


Predictors of critical care nurses' stress, anxiety, and depression in response to COVID-19 pandemic

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic directly affects the psychological well-being of critical care nurses. Several studies had investigated the psychological impact of the pandemic on nurses caring for patients with COVID-19, but few were conducted to identify the predictors of this impact.

Aims and objectives: The objective of this study is to identify the predictors of critical care nurses' stress, anxiety, and depression in response to the COVID-19 pandemic.

Design: A cross-sectional survey was conducted in five intensive care units in five hospitals in Alexandria, Egypt.

Methods: An online questionnaire was distributed. It included socio-demographic and work-related data and the depression, anxiety, and stress scale scores of the nurses under study. A multiple linear regression model was developed to identify the predictors of critical care nurses' stress, anxiety, and depression in response to the COVID-19 pandemic.

Results: Two hundred (64%) of 308 nurses completed the electronic questionnaire. Significant predictors of stress included the number of infected colleagues ($P < .001$) and availability of hospital resources ($P = .01$). Significant predictors of anxiety were age, gender, satisfactory income ($P < .001$), years of experience, time spent caring for patients with COVID-19 ($P = .04$), continuous training, number of infected colleagues ($P = .01$), and availability of hospital resources ($P = .02$). Finally, significant predictors of depression included gender, history of physical problems ($P = .04$), educational attainment, availability of hospital resources, history of psychological problems ($P < .001$), and number of infected colleagues ($P = .001$).

Conclusion: The hospital's lack of human and physical resources and the number of colleagues infected with COVID-19 were the strongest predictors of stress, anxiety, and depression among nurses.

Relevance to clinical practice: Identifying the predictors of stress, anxiety, and depression among nurses who care for patients with COVID-19 is a vital step in developing mental health promotion strategies to support nurses during this pandemic.

KEYWORDS

anxiety, COVID-19, critical care nurses, depression, predictors, stress

1 | BACKGROUND

The coronavirus disease 2019 (COVID-19) pandemic is a substantial health burden that has major implications for public health globally.^{1,2} At this time, 478 160 deaths have been detected in more than 200 countries.³ In mid-April 2020, the COVID-19 mortality rate in Egypt reached 7.5%.⁴ As the pandemic accelerates, health care providers have become overwhelmed and drained because of joining the pandemic control efforts.

Health care providers are essential resources in every country. Their safety is necessary not only for delivering consistent and safe patient care but also for crisis management. Critical care nurses (CCNs) are among the frontline teams caring for patients with COVID-19 and are facing risks constantly due to huge workload, understaffing, long-term fatigue, infection threat, and frustration with the patients' deaths, causing more psychological pressure.^{5,6} Moreover, CCNs face many challenges while caring for patients with COVID-19, such as longer working hours, lack of specific drugs and protocols, lack of personal protective equipment, and being away from family. According to Labrague and Santos³ and Wilson et al,⁷ high stress levels had resulted in post-traumatic stress disorder. Additionally, these studies had considered stigmatization, resignation, fear of contagion, and spread among friends and families, all of which resulted in higher levels of stress, depression, and anxiety.

A study by Wilson et al⁷ assessed the prevalence and predictors of stress, depressive, and anxiety symptoms among health care providers in India and revealed that the prevalence of high-level stress was 3.7%, while the prevalence rates of depression needing treatment and anxiety were 11.4% and 17.7%, respectively. Females had twice the risk of experiencing moderate- or high-level stress, depression requiring treatment, and anxiety. Similarly, females who stayed in temporary accommodation had double the risk of developing depression or anxiety.⁸

Several factors may affect the physical and psychological states of nurses during COVID-19 infection, such as age, gender, years of experience, a history of psychological illness, the presence of comorbidities, and perceived inability to de-stress. Therefore, there is a tremendous need for early assessment and measures to focus on the psychological needs of CCNs. If these psychological predictors were not detected and managed effectively, nurses may not only have a decline in their immunity, which increases the chances of COVID-19 infection, but also have an adverse impact on the safety and quality of the health care system.^{5,8}

2 | AIM

This study was designed to identify the predictors of stress, anxiety, and depression of CCNs in response to the COVID-19 pandemic.

What is known about this topic

- Coronavirus disease 2019 (COVID-19) is an extremely infectious disease that spreads quickly, particularly among health care providers, especially critical care nurses, causing physical and psychological adverse effects.
- Factors that contribute to higher levels of stress, anxiety, and depression related to COVID-19 require further evaluation to provide appropriate support to nurses during this pandemic.
- Most cross-sectional studies that identified factors contributing to higher levels of stress, anxiety, and depression among critical care nurses did not predict their relationship.

