

Anxiety Levels Among Female Iranian Health Care Workers During the COVID-19 Surge: A Cross-sectional Study

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ABSTRACT

Background & Objective: The recent surge in coronavirus disease 2019 (COVID-19) cases has exposed health care workers (HCWs) to a wide range of psychological stressors and predisposed them to anxiety-related disorders. In this study, we observed the anxiety level in this population.

Materials & Methods: This multicenter, cross-sectional study was performed on 1,038 HCWs in 14 hospitals of Tehran during the COVID-19 pandemic. In May 2020, Beck Anxiety Inventory (BAI) was used to measure the level of anxiety in this population.

Results: The mean±SD age of participants was 36.30±8.23 years old. Most participants were 31 to 40 years old (43.2), female (87.6%), and nurses (49.5%). The BAI scores of the participants were in a positive skew distribution, with a score range of 0-63, a median of 12, and a mean value of 15.30±11.43. Out of 1,038 hospital staff, 411 (39.6%) had moderate to severe anxiety. The anxiety level was significantly higher in HCWs ≤40 years old, women, and nurses. However, there was no significant relationship between stress levels among frontline workers compared to second-line workers ($P=0.82$).

Conclusion: It seems that HCWs experienced a high level of anxiety in the COVID-19 outbreak. One of the critical measures in every epidemic is to provide supportive care to maintain the mental well-being of HCWs, especially in high-risk groups, including younger HCWs, women, and nurses.

Keywords: Anxiety level, Beck anxiety inventory (BAI), Coronavirus, COVID-19, Health Care, Worker, Iran



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Introduction

Since the onset of coronavirus disease 2019 (COVID-19) in Wuhan, it has spread to about 212 countries/territories and caused more than 4,075,614 deaths worldwide. The emergence of the disease has greatly burdened hospitals and health care workers (HCWs) (1). This increased the need for HCWs and health care facilities, leading to an increase in demands of psychological support as well (2).

Providing health care services has been one of the most stressful jobs in this outbreak (3). The recent surge in COVID-19 cases has exposed them to a wide range of psychological stressors. Extended working hours and shortage of personal protective equipment

(PPE) have made their mental health more vulnerable than ever (4). HCWs' current situation predisposes them to anxiety and depression-related disorders, which might lead to poor performance and decision-making (5).

HCWs are on the frontline of the battle with COVID-19. Therefore, their mental and physical health should be a priority (6). As a result, identifying the most stressed hospital workers and providing more support for this group is essential.

Beck Anxiety Inventory (BAI) is a valid self-report questionnaire to measure anxiety levels in the general population (7,8). We used the validated Persian version

of BAI to measure the rate of anxiety-related symptoms and the level of anxiety among our HCWs (9).

This multicenter study aimed to evaluate the level of anxiety in HCWs of tertiary hospitals (university hospitals in Tehran) designated for COVID-19 patients. These data can help us identify the most vulnerable groups of HCWs during the COVID-19 pandemic. To our knowledge, two other studies evaluated stress levels among HCWs in Iran: The first study compared stress levels between 160 nurses, and the second one compared stress levels between 528 therapeutic and non-therapeutic personnel. As far as we know, this study is the first report done between 1,038 Iranian HCWs of 14 referral hospitals in Tehran during the COVID-19 pandemic.

Materials and Methods

This multicenter, cross-sectional, web-based survey started on March 25, 2020, and 1,038 HCWs from 14 tertiary care hospitals affiliated with Tehran University of Medical Sciences (TUMS) participated in the study. The questionnaire was made online and sent to all 14 designated hospital staff through social media. The staff could decide whether or not they want to participate in the survey. Respondents were chosen from the doctors, nurses, midwives, and other staff members who were working in the designated COVID-19 wards. Personnel who had no contact with COVID-19 patients were excluded from the study. All participants consented to complete the questionnaire forms. The confidentiality of their name and personal information was assured, and the principle of confidentiality was observed. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1399.087). Inclusion criteria consisted of all HCWs working in referral COVID-19 hospitals. Exclusion criteria consisted of HCWs with a history of psychological disorders and non-HCWs.

