



Quality of Care and Mental Health among Nurses during the COVID-19 Pandemic: Results of a Canonical Correlation Analysis

Esmat Boshag¹, Fereshteh Davoodi^{2*}, Reza Bahari³ and Kimia Taheri Aligoodarzi³

¹Lecturer, Department of Nursing, School of Medical Sciences, Islamic Azad University of Aligoodarz, Lorestan, Iran

²MSc in Epidemiology, Department of Epidemiology, Faculty of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³BSc Student of Nursing, Department of Nursing, Islamic Azad University of Aligoodarz, Lorestan, Iran

* **Corresponding author:** Fereshteh Davoodi, Department of Epidemiology, Faculty of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Tel:09168641305; Email: davoodifershteh7@yahoo.com

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Abstract

Background: Nurses have experienced severe psychological stress which seriously affected their mental health during the Coronavirus disease 2019 (COVID-19) pandemic due to exposure to numerous critically ill patients, increased working time, and their colleagues' disease or demise.

Objectives: The present study aimed to examine clinical nurses' mental health status and elucidate its relationship with the quality of care provided by them.

Methods: This cross-sectional descriptive study was conducted in 2020 on the nurses working at two hospitals affiliated with Lorestan University of Medical Sciences. A total of 104 nurses were selected from all wards via convenience sampling. The data were collected using the Quality Patient Care Scale and Goldberg and Williams's General Health Questionnaire to check nurses' general health status. Statistical tests, including canonical correlation analysis, were used to analyze the data in SPSS software (version 20).

Results: There was a negative correlation between mental health and the quality of care provided by male ($\rho = -0.556$; $P < 0.001$) and female ($\rho = -0.351$; $P = 0.017$) nurses. Social dysfunction, anxiety, and insomnia in male nurses, as well as somatic symptoms and social dysfunction in female nurses, had the largest share of their general health, while physical care had the largest share of nursing care quality.

Conclusion: As evidenced by the obtained results, female nurses had better mental health status and provided higher-quality nursing care during the COVID-19 pandemic, as compared to male nurses. This higher quality may be attributed to women's better mental health status. The important findings of the current study highlight the necessity of regular programs for the improvement of nurses' mental health, thereby enhancing the quality of nursing care.

Keywords: Care quality, COVID-19, Mental health, Nurses

1. Background

Coronavirus disease 2019 (COVID-19) is an acute disease of the respiratory system which was first observed in China. On 11 March 2020, the World Health Organization (WHO) announced a pandemic state due to high transmissibility and consequences of this disease (1). The most common clinical symptoms of COVID-19 include fever, coughs, and fatigue. In addition to the lungs, this virus damages other tissues of the body (2). The mortality rate of COVID-19 has been estimated at 3.4% (3, 4). Its high prevalence in the entire population of many countries, as well as its novelty and infectious nature, have raised mental health issues.

Based on the result of a longitudinal study on the total Chinese population, although post-traumatic stress disorder (PTSD) considerably declined four weeks after the initial epidemic peak, the participants' higher scores of PTSD from the cut points indicate the presence of PTSD in the Chinese population (5). Moreover, in a secondary analysis of a national longitudinal cohort study in the United Kingdom, adults' mental health was assessed using a general health questionnaire before and during the lockdown days. The results indicated that the

prevalence of mental distress reached from 18.9% in 2018-19 to 27.3% in 2020 (6).

The COVID-19 outbreak and its subsequent psychological problems not only have affected the general population but also have challenged the mental health of healthcare workers. Since healthcare workers are on the front line of healthcare provision to patients with COVID-19, they run a serious risk of contracting this disease (7, 8). Healthcare workers are under stressful conditions during the current pandemic due to heavy workload and pressure, limited facilities, exposure to high rates of patient mortality, and unpredictability of the disease (9, 10). Numerous studies have investigated the mental health consequences in health care workers handling patients with COVID-19.

A systematic review and meta-analysis in 2020 assessed the evidence on the prevalence of depression, anxiety, and insomnia among health care workers during the COVID-19 outbreak. Based on the results of this study, the pooled prevalence rate of anxiety, depression, and insomnia was estimated at 23.2%, 22.8%, and 16.5%, respectively (11). In a study in China in February 2020 on people at risk of COVID-19, especially healthcare workers, the prevalence rates of harmful stress, depression,

general anxiety, and insomnia were reported to be 73.4%, 50.7, 44.7%, and 36.1%, respectively (7). Moreover, in a study by Hosseinabadi et al. (2020) in Torbat Heydarieh (Iran), the nurses working in COVID-19 wards demonstrated moderate levels of anxiety and depression (12).

