, were present in the last 4 weeks and the severity (response categories of "not bothered at all," "bothered a little," and "bothered a lot"). The Cronbach's alpha coefficient of PHQ-15 is 0.83 (Zhang et al., 2016). With a cutoff total score of 6 or more, the sensitivity of the PHQ-15 was 78% and specificity was 71% (Van Ravesteijn et al., 2009).

The participants were also asked whether they currently needed the help of a mental health professional; whether they felt it necessary to participate regularly in individual or group counseling during the outbreak.

Statistical Analysis

Data were analyzed using SPSS 26.0 for Mac (SPSS, Chicago, IL). Descriptive statistics was applied to the general characteristics and study variables. Groups were compared using the chi-square analysis, *t* test, and one-way ANOVA according to the characteristics of the variable being examined. Variables with p value $<.05$ in univariate analyses were subjected to multivariable logistic regression analysis with a stepwise forwards elimination procedure.

Findings

Four thousand eight hundred and thirty-eight nurses completed the online questionnaire; 146 questionnaires with a logic mistake (e.g., age > 80 years) or nonresponse items ≥10% were excluded, and 4,692 nurses' questionnaires were included in the final analysis. Details of the respondents' demographic information are shown in Table 1.

The overall prevalence of depression, anxiety, and somatic symptoms were 9.4% (n = 442), 8.1% (n = 379) and 42.7% (n = 2005), respectively. The three most common symptoms were "feeling tired or having low energy" (n = 2978), "pain in arms, legs or joints" (n = 2213), and "shortness of breath" (n = 1981). About 6.5% (n = 306) of respondents reported suicidal ideation. Total 3,556 (75.8%) respondents believed it was necessary to participate regularly in individual or group counseling during the outbreak, 363 (7.7%)

Table 1 – Participants' Characteristics and Survey Responses (n = 4,692)

Characteristics	*n* (%)
Age	
19–30 years	2,649 (56.5%)
31–40 years	1,580 (33.7%)
>40 years	463 (9.9%)
Sex	
Woman	4,548 (96.9%)
Man	144 (3.1%)
Marital status	
Married	3,013 (64.2%)
Single	1,679 (35.8%)
Educational level	
Below baccalaureate degree	1,602 (34.1%)
Baccalaureate degree and above	3,090 (65.9%)
Years of working	
≤5 years	1,673 (35.6%)
6–10 years	1,677 (35.7%)
>10 years	1,342 (28.6%)
Department	
Isolation ward	381 (8.1%)
Non-isolation ward	4,311 (91.8%)
Directly care of COVID-19 patients	506 (10.8%)
Subjective health	
Poor	151 (3.2%)
Fair	1,852 (39.5%)
Good	2,689 (57.3%)
Willing to work in COVID-19 unit	3,458 (73.7%)
Possibility of being infected	
None	377 (8.0%)
Low	3,075 (65.5%)
High	1,240 (26.4%)
Family member got infected	18 (0.4%)
Neighbor got infected	542 (11.6)
Encountered discrimination	724 (15.4%)
Job-related stress	
Low	2,004 (42.7)
Medium	2,378 (50.7)
High	310 (6.6)
Perceptions of support	
Family	4,447 (94.8)
Colleagues	4,475 (95.4)
Hospital authority	4,013 (85.5)
Patients	3,755 (80.0)
Insurance and compensation	3,665 (78.1)
Mass media	4,036 (86.0)

respondents reported they currently needed the help of a mental health professional. Characteristics associated with psychological morbidities were depicted in Table 2.

Logistic regression showed that being married (odds ratio [OR] = 0.74) was a protective factor for depression. Education below baccalaureate degree (OR = 1.26) and family member not infected (OR = 0.31) were shown to be a risk factor and a protective factor of anxiety, respectively. Female gender (OR = 1.79) and education below baccalaureate degree (OR = 1.14) were risk factors of somatic symptoms. In the analysis of suicidal ideation, poorer subjective health (poor: OR = 7.56; fair: OR = 3.38), not enough support from family (OR = 2.05) or hospital authority (OR = 1.54), and less opportunities for reflecting opinions through mass media (OR = 1.47) were shown to be risk factors. Family member not infected (OR = 0.15) and lower job-related stress (low: OR = 0.40; medium: OR = 0.61) had protective effects on suicidal ideation (Table 3).

Discussion

The outbreak of COVID-19 in Wuhan provoked an overwhelming public health response and concerns with infection control during the beginning of 2020. Nurses working in the hospitals officially designated for the patients diagnosed or suspected with COVID-19 have been and are under extreme physical and psychological stress. This multicenter survey showed that the rate of depression, anxiety, somatic symptom was 9.4%, 8.1%, 42.7%, respectively, and 6.5% (n = 306) respondents had suicidal ideation. Many studies comparing psychological well-being across different occupational roles showed that nurses were more likely to have poorer outcomes in handling infectious disease outbreaks than other health care workers (Koh et al., 2005; Maunder et al., 2004; Nickell et al., 2004; Tam et al., 2004; Wong et al., 2005). However, the rate of depression and anxiety in this study was lower compared with that found in medical staff (including nurses) working in Wuhan during the same period (Chen et al., 2020; Zhu et al., 2020). Despite of the different measurements used in these studies, the differences may mainly due to the situations that participants were facing. As the epicenter of COVID-19, health care workers in Wuhan were experiencing more panic, distress and heavier workload.

