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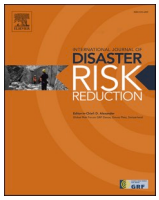

Psychological effects of the COVID-19 outbreak on nurses working in tertiary women's and children's hospitals from Sichuan, China: A cross-sectional study

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ABSTRACT

The evolving COVID-19 pandemic is placing unprecedented pressures on health systems. Accumulative studies suggest that nurses were more likely to develop negative psychiatric outcomes following a public health disaster than other medical staffs, due to their more frequent and closer contact with patients. We examined the psychological status of nurses working in the tertiary women's and children's hospitals in Sichuan, China, in order to explore the possible effect of the COVID-19. The cross-sectional survey was conducted at the peak period of COVID-19 among 1971 nurses. Their anxiety, depression and self-efficacy were assessed by the seven-item anxiety scale (GAD-7), the nine-item Patient Health Questionnaire (PHQ-9), and the General Self-efficacy Scale (GSES), respectively. 1934 valid questionnaires were returned with a response rate of 98.1%. We found that 29.3% and 22.7% of the nurses were identified with anxiety and depressive symptoms, respectively. The median score of GSES was 30, which was at the upper middle level among all populations. Nurses having longer working years and cold-like symptoms, those who were at work during breakout period and working in pediatric ward were significantly associated with the presence of anxiety and depression. Findings suggest that the epidemic of COVID-19 does not necessarily affect the psychological health of nurses working in women's and children's hospitals in Sichuan. The results of this study could serve as valuable suggestions to direct the promotion of psychological well-being among targeted nurses.

1. Introduction

Coronavirus disease 2019 (COVID-19) was first identified in Dec 2019, and has soon become a major epidemic threat over the China in one month [1]. Despite the virus spread rapidly to all provinces of China, series of measures (e.g.isolating suspected patients, monitoring contact status of patients, developing diagnostic and treatment protocols and limiting movements of population etc.) brought into force by Chinese government had worked to limit the epidemic [2,3], and the major epidemic was under control in two months. Nevertheless, it caused a total of 81,077 confirmed cases and 3218 deaths by Mar 16, 2020 [4]. The disease spread worldwide afterwards, and was identified by WHO as a public health emergency of international concern [5]. Health workers as a frontline were facing massive risk of infection during epidemic of disease. It was reported that 3387 health workers in China were infected with COVID-19 [1]. The life threats posed by the disease may cause great stress on medical staffs. Stress may derive from their heavy workload and witness of patients' adverse outcome. Among medical staffs, nurses are the direct carer, who would stay with patients for the longest time, and may be psychologically influenced more by the epidemic than other

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staffs. Accumulative studies suggest that nurses were more likely to develop negative psychiatric outcomes following a public health disaster like SARS and H1N1 outbreak than physicians, due to their more frequent and closer contact with patients [6–11]. It is reasonable to assume that the COVID-19 would also affect nurses' psychological status and further impair their cognitive functioning, and clinical decision-making [12,13] and ultimately reduce quality of care. Since it was found that the severity of psychiatric problems were higher in the initial phase than recovery phase of the SARS, exploring the psychological impact of COVID-19 on nurses during the most serious period of epidemic might be more significant for administrators in human resources management [14].

Among all nurses, those in women's and children's hospitals assume a unique role in fighting against the public health disaster. They are in charge of the health and safety of women and children, who are vulnerable during various disasters. Particularly, pregnant women and children are more susceptible to respiratory pathogens for their respiratory anatomy [15]. Infection with respiratory infectious disease would lead to high rates of spontaneous abortion, premature birth, and intrauterine growth restriction in pregnant women and more systemic complaints or complications in a variety of organs and systems of children [16–18]. The nurses working for women's and children's health hence might face challenges for clinical care and self-protection during epidemic of COVID-19. They may also encounter with increased workload brought by the absence of some colleagues, who were dispatched to epidemic center to Hubei province at the peaking time of the COVID-19. Nurses must still assume some additional disinfection and sterilization work specially for respiratory infections diseases, as well as psychological support for patients during the epidemic. The risk of being infected and increased workload may increase their stress and further affect their psychological well-being.