Based on the evidence, apart from its psychological and physical impacts on the personnel, stress can reduce organizational efficiency and nurses' performance quality (13, 14) in the pandemic era. Nurses' physical and mental health may be associated with the quality of care provided by them, their job satisfaction, and efficiency (15). Motivated by the absence of similar studies during the pandemic, the current study was conducted to determine the relationship between nurses' mental health status and the quality of care provided by them in Imam Jafar and Shahid Valian Hospitals (Aligoodarz, Iran). The results of this cross-sectional descriptive study may lay the groundwork for more informed and precise care, protection, and management programs for healthcare providers.

2. Objectives

The present study aimed to examine clinical nurses' mental health status and elucidate its relationship with the quality of care provided by them.

3. Methods

3.1. Study design

This cross-sectional descriptive study was conducted from June-July 2020 among clinical nurses working at two hospitals affiliated to the Iranian Ministry of Health and Medical Education (MoHME) in Aligoodarz, Lorestan (west of Iran).

3.2. Participants

The participants were 104 nurses working at Imam Jafar and Shahid Valian hospitals affiliated with Lorestan University of Medical Sciences during the COVID-19 pandemic. The inclusion criteria for nurses were: at least three months of experience working in a clinical ward, holding an A.D., B.Sc., or M.Sc. in nursing, and having worked in the ward for at least one full shift. The exclusion criterion was the presence of any psychological disorder.

3.3. Ethical considerations

The study protocol was approved by the Regional Ethics Committee of Lorestan University of Medical Sciences (code IR.IAU.B.REC.1399.053). One of the researchers briefed all the participants about the objectives of the study and ensured them that they could withdraw from the study at any time. All the participants provided informed consent for participation.

3.4. Data collection

A total of 104 nurses working in all wards of the mentioned hospitals were selected to assess the relationship between their mental health status and the quality of nursing care. The nurses who had worked in a clinical ward for at least three months, hold an A.Sc./B.Sc./M.Sc. in nursing, and had worked in that ward for at least one full shift were included. A checklist was used to record the information about gender, age, work experience, education level, and marital status. Two standard questionnaires were also administered to collect data: Goldberg and Williams' General Health Questionnaire (GHQ) and the Quality Patient Care Scale (QUALPAC) (meeting patients' needs through targeted care with suitable communication, support, mutual respect, accountability, and responsiveness).

3.5. Measurement

3.5.1. General Health Questionnaire

The GHQ-28 is a 28-item questionnaire with four subscales aiming to detect minor psychiatric disorders in nurses. These subscales include somatic symptoms (items 1, 3, 4, 8, 12, 14, and 16), anxiety and insomnia (items 2, 7, 9, 13, 15, 17, and 18), social dysfunction (items 5, 10, 11, 25, 26, 27, and 28), and severe depression (items 6, 19, 20, 21, 22, 23, and 24) (16). The items are scored on a four-point Likert scale (0: not at all, 1: no more than usual, 2: rather more than usual, and 3: much more than usual), with a total score of 0-84. Higher scores indicate higher levels of distress. The cut-off score for clinical relevance was set at 24, as previously described (17). According to Sterling, the test-retest reliability of this questionnaire is high (0.78-0.90), and the interrater and intra-rater reliability is excellent (Cronbach's α : 0.90-0.95). In the present study, its internal consistency based on Cronbach's alpha was $\alpha = 0.86$ which is acceptable.

3.6. Quality Patient Care Scale

The Quality Patient Care Scale (QUALPAC) comprises three dimensions of physical (n=24), psychosocial (n=), and communication, with 65 items in total (24 for physical, 28 for psychosocial, and 13 for communication dimensions) and is scored on a three-point Likert scale (rarely: 0, sometimes: 1, most often: 2). The total scores range from 9-130 and are divided into three categories: unfavorable (0-43), desirable (44-87), and very desirable (87-130). In Iran, Haghghi and Khoshkhoo (2004) confirmed its reliability and validity when assessing the quality of nursing care from the viewpoint of nurses and patients in training healthcare centers (18). In the present study, the internal consistency of QUALPAC by Cronbach's alpha was $\alpha = 0.855$, which is acceptable.