Basic demographic data, including age, gender, and their working positions, were asked through a web-based questionnaire. Their basic information and working positions were then confirmed by the hospitals. The level of anxiety was measured using the validated Persian version of 21-question BAI, and each question was graded from 0 to 3 (0=minimal, 1=mild, 2=moderate, 3=severe) (9). In this survey, the subjects were asked whether they had common symptoms of anxiety working over the past week. The sums of all question scores were defined as an indicator of anxiety, which provides a score between 0 and 63 (0 to 7=minimal anxiety, 8 to 15=mild anxiety, 16 to 25=moderate anxiety, and 26 to 63=severe anxiety). Only a single response to the questionnaire was permitted for each person. The survey continued up to March 31, 2020.

The participants were categorized twice in terms of working positions. Once classified as two groups of frontline workers vs. second-line workers, then classified as four groups of physicians, nurses, midwives, and other working positions. Other working positions consisted of paramedics, nurse assistants, and administrative officers. First-line workers were defined as a group of personnel who had direct contact with confirmed/suspected COVID-19 patients and were involved in aerosol-generating procedures (e.g., tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy) (10). Second-line workers were defined as personnel who did not have direct contact with confirmed/suspected patients and those who were not involved in aerosol-generating procedures. Demographic data including age (20-25, 26-30, 31-40, 41-50, or >50 years), gender (male or female), and working positions (physicians, nurses, midwives, other positions/frontline vs second-line workers) were collected in the studied population. The overall score of anxiety was reported as a four-level variable (minimal anxiety, mild anxiety, moderate anxiety, and severe anxiety) in our studied population. In addition, the association of anxiety level with age, gender, or different working positions was investigated.

Data analysis was performed at both descriptive and inferential levels. At the descriptive level, mean±SD was used for interval variables, frequency, and percent for categorical variables. At the inferential level, the Kolmogorov-Smirnov test was used to evaluate the distribution of the data. The Pearson correlation coefficient test was used to investigate the relationship between anxiety level and the age of the population. Also, one-way analysis of variance (ANOVA) was used to investigate the relationship between the level of anxiety in gender, age groups, working positions (regarding both groupings [i.e., physicians, nurses, midwives, others vs first-line and second-line workers]) of our participants. In addition, Tukey's post hoc test was used to examine the difference in anxiety levels between different ages and working position groups. P-value<0.05 was considered significant, and 95% CI was considered acceptable. All data were analyzed using SPSS 24 (SPSS Inc., Chicago, Ill., USA).

Results

In total, 1,038 HCWs from 14 designated hospitals participated in this study; nurses were the most common participants, and midwives were the least common participants. The mean age of the participants was 36.30±8.23 years old (ranged from 20 to 66). Most participants were women (909 [87.6%]) and aged between 31 to 40 years (449 [43.2%]). In this study, participants were categorized twice in terms of working positions (Table 1).

Table 1. Basic Demographic data of participants

| Demographic data | N(%) |
|---------------------|------------|
| Age | |
| 20-25 years | 89 (8.6) |
| 26-30 years | 193 (18.6) |
| 31-40 years | 449 (43.2) |
| 41-50 years | 217 (20.9) |
| ≥51 years | 56 (5.4) |
| Missing | 34 (3.3) |
| Gender | |
| Female | 909 (87.6) |
| male | 129 (12.4) |
| Job type | |
| First line | 933 (89.9) |
| Second line | 105 (10.1) |
| Occupation | |
| physician | 214 (20.6) |
| Nurse | 514 (49.5) |
| Midwife | 143 (13.8) |
| Others ^a | 167 (16.1) |

^a Including paramedics, nurse assistants and administrative officers.

The scores of BAI for the participants had a positive skew distribution, which means the majority of HCWs had minimal to mild anxiety ($N=627$, 60.4%). The other 411 workers had moderate to severe anxiety (39.6%). Our study's population overall BAI score ranged from 0 to 63 and had a mean value of 15.30 ± 11.43 with a median of 12.

The score of anxiety was higher among employees less than 40 years old. The age groups under 40 years had a similar mean anxiety score (age 20-25: mean anxiety score of 16.46; age 26-30: mean anxiety score of 16.33; age 31-40: mean anxiety score of 16.16). However, the anxiety score was lower in workers ≥ 41 years old, and the mean score was similar among age groups above 40 years old (age 41-50: mean anxiety score of 12.73; age ≥ 51 : mean anxiety score of 12.82). Male workers had lower anxiety than female workers (mean anxiety score: 10.26 vs. 16.03). Male employees between 31-40 years old had the lowest anxiety (mean score of 9.05). However, the highest anxiety was observed in female employees between 31-40 years of age (mean score of 17.19). The analysis of different working positions showed the lowest anxiety score in physicians (mean score of 13.03), followed by midwives, nurses, and others (mean score of 15.80, 15.88, and 16.01, respectively). The highest anxiety was seen in female workers of other working positions (mean score of 16.82). [Table 2](#) presents the BAI

score (mean \pm SD) in male and female workers according to their age and working positions.