There are various factors found to be associated with psychological well-being of nurses in disasters [6]. Self-efficacy is a protective one that is negatively associated with anxiety of nurses in disasters [19,20]. It is the individual's belief in their abilities to succeed in a particular situation, which significantly contributes to goal achievements, duties fulfillment, and overcoming challenges [21]. People with high efficacy are more resilient to setbacks and less possibilities to develop psychological problems [22,23]. Investigating self-efficacy of nurses under major epidemic could help nursing administrators to find out the key points to improve nurses' psychological well-being.

Although it is crucial to explore the psychological impact of the epidemic on nurses and its influencing factors according to the above analysis, there were no studies conducted on nurses working in women's and children's hospitals. Whether the major epidemic like COVID-19 influences nurses caring for women and children remain unknown, which would handicap administrators to provide targeted support to their staffs and further promote care quality. In consideration of this, we conducted a cross-sectional survey to examine the psychological effects of the COVID-19 outbreak on nurses working in women's and children's hospitals.

2. Materials and methods

2.1. Setting and participants

This cross-sectional study was conducted on nurses working in 17 tertiary women's and children's hospitals by convenient sampling in Sichuan during the peak period of epidemic (from Jan 28th to Feb 11th, 2020). Sichuan was identified as medium risk area in China with 538 identified cases and 3 deaths during the peak period. All tertiary hospitals there were prepared to receive suspected and identified patients, and nurses in those hospitals were possible to contact COVID-19 patients. Inclusion criteria for participants were:(1) clinical nurse practitioners in tertiary women's and children's hospitals; (2) having no known history of auditory, language, or cognitive problems. The nurses would be excluded if they were: (1) retired; (2) being currently involved in other psychological intervention studies; (3) working in other fields rather than departments related to women's and children's health (e.g. nurse in back office and administrative department); (4) nursing students and visiting scholars. The sample size was determined by using formula $N = Z\alpha 2\ P(1 - P)/d2$, in which $\alpha = 0.05$, $Z\alpha = 1.96$, and the estimated acceptable margin of error for proportion d was 3%. The proportion of nurses with psychological morbidity was estimated as 26% [24]. To allow for subgroup analysis, the sample size was amplified by 50%–1642.

2.2. Data collection and procedures

A letter containing the purpose and procedures of the current study was sent to the nursing departments of the 17 hospitals and ask their heads for help to recruit nurses who were willing to participate in our investigation. After signing online informed consent, participants would be given questionnaires through an online survey platform ('SurveyStar'). Questionnaires were completed anonymous to guarantee confidentiality.

2.3. Measures

The demographic characteristics are age, gender, hospital grade, department, length of employment, working status, whether having cold-like symptoms themselves, whether having implemented home isolation with cold-like symptoms, whether family members having cold-like symptoms. The main results of this study were obtained by using three questionnaires in Chinese: the seven-item anxiety scale (GAD-7), the nine-item Patient Health Questionnaire (PHQ-9), and the General Self-efficacy Scale (GSES).

The GAD-7 is a self-rating scale with 7 items, which was designed to assess the anxiety [25]. It was proved to have acceptable psychometrics in general population, with the Cronbach's α coefficient of 0.89 and good predictive validity [26]. It was also applied to measure generalized anxiety disorder following disasters [27–29]. Participants in the current study were required to appraise their symptoms over the past 2 weeks on a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). The total score of 5, 10, and 15 are the cut-off points for mild, moderate, and severe levels of anxiety respectively [25].