3.7. Sample size

Since there was no similar study in the literature,

we conducted a pilot study to determine the sample size. In this pilot study, based on the rule of thumb (19), we considered 10 participants per variable and a total of 20 participants, according to which the correlation coefficient was 0.34. The pilot study was a small-scale one to predict an appropriate sample size for the full-scale study, where all standards of the full-scale study were considered including sample selection (inclusion and exclusion criteria) and ethical consideration. Subsequently, the sample size was determined according to the following formula, a 95% confidence level, and test power of 80%. Considering a 10% attrition rate, the sample size of 104 nurses was deemed sufficient. The participants were selected from all the wards of the chosen hospitals using convenience sampling.

$$n = \left(\frac{Z_{(1-\frac{\alpha}{2})} + Z_{(1-\beta)}}{\frac{1}{2} \ln\left(\frac{1+r}{1-r}\right)} \right)^2 + 3$$

3.8. Data analysis

The Kolmogorov-Smirnov test was performed to check the normality of data distribution. In case of a violation of normal distribution, the data that deviated more than 5 standard deviations (SD) from the mean were deleted pairwise. We used principal component analysis (PCA) to identify multicollinearity in each set of variables (eigenvalues of zero or near zero). Descriptive statistics were applied to summarize the demographic

and clinical data, and canonical correlation analysis (CCA) was performed to analyze the relationship between GHQ and the quality of nursing care. The CCA was carried out using four variables of GHQ as the predictors of three variables of nursing care quality among men and women separately. The determinant variables that affected the entire relationship were identified in GHQ and the quality of nursing care. The statistical significance threshold was set at 0.05. According to Cohen (1988) (20), $r = 0.10, 0.30,$ and 0.50 represent small, medium, and large correlations, respectively. All the data were analyzed in SPSS 20 (SPSS Inc., Chicago, IL, USA).

4. Results

Out of 104 nurses, 80 (77%) cases were female. The majority of participants (43.3%) belonged to the age group of 30-36 years, and 92.3% of them had a B.Sc. The majority of the nurses (35.6%) were permanently employed, and 63.5% of them were married. Moreover, 67.3% of the nurses worked rotating shifts. Many of them (22.1%) worked in the surgical ward, and 53.8% had a working experience of up to five years. Furthermore, 51.9% of them reported up to two years of working experience in the ward (Table 1).

4.1. Canonical correlation analysis

Table 2 presents the descriptive statistics of each

Table 1. Frequency distribution of demographic information and clinical characteristics of the nurses

Variable		Combined (n = 104)	Women (n = 80)	Men (n = 24)
Age(years)	23- 29	39 (37.5%)	31 (38.8%)	8 (33.3%)
	30-36	45 (43.3%)	32 (40.0%)	13 (54.2%)
	> 37	20 (19.2%)	17 (21.3%)	3 (12.4%)
Education	A.Sc & B.Sc.	100 (93.3%)	73 (91.3%)	24 (100.0%)
	M.Sc.	7 (6.7%)	7 (8.8%)	0 (0.0%)
Employment	Permanent	37 (35.6%)	32 (40.0%)	5 (20.8%)
	Contractual	33 (31.7%)	19 (23.8%)	14 (58.3%)
	Temporary to permanent	11 (10.6%)	8 (10.0%)	3 (12.5%)
	Conscription	23 (22.1%)	21 (26.3%)	2 (8.3%)
Marital Status	Single	38 (36.5%)	26 (32.5%)	12 (50.0%)
	Married	66 (63.5%)	54 (67.5%)	12 (50.0%)
Shift	Morning & Evening	30 (28.9%)	27 (33.8%)	3 (12.5%)
	Night	4 (3.8%)	2 (2.5%)	2 (8.3%)
	Rotational	70 (67.3%)	51 (63.7%)	19 (79.2%)

Note: All the values are presented as n (%).