What does this paper add

- This study utilized a novel evaluation method to identify factors of high levels of stress, anxiety, and depression among critical care nurses who care for patients with COVID-19.
- Identifying these factors is critical for developing management strategies to reduce the levels of stress, anxiety, and depression among critical care nurses caring for patients with COVID-19.

3 | METHODS

3.1 | Design, setting, and sample

A cross-sectional survey design was adopted for this study. The study sample was selected from five intensive care units (ICUs) in five hospitals that care for patients with COVID-19 in Alexandria, Egypt. The sample size was estimated using G*Power (version 3.1.9.7) for multiple linear regression analysis. The minimum sample size was 118 based on an effect size of 0.15 with a power of 80% for 12 predictors and a statistically significant level of .05. The inclusion criteria were CCNs of both sexes who provided direct care for patients with COVID-19 for at least 1 week. The exclusion criterion was CCNs who are not bedside nurses.

3.2 | Research instruments

An electronic questionnaire was used in this study. The questionnaire was composed of two parts. Part one consisted of items regarding socio-demographic and work-related variables. The socio-demographic variables included gender, social status, educational attainment, satisfactory income, and history of physiological and psychological problems. The

work-related variables included years of ICU experience, continuous education and training on infection control, time spent caring for patients with COVID-19 per week, the number of colleagues infected with COVID-19, and the availability of hospital resources.

Part two was the depression, Anxiety and Stress Scale (DASS-21), which was developed by Henry and Crawford.⁹ This scale included a 21-item self-report questionnaire designed to assess the severity of the core symptoms of depression, anxiety, and stress; each sub-scale had seven items. The depression sub-scale assessed nurses' feelings of meaning in life, the lack of initiative to do things, and the inability to become enthusiastic about anything. The anxiety sub-scale assessed physical and psychological cues of anxiety. The stress sub-scale assessed reactivity towards stressful situations, nervous energy, and agitation. Each item was scored from 0 (not being applied at all over the last week) to 3 (being applied very often or most of the time over the past week). For each sub-scale, the sum of the scores was calculated, and the total score ranged between 0 and 63. The key variables of this survey were chosen based on an extensive review of the related literature, clinical experience, and the use of one of the most reliable and valid scales for measuring depression, anxiety, and stress (DASS-21). A pilot test was conducted on 30 CCNs to ensure the face validity of the questionnaire, and no changes were needed.

3.3 | Method

3.3.1 | Data collection

All nurses in the previously mentioned settings were invited to participate in the study via email or WhatsApp. Nurses who accepted the invitation to participate were included in the study. Nurses' socio-demographic and work-related data were assessed. A survey was distributed online via Google Forms to all nurses working in ICUs, who cared for patients with COVID-19, to assess the predictors of stress, anxiety, and depression of CCNs in response to the COVID 19 pandemic.

3.4 | Ethical considerations

Ethical approval was obtained from the Faculty of Nursing Ethics Committee at Alexandria University before the study was conducted (approved on 13 August 2020). An electronic informed consent was obtained from all nurses after explanation of the aim of the study through emails and WhatsApp. All nurses were informed that participation in this study was optional, and they could withdraw from the study without giving reasons. Nurses' privacy was respected. Data confidentiality was assured during the implementation of the study.

3.5 | Statistical analysis

Statistical Package for the Social Sciences (version 26.0; IBM Corp., Armonk, New York) was used to analyse the data of this study.

Categorical variables were presented in number and percentage. Continuous variables were examined for normality of data distribution using the Shapiro–Wilk test, and they were normally distributed. They were presented in mean and standard deviation. Pearson's correlation coefficients were used to determine linear relationships between a pair of continuous normally distributed variables. One-way analysis of variance was performed to find the relationship between categorical normally distributed variables. The paired sample *t*-test was used to determine the relationship between two continuous normally distributed variables. *P* values less than .05 were used to denote statistical significance.

Multiple linear regression was used to identify the predictive factors of nurses' stress, anxiety, and depression. Variables that were significantly associated with stress, depression, and anxiety were used in multiple linear regression analysis. The multiple linear regression was conducted according to the following steps. Firstly, a univariate analysis was performed for each independent variable. This step was conducted to investigate the socio-demographic and occupational variables associated with the dependent variables, which were stress, anxiety, and depression. All independent variables with *P* < .05 from the first step were divided into two blocks. The two blocks were the socio-demographic variables and the occupational variables blocks. Variables in the blocks with *P* < .05 were included in the last step of the multivariate linear regression analysis. A total of 12 independent variables were investigated.