Depressive symptoms were assessed by using the PHQ-9, which is the depression module of the Primary Care Evaluation of Mental Disorders (PRIME-MD). It is a well-validated tool with Cronbach's α coefficient of 0.854 in medical students and good validity for health care teams (physicians, nurses, nursing assistants, and community health workers) [30,31]. The PHQ-9 was also used to measure the depression in health care professionals following the Ebola virus outbreak [32]. Similar to the GAD-7, the PHQ-9 requires respondents to appraise how often they had experienced various depression-related symptoms in the last two weeks. Each item is assigned a score between 0 and 3 (from 0 for"not at all" to 3 for "nearly every day"). The total score indicates different levels of depressive symptoms with 5–9 as mild, 10–14 as moderate, 15–19 as moderately severe symptoms, and greater than 20 as severe level [33].

The General Self-efficacy Scale (GSES) was applied to investigate the self-efficacy of nurses. The Chinese version was tested among the general population with good psychometrics. The internal consistency was noted ($\alpha = 0.91$–0.92), and the unidimensionality of the scale was confirmed [34–36]. Each item scores 1 to 4, and the total score ranges from 10 to 40 with higher scores indicating higher self-efficacy.

2.4. Ethical considerations

The study was approved by the ethics committee of the West China Second University Hospital of Sichuan University.

2.5. Statistical analysis

All the statistical analyses were performed in IBM SPSS 21.0 for Windows. Normality was tested by the Kolmogorov-Smirnov test. Non-parametric tests including two independent sample Mann-Whitney and multiple samples Kruskal Wallis test were used to compare the differences in the GAD-7 scores, the PHQ-9 scores and GSES scores against demographic factors. Spearman correlation analysis were carried out for testing the associations among continuous variables (e.g. age, GAD-7 scores). In order to determine whether demographic factors were significantly associated with the prevalence of anxiety and depression, multivariable logistic regression analysis was performed. The statistical significance was set at $p < 0.05$.

3. Results

A total of 1971 nurses from 17 tertiary women's and children's hospitals in Sichuan were recruited, and 1934 nurses returned valid questionnaires. The response rate is 98.1%.

3.1. Demographic characteristics of participants

The demographic characteristics of the respondents were shown in Table 1. The average age was 30.42, ranging from 18 to 56. Their average length of employment was 8.28.

3.2. The levels of anxiety, depression and self-efficacy among respondents

According to the Kolmogorov-Smirnov test, the results of GAD-7, PHQ-9 and GSES presented as skew distribution. The median score, range and number of participants in each level are listed in Table 2.

Table 1
Demographic characteristics of nursing staff.

Characteristics	Groups	N (%)
Age,yr	<25	353(18.3%)
	25–34	1157(59.8%)
	35–45	324(16.8%)
	>45	100(5.1%)
Gender	Male	35(1.8%)
	Female	1899(98.2%)
Hospital grade	Public tertiary A hospital	1869(96.6%)
	Public tertiary B hospital	65(3.4%)
Department	Gynecological ward	379(19.6%)
	Maternity ward	456(23.6%)
	Delivery room	107(5.5%)
	Pediatric ward	490(25.3%)
	Emergency department	90(4.7%)
	Intensive Care Unit (ICU)	359(18.6%)
	Outpatient department	53(2.7%)
Length of employment, yr	<1	20(1.0%)
	1–5	920(47.6%)
	6–10	466(24.1%)
	11–20	359(18.6%)
	>20	169(8.7%)
Working status	working	1500(77.6%)
	vacation	434(22.4%)
Having cold-like symptoms themselves	Yes	154(8.0%)
	No	1780(92.0%)
Home isolation when having cold-like symptoms	Yes	60(3.1%)
	No	94(4.9%) (continued on next page)
Family members having cold-like symptoms	Yes	107(5.5%)
	No	1827(94.5%)

Table 2
The levels of anxiety, depression and self-efficacy among respondents.