Abbreviation years: years; A.Sc.: Associate of Science; B.Sc.: Bachelor of Science; M.Sc.: Master of Science

Table 2. Detailed values of general health and care quality among nurses during the COVID-19 pandemic

Testing items (range)	Combined (n = 104)	Women (n = 80)	Men (n = 24)	p-value†
General Health				
Somatic symptoms (0-21)	6.71±4.15	6.65±3.89	6.92±5.01	0.784
Anxiety and insomnia (0-21)	6.67±5.41	6.64±5.20	7.37±6.15	0.472
Social dysfunction (0-21)	7.99±4.05	8.10±4.04	7.63±4.15	0.617
Depressive symptoms (0-21)	3.00±4.34	2.70±4.08	4.00±5.10	0.200
Total (0-84)	24.38±13.22	23.91±12.10	25.92±16.61	0.517
Nursing care				
Psychosocial (0-56)	41.23±7.32	42.54±7.81	36.88±8.51	0.113
Communicational (0-26)	20.08±3.86	20.55±3.54	18.50±4.83	0.265
Physical (0-48)	36.73±7.66	38.49±6.92	30.88±7.69	0.016
Total (0-130)	108.04±15.47	102.58±15.85	98.25±16.55	0.042

† The result of independent samples t-test

Table 3. Correlation between the subscales of general health and the quality of nursing care among nurses during the COVID-19 endemic

Variables	Quality of nursing care, psychosocial	Quality of nursing care, communication	Quality of nursing care, physical
Female			
GHQ somatic symptoms	-.062 (.591)	.071 (.540)	.121 (.294)
GHQ anxiety and insomnia	.045 (.697)	.063 (.584)	.113 (.329)
GHQ social dysfunction	.228 (.046)	.231 (.043)	.367 (.001)
GHQ depressive symptoms	-.093 (.421)	-.088 (.448)	-.057 (.625)
Male			
GHQ somatic symptoms	.163 (.481)	.238 (.299)	.106 (.648)
GHQ anxiety and insomnia	.084 (.716)	-.082 (.724)	-.017 (.943)
GHQ social dysfunction	.113 (.627)	-.054 (.817)	.222 (0.332)
GHQ depressive symptoms	-.219 (.340)	-.119 (.607)	-.079 (.733)

Note: The values are presented as correlation coefficient (p-value); All p-values are based on partial correlation adjusting for age, marital status, and shift.

subscale in GHQ and the quality of nursing care. In general, male nurses scored higher in all general health subscales, indicating that men had a poorer health status than women. Nonetheless, the difference between men and women in terms of general health and its subscales was not statistically significant. Female nurses' high scores in all the subscales of nursing care quality signified that this factor was far better in women than men. The high mean score of the physical dimension of nursing care quality and the total score of this factor among female nurses were also statistically significant ($P=0.016$ and $P=0.042$, respectively). As displayed in Table 3, mild-to-moderate correlations between and within the four general health subscales and three subscales of nursing care quality could be inferred among women and men, respectively.

4.2. Analysis of variance explained of canonical function

From the above-mentioned analysis, four general health subscales and three subscales of nursing care quality were included in the CCA. The correlation coefficients of the first canonical function exhibited statistical significance in females ($P=-0.351$; $P=0.017$) and men ($P=-0.556$; $P<0.001$). The equations were obtained based on standardized canonical correlation coefficients between the first canonical function (v_1 in GHQ and u_1 in quality of nursing care) and the variables.

Women:

$$v_1 = -0.540 * \text{somatic symptoms} - 0.177 * \text{anxiety and insomnia} - 0.869 * \text{social dysfunction} - 0.085 * \text{depressive symptoms}$$

$$u_1 = 0.377 * \text{psychological} + 0.418 * \text{communication} + 0.324 * \text{physical}$$

Men:

$$v_1 = -0.582 * \text{somatic symptoms} - 0.513 * \text{anxiety and insomnia} - 0.656 * \text{social dysfunction} - 0.489 * \text{depressive symptoms}$$

$$u_1 = 0.139 * \text{psychological} + 0.516 * \text{communication} + 0.700 * \text{physical}$$

Note that v_1 explained 24% and 70% of general health variance in female and male nurses, respectively, while u_1 explained 25% and 34% of general health