It should be noticed that there was an extremely high prevalence of somatic alteration among frontline nurses during the outbreak compared to Chinese nurses in non-COVID times (Gu, Tan, & Zhao, 2019). Due to the requirements for isolation and disinfection, nurses need to wear several layers of protection mask and clothing. It increases the intensity of their work and requires great physical energy, causing hypoxia and physical symptoms such as fatigue and muscle pain. Previous studies have shown that emotional

Table 2 – Univariate analysis of participants with psychiatric morbidities

Characteristics	Depression (n=442)	P	Anxiety (n=379)	P	Somatic symptom (n=2005)	P	Suicidal ideation (n=306)	P
Woman	429 (97.1%)	0.870	370 (97.6%)	0.414	1962 (97.9%)	0.002	296 (96.7%)	0.835
Married	251 (56.8%)	0.001	246 (64.9%)	0.769	1278 (42.4%)	0.558	192 (62.7%)	0.579
Baccalaureate degree and above	267 (60.4%)	0.011	231 (60.9%)	0.036	1286 (64.1%)	0.032	192 (62.7%)	0.235
Self-rating of health condition		0.922		0.510		0.727		<0.001
Poor	13 (2.9%)		16 (4.2%)		61 (3.0%)		45 (14.7%)	
Fair	173 (39.1%)		147 (38.8%)		784 (39.1%)		192 (62.7%)	
Good	256 (57.9%)		216 (57.0%)		1160 (57.9%)		69 (22.5%)	
perceived possibility of getting infected		0.501		0.495		0.970		<0.001
None	41 (9.3%)		32 (8.4%)		160 (8.0%)		19 (6.2%)	
Low	291 (65.8%)		238 (62.8%)		1318 (65.7%)		156 (51.0%)	
High	110 (24.9%)		109 (28.8%)		527 (26.3%)		131 (42.8%)	
Family member got infected	4 (0.9%)	0.062	4 (1.1%)	0.027	8 (0.4%)	0.883	6 (2.0%)	<0.001
Encountered discrimination	69 (15.6%)	0.912	59 (15.6%)	0.939	290 (14.5%)	0.113	83 (27.1%)	<0.001
Job-related stress		0.943		0.157		0.300		<0.001
Low	187 (42.3%)		147 (38.8%)		846 (42.2%)		66 (21.6%)	
Medium	227 (51.4%)		210 (5.4%)		1037 (51.7%)		179 (58.5%)	
High	28 (6.3%)		22 (5.8%)		122 (6.1%)		61 (19.9%)	
Not enough support from family	24 (5.4%)	0.836	18 (4.7%)	0.666	101 (5.0%)	0.624	258 (84.3%)	<0.001
Not enough support from colleagues	21 (4.8%)	0.894	16 (4.2%)	0.697	80 (4.0%)	0.074	271 (88.6%)	<0.001
Not enough support from hospital authority	70 (15.8%)	0.391	63 (16.6%)	0.214	292 (14.6%)	0.877	207 (67.6%)	<0.001
Not enough support from patients	78 (17.6%)	0.199	62 (16.4%)	0.067	399 (19.9%)	0.918	192 (62.7%)	<0.001
Not enough support from insurance and compensation	106 (24.0%)	0.263	96 (25.3%)	0.091	444 (22.1%)	0.714	208 (68.0%)	<0.001
Not enough support from mass media	50 (11.3%)	0.089	48 (12.7%)	0.441	275 (13.7%)	0.651	221 (72.2%)	<0.001

Table 3 – Logistic Regression With Predicting Psychiatric Morbidities

	p	OR (95% CI)
Depression		
Married	.004	0.740 (0.603–0.907)
Anxiety		
Below baccalaureate degree	.037	1.258 (1.014–1.561)
Family member not infected	.039	0.308 (0.101–0.942)
Somatic symptom		
Woman	.002	1.786 (1.244–1.292)
Below baccalaureate degree	.031	1.144 (1.012–1.292)
Suicidal ideation		
Subjective health (poor)	<.001	7.556 (4.685–12.187)
Subjective health (fair)	<.001	3.380 (2.504–4.561)
Family member not infected	<.001	0.146 (0.048–0.438)
Not enough support from family	.001	2.045 (1.364–3.066)
Not enough support from hospital authority	.011	1.540 (1.105–2.146)
Not enough support from mass media	.036	1.474 (1.025–2.119)
Job-related stress (low)	<.001	0.404 (0.247–0.660)
Job-related stress (medium)	.014	0.611 (0.412–0.907)

disorders, such as depression or anxiety predict the appearance of somatic symptoms which worsen the individual's health, and this in turn, leads to new states of anxiety and somatization (Berghoff, Tull, DiLillo, Messman-Moore, & Gratz, 2017; Creed, Tomenson, Chew-Graham, Macfarlane, & McBeth, 2018). The decreased psychosomatic health of nurses will also generate a negative influence on health care performance (Gu et al., 2019; Johnson et al., 2018). In this study, female gender was one of the risk factors of somatic symptoms, which is consistent with previous studies (Barsky, Peekna, & Borus, 2001; Halbreich & Kahn, 2007). Therefore, there is an urgent need of strengthen labor protection for women in special periods.