Variables	Median scores (min, max)	Levels	N (%)
anxiety	2 (0,5)	no symptoms	1367(70.7%)
		mild	402(20.8%)
		moderate	121(6.3%)
		severe	44(2.2%)
depression	1 (0,4)	no symptoms	1495(77.3%)
		mild	312(16.1%)
		moderate	80(4.2%)
		moderately severe	33(1.7%)
		severe	14(0.7%)
self-efficacy	30 (26,35)	low	150(7.8%)
		medium	894(46.2%)
		high	890(46.0%)

3.3. Multivariable analysis for GAD-7 scores, PHQ-9 scores and GSES scores against demographic data

The multivariable analysis was performed using two independent sample MannWhitney and multiple samples Kruskal Wallis test to compare the GAD-7, PHQ-9 and GSES scores against demographic factors by group (Table 3). Both GAD-7 scores and PHQ-9 scores were higher in nurses who were older, female, working in the pediatric ward, having longer years of employment, on duty during the period, having cold-like symptoms and whose family members having with cold. Pediatric nurses had higher GAD-7 scores and outpatient nurses had higher PHQ-9 scores. GSES scores were higher in nurses who were older, male, working in the delivery room, having longer years of employment, no cold-like symptoms appeared in themselves and family members.

3.4. Correlations among scores for GAD-7, PHQ-9, and GSES, and demographic data

The correlations among the scores for GAD-7, PHQ-9, GSES and demographic data are listed in Table 4.

3.5. Risk factors of anxiety and depressive symptoms

Multivariable logistic regression analysis indicated that longer years of employment and working status were associated with anxiety symptoms. Depression symptoms were associated with length of employment and whether having cold-like symptoms. Compared with working in Gynecological ward, working in pediatric ward appeared to be significantly associated with both anxiety and depression symptoms (Table 5).

4. Discussion

4.1. The psychological status and self-efficacy of nurses in the tertiary women's and children's hospitals during the peak period of epidemic

29.3% of the participants were identified with mild or severer anxiety (Table 2). Similarly, 22.7% of them had mild or severer depressive symptoms. Compared with the results of studies on nurses in Wuhan (anxiety ranging from 24.1% to 44.6% and depression ranging from 13.5% to 50.4%), the morbidity of depression and anxiety in the current study was relatively lower [37,38]. This might be attributed to the severity of epidemic of disease. Wuhan is the epicenter of the epidemic with the greatest number of infected cases in China, and nurses there faced more challenges than other places: heavier work loads and higher risk of occupational exposure to virus. By contrast, Sichuan was the moderate risk areas with less infected cases (145), and nurses there may experience less threats to their health and lives, which could lead to lower level of anxiety and depression [39]. In addition, the infected patients were concentrated in the department of epidemiology or the designated hospitals for COVID-19. Nurses working in the departments

Table 3
Multivariable analysis of GAD-7, PHQ-9, and GSES scores against demographic data.