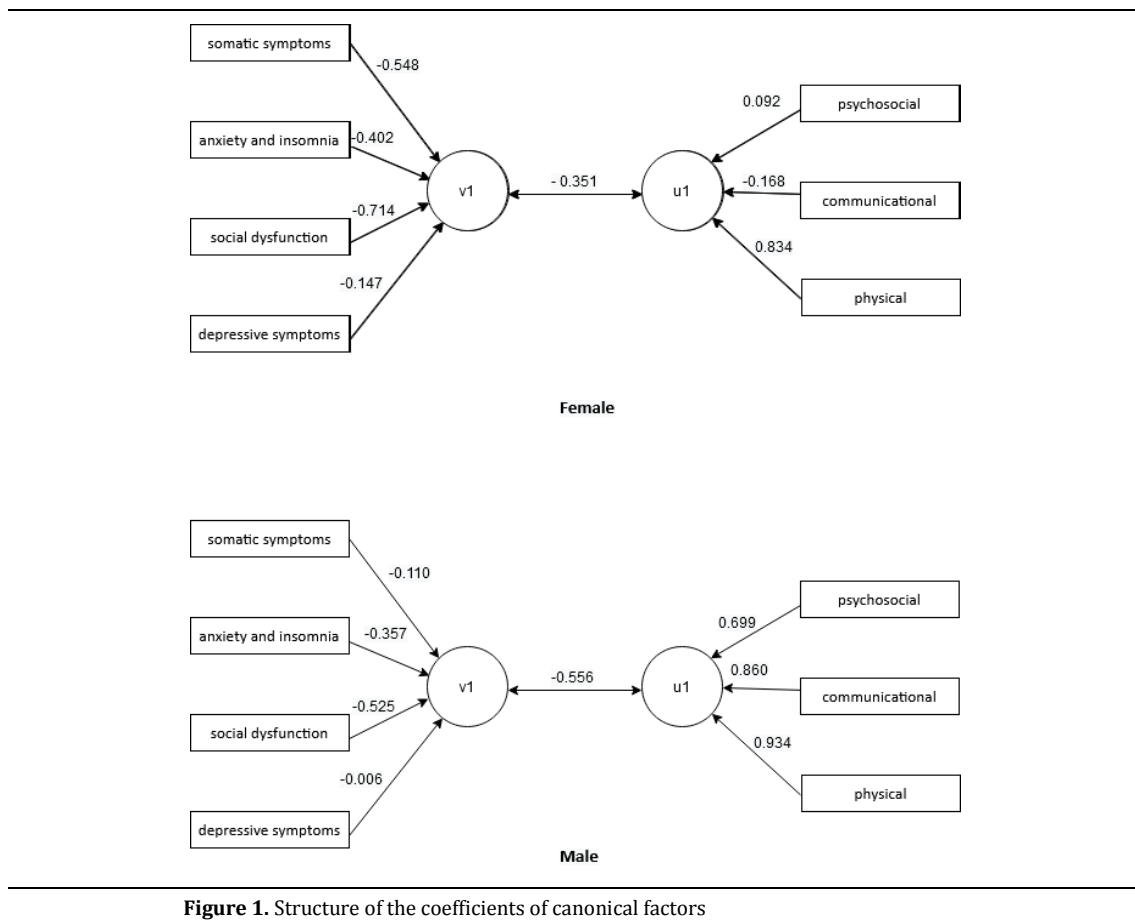
variance in female and male nurses, respectively.

4.3. Structure coefficient of canonical factors (load analysis)

The results of canonical loadings revealed that somatic symptoms and social dysfunction exhibited a negative relationship with general health, signifying that lower scores in somatic symptoms and less social dysfunction contributed to higher scores in general health. In addition, physical care displayed a positive relationship with the quality of nursing care, indicating that higher scores in the physical dimension were associated with a higher quality of nursing care. Social dysfunction ($rs=-0.714$) and somatic symptoms ($rs=-0.548$) contributed the most to v_1 in general health and physical care ($rs=0.834$) had the greatest contribution to u_1 in the quality of nursing care provided by female nurses. Among the male nurses, social dysfunction ($rs=-0.525$) and anxiety and insomnia ($rs=-0.357$) were the largest contributors to v_1 in general health, and physical care ($rs=0.934$) contributed the most to u_1 in the quality of nursing care. Figure 1 depicts the details of the aforementioned coefficients.

5. Discussion

The majority of studies have examined mental health or nursing care quality separately (21-23). To the best of our knowledge, this is one of the few studies which simultaneously assessed nurses' mental health and quality of nursing care and evaluated the relationships among all dimensions of these two variables. The findings revealed that nurses, especially males, had poor mental health during the COVID-19 crisis; nonetheless, they still managed to provide high-quality nursing care. The CCA results pointed to a negative relationship between mental health and the quality of nursing care in male (CCA=-0.556) and female (CCA=-0.351) nurses. This confirms the close association hypothesized between nurses' mental health and the quality of care. Therefore, potential improvements in care quality can be attained by enhancing nurses'



mental health.