4 | RESULTS

In this study, 308 nurses were invited to participate. The response rate was 64%. Table 1 shows that the age of 70.5% of the nurses was between 20 and 40 years. Moreover, 61.5% of the nurses were females, and 67.0% were married. Nurses who had a bachelor's degree accounted for 84.5% of the sample. More than half (61.0%) of the nurses expressed unsatisfied income. Only 5% of nurses had a history of physiological problems, and 4% had a history of psychological problems.

Regarding work-related data, 73.5% of the nurses reported having between 1 and 5 years of ICU experience. The percentage of nurses who attended continuous training and education on infection control was 86.0%. Nurses who spent 36 hours or less caring for patients with COVID-19 per week accounted for 98.0% of the total sample. The percentage of nurses who reported having colleagues infected with COVID-19 was 87.5%. More than half (54.0%) of the nurses reported the unavailability of hospital resources.

Frequency description of CCNs' stress, anxiety, and depression is illustrated in Table 2. Moreover, among the nurses under study, 38.5% had severe stress, 10% had extremely severe stress, 62% had severe anxiety, and 34.5% had moderate depression.

Table 3 shows the association between the nurses' characteristics and their stress, anxiety, and depression. Regarding stress, increase in nurses' age (*P* = .001) and a history of physiological problems (*P* = .03) were significantly associated with high stress scores.

Critical care nurses' data		No.	%
Socio-demographic characteristics			
Age	<20 years	2	1.0
	20-40 years	141	70.5
	≥40 years	57	28.5
Gender	Male	77	38.5
	Female	123	61.5
Social status	Single	66	33.0
	Married	134	67.0
Educational attainment	Diplomat	2	1.0
	Technical	29	14.5
	Bachelor	169	84.5
Satisfactory income	Satisfied	78	39.0
	Unsatisfied	122	61.0
History of physiological problem	Yes	10	5.0
	No	190	95.0
History of psychological problem	Yes	8	4.0
	No	192	96.0
Occupational history			
Years of ICU experiences	<1 year	6	3.0
	1-5 years	147	73.5
	6-10 years	39	19.5
	>10 years	8	4.0
Continuous education and training on infection control	Yes	172	86.0
	No	28	14.0
Duration spent in caring for COVID 19 patients/week	≤36 hours	196	98.0
	>36 hours	4	2.0
Infected colleagues with COVID 19	Yes	175	87.5
	No	25	12.5
Availability of hospital resources	Yes	108	54.0
	No	92	46.0

TABLE 1 Frequency distribution of critical care nurses according to their characteristics (n = 200)

Abbreviation: ICU, intensive care unit.

TABLE 2 Frequency description of critical care nurses' stress, anxiety, and depression (n = 200)

Psychological characteristics	Severity of psychological characteristics (N = 200)									
	Normal		Mild		Moderate		Severe		Extremely Severe	
	No.	%	No.	%	No.	%	No.	%	No.	%
Stress	60	30%	31	15.5%	12	6%	77	38.5%	20	10%
Anxiety	28	14%	8	4%	31	15.5%	124	62%	9	4.5%
Depression	95	47.5%	36	18%	69	34.5%	0	0%	0	0%

Furthermore, decreased years of ICU experience ($P = .02$), absence of continuous education and training on infection control ($P < .001$), longer time spent caring for patients with COVID-19 per week ($P = .04$), the increased number of colleagues infected with COVID-19 ($P = .04$), and the unavailability of hospital resources ($P < .001$) were significantly associated with high stress scores.

Regarding anxiety, increase in nurses' age ($P = .04$), female gender ($P = .01$), unsatisfactory income ($P = .03$), history of physiological problems ($P = .02$), and history of psychological problems ($P = .001$) were significantly associated with higher anxiety scores. Additionally, decreased years of ICU experience ($P = .01$), absence of continuous education and training on infection control ($P < .001$), longer time spent caring for patients with

TABLE 3 Association between nurses' characteristics and nurses' stress, anxiety, and depression