Variables	Groups	GAD-7 scores	PHQ-9 scores	GSES scores
Age, yr	<25	1 (0, 3)	1(0, 3)	30(25, 33)
	25–34	2 (0, 5)	1(0, 4)	30(26, 34)
	35–45	3 (0, 6)	1(0, 5)	31(28, 36)
	>45	3 (0, 7)	2(0, 6)	31(26, 35)
	H	39.242	14.244	16.960
	Sig.	0.000*	0.003*	0.001*
Gender	Male	0 (0, 3)	0 (0, 4)	33 (29, 38)
	Female	2 (0, 5)	1 (0, 4)	30 (26, 34)
	Z	−2.313	−1.600	−2.418
	Sig.	0.021*	0.011*	0.016*
Hospital grade	Public tertiary A hospital	2 (0, 5)	1 (0, 4)	30 (26, 35)
	Public tertiary B hospital	2 (0, 7)	1 (0, 5.5)	30 (25, 33)
	Z	−0.989	−0.968	−1.293
	Sig.	0.323	0.333	0.196
Current department	Gynecological ward	1 (0, 4)	0 (0, 3)	30 (27, 35)
	Maternity ward	2 (0, 5)	1 (0, 4)	30 (26, 35)
	Delivery room	1 (0, 5)	1 (0, 3)	32 (28, 37)
	Pediatric ward	2.5 (0, 6)	1 (0, 6)	30 (25, 34)
	Emergency department	2 (0, 5)	1 (0, 4)	30 (26.75, 35)
	Intensive Care Unit (ICU)	2 (0, 5)	1 (0, 4)	30 (26, 34)
	Outpatient department	2 (1, 6)	2 (0.5, 5)	30 (24, 32)
	H	22.378	24.366	18.388
	Sig.	0.001*	0.000*	0.005*
Length of employment, yr	<1	0 (0, 4.75)	0 (0, 2)	29.5 (25.25, 32.75)
	1–5	1 (0, 4)	1 (0, 3)	30 (25, 34)
	6–10	3 (0, 7)	1 (0, 6)	30 (26, 34)
	11–20	3 (0, 6)	1 (0, 5)	31 (27, 36)
	>20	3 (0, 7)	2 (0, 5)	31 (27, 35)
	H	63.254	14.775	14.666
	Sig.	0.000*	0.005*	0.005*
Working status	working	2 (0, 6)	1 (0, 4)	30 (26, 35)
	vacation	1 (0, 4)	1 (0, 3)	30 (27, 35)
	Z	- 3.580	−2.871	−0.777
	Sig.	0.000*	0.004*	0.429
Having cold-like symptoms	Yes	3 (0, 7)	2 (0, 6)	29 (23, 32)
	No	2 (0, 5)	1 (0, 4)	30 (26, 35)
	Z	−2.843	−3.567	−3.806
	Sig.	0.003*	0.000*	0.000*
Home isolation since having cold	Yes	2 (1, 6)	2 (0, 5.75)	29 (24, 32)
	No	3 (0, 7.25)	3 (0, 7.25)	28 (23, 32.25)
	Z	−0.498	−0.608	−0.551
	Sig.	0.618	0.543	0.581
Family members having cold-like symptoms	Yes	3 (1, 7)	1 (0, 6)	29 (25, 34)
	No	2 (0, 5)	1 (0, 4)	30 (26, 35)
	Z	−3.594	−2.336	−1.776
	Sig.	0.000*	0.020*	0.076

*P < 0.05 is statistically significant.

related to women's and children's health may experience less exposure to the disease and had lower scores of anxiety and depression.

It was found that the median scores of self-efficacy (GSES) were 30 (Table 2), which is higher than that of general population [36]. This might be explained with the open access of COVID-19 related information and the effectiveness of measurements by Chinese government. Information on the epidemic was reported to WHO on 3 January, and whole genome sequences of the COVID-19 virus were shared on 10 January. Protocols for COVID-19 diagnosis, treatment, surveillance, epidemiological investigation, management of close contacts, and laboratory testing were formulated, and relevant surveillance activities and epidemiological investigations were conducted by China authorities

Table 4
Bivariate correlation analysis of scores in GAD-7, PHQ-9,and GSES, and of demographic data.

Variables	GAD-7	PHQ-9	GSES
Age	0.135**	0.081**	0.088**
Length of employment	0.167**	0.093**	0.079**
GAD-7	1	0.634**	−0.288**
PHQ-9		1	−0.329**
GSES			1

*Correlation is significant at 0.05 (2-tailed).
**Correlation is significant at 0.01 (2-tailed).
P < 0.05 is statistically signifificant.

[40]. All those factors could contribute to reduce medical staffs' ignorance to the disease and relieve their fear to the unknown, which further increase their self-confidence in dealing with the epidemic situation. And, most of the patients cared by nurses in women's and children's hospitals were uninfected pregnant women and children. They might have more confidence to manage the current situation than nurses in other departments [41]. Moreover, Sichuan is a region with frequent geological disasters, such as the 2008 Wenchuan earthquake and 2013 Lushan earthquake, etc. It was suggested that nurses in this region had a relatively low level of psychological problems and a higher level of resilience 6 years after the 2008 Sichuan earthquake [42]. This might help them better respond to other types of disasters, including public health emergencies. All the above could explain the higher GSES. It has also been identified in accumulative studies that higher GSES was negatively associated with depression and anxiety [43–45]. This might also explain the results in nurses of current study, which the self-efficacy was in the upper middle level and negatively correlated with anxiety and depression (Table 4).