Among the sociodemographic characteristics, the common risk factor for acute anxiety and somatization was lower educational level. The importance of preparedness, in terms of either specialized training or previous experience working during a crisis was highlighted in previous studies. It has been proved that nurses who were confident in their infection control knowledge and skills had lower stress levels than those who felt less prepared. Moreover, nurses perceived inadequate training were more likely to experience burnout, posttraumatic stress symptoms, and longer continuing perceived risk even after the crisis (Maunder et al., 2006). The knowledge about handling infectious disease outbreaks and accurate updates about the COVID-19 outbreak should be provided to nurses in order to address their sense of uncertainty and fear (Wong, Wong, Lee, & Goggins, 2007).

These results showed vulnerable perceived health status was a predictor of poor psychological well-being. It should be noted that poor mental health may bias the estimates, and the correlation between perceived risk and mental health symptoms may be bidirectional. Therefore, treatment of the distress symptoms, or cognitive behavioral approaches designed to alter the negative thinking patterns, may be helpful in improving mental health symptoms and potentially lessening risk estimates. Specialized training may be helpful to decrease nurses' negative perception and thus lead to more positive outcomes (Styra et al., 2008; Wu et al., 2009).

In this study, occupational stressors during the outbreak were shown to be associated with even poorer mental health outcomes—suicidal ideation. Similar findings have been reported in studies on the H1N1 and SARS pandemics, which showed that staffs in infected wards and fever clinics experienced more serious anxiety, fatigue, and higher posttraumatic stress symptoms than those in low-risk work environments(Brandt, Rabenau, Bornmann, Gottschalk, & Wicker, 2011; Matsuishi et al., 2012; Maunder et al., 2004; McAlonan et al., 2007). Other job-related stressors included high workload, being quarantined, impaired work ability was also shown to be significantly associated with poor mental health. On the other hand, there have been researches suggesting that health care workers experience positive effects such as personal growth, sense of achievement, and a better appreciation for life (Rubin et al., 2016; West et al., 2008). It may be useful for preparatory training and interventions to encourage nurses to focus on the potential positive impact and take positive coping strategies during the humanitarian work.

Besides occupational factors, social factors are significantly related to nurses' psychological well-being. Poor perceived support from both family and hospital authority was shown to be important risk factors against poor mental health. Married nurses could receive more support from family, which decreased the risk of depression. Being discriminated against was also associated with psychological morbidities in nurses. During the epidemic, health care workers were labeled as the source of infection. Discrimination and stigmatization increased the isolation of the nurses, and even had potentially long-term effects on individuals' psychological well-being (Liu et al., 2012; Robertson, Hershenfield, Grace, & Stewart, 2004). Although few studies discussed the effect of supportive mass media, we found that less opportunities for reflecting opinions through mass media were associated with nurses' distress. Frontline health care workers need more encourages and constructive feedback from the public.

In this study, nurses who had family members infected presented a significantly increased risk of anxiety and suicidal ideation. Administrators should

provide better psychosocial support to nurses and to strike a balance between professional obligations and family responsibilities of nurses. Interestingly, except for "family members not infected," all of the influencing factors of suicidal ideation were subjective perception toward stress and support. Subjective perceptions regarding the risk can differ widely among individuals with objectively similar levels of danger exposure. These subjective perceptions may be more strongly associated with an individual's subsequent psychological morbidity (Gallacher, Bronstering, Palmer, Fone, & Lyons, 2007; Marshall et al., 2007).

During the initial phase of outbreak, people were shocked by the sudden disruption of normal work and life. Feelings of extreme vulnerability, helplessness, loss of control, uncertainty, and threat to life were generally perceived. Nurses felt their job put them at great risk of exposure to COVID-19, and perceived more job-related stress. For most health workers, emotional and behavioral responses are part of an adaptive response to extraordinary stress, and psychotherapy techniques such as those based on the stress-adaptation model are helpful.

This study had several limitations. The present research was conducted during the initial phase of the crisis, the long-term psychological effects of COVID-19 could be either under-estimated or over-estimated. Longitudinal prospective studies are needed to examine the long-term effects of crisis on nurses' psychological health. Although this study yielded a large sample size, we could not decide the accurate response rate because of the nature of online survey. Moreover, the voluntary nature of participant selection may have caused selection bias.

This study showed that the overall mental health of frontline nurses was generally poor during COVID-19 outbreak, and several impact factors associated with nurses' psychological health were identified. In the face of such a sudden disaster as COVID-19, it is important to pay attention to nurses' mental health conditions while fulfilling their responsibilities. Further research is needed to ascertain whether training and support strategies are indeed able to mitigate psychological morbidities.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.outlook.2020.07.007.

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