Based on the GHQ, fewer somatic symptoms and less social dysfunction in nurses lead to the higher quality of care provided by them. Among the subscales of nursing care quality, physical care had the most marked effect on this scale via a significant and positive relationship. Social dysfunction, as well as anxiety and insomnia, in male nurses, and social dysfunction and somatic symptoms in female nurses had the largest share of their general health, while physical care had the largest share of nursing care quality. Giorgi G et al. reported poor sleep quality in healthcare workers who deal with COVID-19 patients (9).

Social support for healthcare workers does not directly affect their quality of sleep but can improve it through several indirect pathways. It can help mitigate anxiety, improve self-efficacy, increase understanding, respect, encouragement, courage, a sense of professional success, and concentration (10, 11). A comparison between the general health mean scores obtained for the nurses in this research and those of studies before the pandemic indicates that during the COVID-19 pandemic, nurses have had an undesirable general health status and experienced unpleasant mental states (24, 25). In a similar vein, it has been reported that nurses deal with numerous challenges (e.g., bad feeling, inefficiency, stress, excessive physical fatigue, and being trapped in personal protective equipment) when taking care of

patients with COVID-19, all of which expose them to undesirable mental states (10, 26).

Based on another study, other sources of anxiety for nurses include separation from and fear of infecting their family (12). As illustrated by the results of studies during Severe Acute Respiratory Syndrome (SARS) and Ebola epidemics, the prevalence of psychological disorders, such as anxiety, stress, and depression, is high during epidemics (27, 28). In the same context, Sun et al. concluded that nurses' working time was increased to 1.5-2 times its usual length with a rise in the number of patients during the COVID-19 pandemic. The workload also increased and working multiple shifts led to their fatigue. It seems that the protective clothing worn for safety also contributes to this excessive fatigue (29).

Based on the results of the present study, despite having poorer mental health, the nurses provided higher-quality care. Different studies have pointed out that nurses with poor mental health cannot effectively take care of patients. Therefore, nurses' mental health promotion plays a key role in improving the quality of nursing services (30, 31).

Research evidence suggests that nurses perceive a strong professional threat in continuing their work despite risks (29). Therefore, respecting and revering this profession can help them continue to provide healthcare services during epidemics (10). Despite

the challenges nurses deal with during the COVID-19 pandemic, such factors as new opportunities for employment, job promotions, authorities' supports, and gratitude towards the nursing profession have motivated and encouraged them to provide services during this crisis. This can, in turn, improve their mental health and the quality of nursing care in this demanding period (32).

Strengths and limitations

One of the strengths of this study was the use of CCA and the assessment of the role of all factors together. In the absence of similar studies, another strength was examining the relationship between mental health and the quality of nursing care during the COVID-19 pandemic. On the other hand, among the major limitation of this study, we can refer to the reduced validity of data due to time constraints imposed on data collection during the pandemic. Since the data were collected via questionnaires, the respondents' honest responses could not be guaranteed. Therefore, before distributing the questionnaires, the participants were brief about the goals and importance of the study. This study did not investigate major confounders of the relationship between mental health and the quality of nursing care (such as medical history). Moreover, we could not assess the nurses' prior general health status; therefore, they might have had general health disorders even before the pandemic. Due to the convenience sampling method, the prevalence of care quality and mental health problems could not be estimated. Furthermore, since this was a cross-sectional study, no causal relationship can be inferred. Another limitation was the heavy workload of nurses during the pandemic at hospitals; therefore, we gave them two weeks to complete the questionnaires. Some nurses were not interested in participating in the study; as a result, we explained the importance of the study to them to resolve this problem. We also assured the participants about the confidentiality of the data since some of them were worried about this.

6. Conclusion

The results of the present study pointed to the effect of the COVID-19 pandemic on the mental health of nurses working in hospitals. It is, therefore, suggested that when similar conditions arise, hospital managers and policymakers pay more attention to the mental health of nurses and other hospital staff. The improvement of nurses' mental health in critical situations, such as COVID-19, will enhance the quality of nursing care; therefore, hospitals should have specific programs to improve nurses' mental health. Stress alleviation programs can be an effective intervention to enhance nurses' mental health. Training stress management skills in seminars,

holding continuing education sessions, and offering practical workshops are also recommended.

Footnotes

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Conflicts of Interest: The authors declare that they have no conflict of interest regarding the publication of this article.

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