4.2. The influencing factors associated with psychological effects of the COVID-19 on nurses in tertiary women's and children's hospitals

The sociodemographic data suggested that female nurses reported more severe anxiety and depressive symptoms, and lower self-efficacy than male (Table 3). It might be related to the difference in gender traits. Women are more concerned about inner experiences and self-perceptions, which made them more fragile and sensitive, and more vulnerable to depression, anxiety and loneliness [46–48]. Since the sample size of male nurses was small (1.8%) and the gender was not included in regression model (Table 5), whether female nurses were prone to psychological problems need further research to identify.

The regression analysis (Table 5) indicated that nurses with longer years of employment were more prone to anxiety and depression. It is consistent with some other studies which focused on psychiatric symptoms of nurses after emergent public health events [37,49]. It is probably attributed to more occupational burnout and family responsibilities accompanied with longer years of employment. Occupational burnout has been defined as a chronic response to work stress, and its three principal dimensions involve emotional exhaustion, depersonalization and reduced personal accomplishment [50,51]. It has also been identified in accumulative studies that length of employment was positively correlated with occupational burnout [52–54]. In response to public health emergencies, nurses with higher levels of job burnout and heavier workloads might be more likely to suffer anxiety and depression [55,56]. In addition, nurses would have richer working experience accompanied with longer years of employment, and they might be likely to have a better understanding of the severity and consequences of the disease. It was suggested that experienced nurses were more cautious in dealing with the impact of Hurricane Katrina and were prone to anxiety and depression [57]. While facing the emergent public health events, they had more experience in their fields and confidence to deal with the disease, which presented as higher scores for self-efficacy. Their higher levels of anxiety, depression and self-efficacy suggest that

Table 5
Multivariable logistic regression models for anxiety and depressive symptoms.

Variables	β	SE	Wald	*p*	OR (95%CI)
GAD-7, anxiety symptoms					
Gender (refence:Male)					
Female	0.334	0.432	0.600	0.439	1.397 (0.599–3.257)
Current department (refence:Gynecological ward)					
Maternity ward	0.022	0.169	0.018	0.894	1.023 (0.735–1.423)
Delivery room	0.019	0.254	0.006	0.941	1.019 (0.619–1.677)
Pediatric ward	0.371	0.164	5.124	0.024*	1.449 (1.051–1.999)
Emergency department	−0.018	0.277	0.004	0.949	0.983 (0.571–1.690)
Intensive Care Unit (ICU)	0.137	0.178	0.590	0.442	1.147 (0.809–1.627)
Outpatient department	0.385	0.320	1.442	0.230	1.469 (0.784–2.752)
Working status (refence:vacation)					
working	0.351	0.139	6.381	0.012*	1.421 (1.082–1.866)
Having cold-like symptoms (refence:No)					
Yes	0.269	0.188	2.061	0.151	1.309 (0.906–1.891)
Family members having cold-like symptoms (refence:No)					
Yes	0.338	0.220	2.354	0.125	1.402 (0.911–2.157)
Age,yr	0.023	0.025	0.788	0.375	1.023 (0.973–1.075)
Length of employment, yr	0.254	0.083	9.301	0.002**	1.289 (1.095–1.517)
PHQ-9, depression symptoms					
Gender (refence:Male)					
Female	−0.089	0.415	0.046	0.830	0.915 (0.405–2.063)
Current department (refence:Gynecological ward)					
Maternity ward	0.282	0.187	2.278	0.131	1.326 (0.919–1.914)
Delivery room	−0.195	0.307	0.406	0.524	0.823 (0.451–1.500)
Pediatric ward	0.670	0.181	13.698	0.000**	1.954 (1.371–2.787)
Emergency department	0.185	0.302	0.373	0.541	1.203 (0.665–2.174)
Intensive Care Unit (ICU)	0.241	0.200	1.449	0.229	1.272 (0.860–1.882)
Outpatient department	0.508	0.348	2.129	0.144	1.663 (0.840–3.291)
Working status (refence:vacation)					
working	0.255	0.152	2.832	0.092	1.291 (0.959–1.737)
Having cold-like symptoms (refence:No)					
Yes	0.442	0.194	5.190	0.023*	1.555 (1.064–2.274)
Family members having cold-like symptoms (refence:No)					
Yes	0.427	0.228	3.497	0.061	1.533 (0.980–2.399)
Age,yr	0.020	0.027	0.562	0.453	1.021 (0.968–1.077)
Length of employment, yr	0.245	0.090	7.355	0.007**	1.277 (1.070–1.524)