Critical care nurses' data	Univariate analysis (t/F/r, P)		
	Stress	Anxiety	Depression
Socio-demographic characteristics			
Age	r = 0.21, P = .001**	r = 0.17, P = .04*	r = -0.11, P = .07
Gender	t = -0.51, P = .62	t = -2.61, P = .01*	t = -2.61, P = .01*
Social status	F = 1.01, P = .23	F = 0.28, P = .65	F = 12.03, P = .001**
Educational attainment	F = 1.30, P = .27	F = 2.23, P = .11	F = 7.40, P = .001**
Satisfactory income	t = -0.47, P = .64	t = 2.99, P = .03*	t = -1.94, P = .06
History of physiological problem	t = 4.55, P = .03*	t = 5.21, P = .02*	t = 18.04, P > .001**
History of psychological problem	t = 2.81, P = .09	t = 12.33, P = .001**	t = 5.06, P > .001**
Occupational history			
Years of ICU experiences	r = -0.81, P = .02*	r = -0.19, P = .01*	r = -0.15, P = .06
Continuous education and training on infection control	t = -0.44, P > .001**	t = -0.36, P > .001**	t = 0.59, P = .55
Duration spent in caring for COVID 19 patients/week	r = 0.15, P = .04*	r = 0.51, P = .02*	r = 0.12, P = .10
Infected colleagues with COVID 19	t = 2.01, P = .04*	t = 3.61, P = .03*	t = 3.89, P > .001**
Availability of hospital resources	t = 7.06, P > .01**	t = 2.99, P = .001**	t = 2.92, P = .001*

Abbreviation: ICU, intensive care unit.

Note: * is significant; ** is highly significant; t, paired sample t test; F, One-way ANOVA; r, Pearson correlation coefficient.

COVID-19 per week ($P = .02$), increased number of colleagues infected with COVID-19 ($P = .03$), and the unavailability of hospital resources ($P = .001$) were significantly associated with high anxiety scores.

Regarding depression, female gender ($P = .01$), married nurses ($P = .001$), increased educational attainment ($P = .001$), history of physiological problems ($P < .001$), and history of psychological problems ($P < .001$) were significantly associated with high depression scores. Moreover, increased number of colleagues infected with COVID-19 ($P < .001$) and unavailability of hospital resources ($P = .001$) were significantly associated with high depression scores.

Multiple linear regression analysis for predictive variables of stress, anxiety, and depression showed that the presence of infected colleagues and the unavailability of hospital resources were significant predictors, accounting for 11% of the variance in the stress score. Increasing age, female gender, unsatisfactory income, decreased years of experience, lack of continuous training and education, increasing time spent caring for patients with COVID-19, the presence of infected colleagues, and the unavailability of hospital resources were significant predictors, accounting for 21% of the variance in the anxiety score. Female gender, decreased educational attainment, a history of physical and psychological problems, the presence of infected colleagues, and the unavailability of hospital resources were significant predictors, accounting for 32% of the variance in the depression score (Table S1).

5 | DISCUSSION

Global health care systems have become overwhelmed with caring for patients with COVID-19. As the pandemic spread, CCNs became a

high-risk group for acquiring COVID-19 infection, and as a result, more psychological disorders were detected among them. The likelihood of infected colleagues increases over time, and this may be a source of anxiety and stress in ICUs. The findings of this study revealed that nearly all nurses spent 36 hours or less caring for patients with COVID-19 per week. Most had colleagues infected with COVID-19, and only half of the nurses reported the availability of hospital resources. These results highlighted the need for continuous improvement in both physical and human resources in ICUs. This conforms to the findings of Liu et al,⁶ who reported the infection of more than 3000 medical staff. The need for continuous improvement in both physical and human resources was supported by Breillat and Birtus,^{10,11} who highlighted the importance of fully equipped nurses to enhance their competencies in facing COVID-19. Labrague and Santos³ had revealed that most nurses were not fully equipped to care for patients with COVID-19, and their willingness to take care of them had decreased.

Because CCNs are involved directly as the first-line health care providers caring for patients with COVID 19, assessing their psychological status and implementing measures to support them in facing this pandemic are essential. This study found that slightly more than one-third of the CCNs experienced severe stress, while nearly two-thirds of them experienced severe anxiety, and approximately one-third of them experienced moderate depression. These results were consistent with those of Zhu et al,¹² who showed that one-third of 5000 health care practitioners in Wuhan experienced more stress, but the prevalence rate of severe anxiety and depression was low compared with that in this study. This conforms to the surveys of Chinese staff, which showed that most Chinese staff experienced traumatic