*P < 0.05 is statistically significant.
**P < 0.01 is statistically significant.

administrators should provide targeted training according to the nurse levels. For instance, the nurses with longer years of employment could be more trained with skills and measurements to deal with COVID-19 suspected and confirmed patients rather than emphasizing the outcome of the disease.

Logistic regression analysis also showed that, compared with working in Gynecological ward, nurses in pediatrics ward appeared to be significantly associated with both anxiety and depression (Table 5). With the rapid spread of the epidemic, more and more cases of children affected with COVID-19 were reported all over the world [58]. Cases of severe or even critically ill children have also been reported. Although, children with COVID-19 had milder clinical symptoms and better clinical outcomes, the incubation period of the highly contagious virus for children was longer than that for adults [59]. And, it was proved that SARS-CoV-2 would be mainly transmitted through respiratory droplets, and patients in the incubation period could transmit the virus to other persons [2]. Thus, nurses working in pediatric ward had higher risk of exposure to the disease than those in gynecological and obstetric ward. In addition, the patients in pediatrics are children who have lower self-discipline [60]. It is difficult for them to abide by the regulations against the virus, which caused stress on nurses who are caring them during epidemic. Both the possibilities to contact with infected children and the difficulties to care low self-discipline children increased the pressure of nurses and led to higher scores in anxiety and depression assessment.

In comparison with those on vacation, nurses stayed on their duties had an increased prevalence of anxiety. COVID-19 is a fulminant infectious disease with high transmission efficiency, rapid deterioration and pathogenicity. Although nurses working in women's and children's hospitals had less opportunity to directly contact with confirmed patients, it had been confirmed that COVID-19 is highly infectious during the incubation period, and asymptomatic infection exists as mentioned above [61]. All nurses on duty had the chance to contact with patients during asymptomatic period, and they had higher risk of infection than those on vacation. The regression analysis also showed that nurses who had cold-like symptoms were more likely to suffer from depression (Table 5). As COVID-19 is a newly identified pathogen, there is no known pre-existing immunity in humans. Based on the epidemiologic characteristics observed so far, everyone is assumed to be susceptible. It was reported that the risk of exposure to the disease may increase in people with underlying illness [62]. Therefore, nurses who were having cold-like symptoms were more vulnerable to the disease. They may experience more stress to dealing with this outbreak.

4.3. Limitations and future research

This study has several limitations. First, due to the constraints of time and resources, a convenience sampling strategy was applied. The nonrandom sampling in this study might raise the possibility of selection bias. Second, although the instruments used in present study have satisfactory psychometric properties, the self-reported levels of anxiety and depression may not always be aligned with a standard clinical interview, which might not reflect the true psychological status. Finally, since our study was conducted immediately after the breakout of the epidemic and the epidemic could not be anticipated before, it was very difficult to design a study with longitudinal comparisons to better establish causal relations.Thus, the cross-sectional design of this study limited our ability to establish causal relationships among study variables. Therefore, futher studies with a longer time frame for follow-up observations or an extended longitudinal study may be needed.

5. Conclusion

Nurses' psychological state had not been significantly affected by the epidemic situation. However, some risk factors including length of employment, working status, department and whether having cold-like symptoms were associated with their anxiety, depression and self-efficacy. Administrators could provide targeted training according to nurses levels in order to reduce anxiety and depression and further to improve their psychological health.

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Declaration of competing interest

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