stress, half of them had depression, and nearly half of them had generalized anxiety.^{13,14,15} These survey findings were in line with those of Lee et al,¹⁶ who revealed that approximately half of the nurses experienced dysfunctional anxiety related to COVID-19 and considered these findings as a low level of anxiety, which may be attributed to the improved knowledge of nurses about preventive measures for COVID-19. Mo et al¹⁷ and Teles et al¹⁸ had concluded that applying measures to decrease the dysfunctional level of anxiety among CCNs is essential as it is a major predisposing factor for depression and other psychological disorders. In contrast, Labrague and Santos³ had revealed that only one-third of the nurses in the Philippines had dysfunctional anxiety. This may be due to the increased knowledge about the nature, transmission, signs, and symptoms of COVID-19 and its preventive measures compared with the general population. Additionally, Wilson et al⁷ had reported that the prevalence of high-level stress among Indian nurses caring for patients with COVID-19 was low, and that of anxiety and depressive symptoms requiring treatment was low. This may be due to a decrease in COVID-19 transmission, thus decreasing the number of patients because of the ongoing nationwide lockdown and resilience of Indian physicians during their professional life.¹⁹ However, the same study showed most nurses had moderate stress.

In this study, we analysed the predictors of stress, depression, and anxiety. Regarding the predictors of stress, only the lack of hospital resources and the number of colleagues infected with COVID-19 were significant predictors of stress among CCNs. These findings were consistent with those of Wilson et al,⁷ who discovered that female gender was a significant predictor of psychological stress among rarely affected health care workers, with females having a 2-fold higher risk of stress than males. Thus, the Indian government had taken several initiatives trying to overcome the psychological needs of females. Additionally, this finding was consistent with the findings of Lai et al¹⁴ and Mushtaq et al,²⁰ who showed a significant increase in psychological stress among female nurses. However, Mushtaq et al²⁰ have revealed that staying away from home or living in temporary accommodation was another significant predictor of developing stress.

Another finding of this study was that increasing age, female gender, unsatisfactory income, years of ICU experience from 1 to 5 years, lack of continuous education and training on infection control, time spent caring for patients with COVID-19 per week for more than 36 hours, the number of colleagues infected with COVID-19, and the lack of hospital resources were predictors of anxiety among CCNs. These findings were in line with those of Wilson et al,⁷ Lai et al,¹⁴ and Huang et al,¹³ who revealed that female gender and decreased years of experience were predictors of anxiety among nurses. Additionally, they revealed that staying in temporary accommodation was another significant predictor of anxiety. Also, a study by Shaukat, Ali, and Razzak²¹ had revealed that frontline female nurses working in close contact with patients with COVID-19 for longer hours were highly at risk of developing anxiety, which conforms to the findings of this study. In contrast, Zhu et al¹² had revealed that many years of experience, the presence of chronic diseases, a history of mental disorders, and the presence of suspected infection among family members were

risk factors for anxiety among health care workers during the COVID-19 pandemic.

This study revealed that female gender, educational attainment as technical nurses, a history of physiological and psychological problems, the number of colleagues infected with COVID-19, and the unavailability of hospital resources were predictors of depression among CCNs. This was consistent with the findings of Lai et al,¹⁴ who discovered that female technical nurses' frequent contact with patients with COVID-19 and caring for COVID-19 patients for a longer time were risk factors for severe depression. This was also in line with the findings of Zhu et al,¹² who revealed that the presence of chronic diseases, a history of psychological disorders, and the presence of suspected infection among family members were risk factors for depression among health care workers during the COVID-19 pandemic; moreover, they added that more than 10 years of experience was another risk factor for depression. In contrast, Shen et al⁵ had revealed that less experienced nurses caring for critically ill patients developed depressive signs and symptoms compared with experienced nurses.

6 | LIMITATIONS OF THE STUDY

None of the nurses, who responded to the survey, reported to have severe or extremely severe depression. Thus, they were not presented in the study sample. There may be a systematic bias because of the willingness of some nurses to participate and complete the survey, while others ignored it. Due to the nature of an online questionnaire without face-to-face interviews, the reliance on self-report had limitations, as it may be prone to misinterpretation. Finally, this study represented the variables in a specific period, and the analysis may be different in further studies as psychological status is probably a dynamic parameter that fluctuates in response to stressors and the peak of COVID-19.

7 | CONCLUSION AND RECOMMENDATION

Female CCNs who had a colleague infected with COVID-19, decreased professional development, and the lack of both human and physical resources in hospitals represent the major predictors of stress, anxiety, and depression among nurses. Therefore, early monitoring of these predictors and encouragement of prompt management of hospitals' physical and human resources are required. Moreover, psychological support and motivation for nurses are required.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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