As shown in [Table 3](#), one-way ANOVA was used to examine the association of age, sex, and working positions variables with the anxiety score. The level of anxiety was significantly different in male and female workers ($F_{1,1035}=29.45$; $P=0.0001$), and, according to [Table 2](#), the level of anxiety was higher in female workers. There was a statistically significant difference in the level of anxiety in different age groups ($F_{4,999}=4.71$; $P=0.001$). The Pearson correlation coefficient test showed a negative relationship between age and the level of anxiety ($R=0.13$; $P=0.0001$). Older ages were associated with lower anxiety in our population. However, there was not a significant relationship between stress levels among frontline workers compared to second-line workers ($F_{1,1035}=0.05$; $P=0.82$). However, different working positions (physicians, nurses, midwives, and others) had a different level of anxiety, which was statistically significant ($F_{3,1033}=3.59$; $P=0.01$). According to partial eta squared, it can be concluded that sex, age, and four groups of working positions had the most relationship with anxiety, respectively.

The results of ANOVA were followed by Tukey's post hoc test to examine the difference between different ages and working positions. As shown in

[Table 4](#), the age group of 41-50 years old had lower anxiety compared to the groups of 26-30 and 31-40 years old. Other age groups were similar in terms of anxiety levels. Furthermore, the analysis showed that nurses had higher anxiety than physicians. However, there was no statistically significant difference between other working positions groups ([Table 4](#)).

BAI is a 21-item questionnaire, and each item scores between 0 and 3 based on the severity. Assessing each item gives us valuable information. As shown in Figure

1, the following items had a mean score above 1 as follows: 1) fear of worst happening, 2) unable to relax, 3) unsteady, 4) nervous, and 5) scared. On the other hand, five of the other items had a mean score below 0.4 as follows: 1) faint/lightheaded, 2) face flushed, 3) shaky/unsteady, 4) hands trembling, and 5) wobbliness in legs. The items had a lower mean score among physicians and a higher mean score among nurses and midwives ([Figure 1](#)).

Table 2. Mean and standard deviation of BAI scores in male and female workers according to their age and working positions

| Age groups | | Mean (SD) | | | | |
|----------------|---------------|---------------|---------------|---------------|---------------|--|
| Sex | 20-25 | 26-30 | 31-40 | 41-50 | >51 | |
| Female | 16.56 (12.25) | 16.63 (11.63) | 17.19 (11.92) | 13.29 (10.10) | 14.17 (10.30) | |
| Male | 14.25 (9.36) | 14.42 (12.19) | 9.05 (8.01) | 9.14 (9.08) | 6.60 (3.63) | |
| Total | 16.46 (12.10) | 16.33 (11.70) | 16.16 (11.81) | 12.73 (10.05) | 12.82 (9.87) | |
| Work positions | | Mean (S.D) | | | | |
| Sex | Physician | Nurse | Midwife | Others | Total | |
| Female | 14.51 (11.35) | 16.37 (11.79) | 15.89 (10.00) | 16.82 (12.16) | 16.03 (11.51) | |
| Male | 7.92 (5.48) | 10.40 (9.70) | 3.00 (-) | 13.26 (12.12) | 10.26 (9.42) | |
| Total | 13.03 (10.68) | 15.88 (11.74) | 15.80 (10.02) | 16.01 (12.21) | 15.30 (11.43) | |

Table 3. The results of One-way analysis of variance to examine the association of demographic variables and anxiety scores

| Source of Variance | SS | DF | MS | F | P | η^2 |
|---|-----------|------|--------|-------|--------|----------|
| Sex | 3742.63 | 1 | 3743 | 29.45 | 0.0001 | 0.03 |
| Error | 131550.68 | 1035 | 127 | | | |
| Total | 135293.32 | 1036 | | | | |
| Age Groups | 2428.39 | 4 | 607 | 4.71 | 0.001 | 0.02 |
| Error | 128786.69 | 999 | 129 | | | |
| Total | 131215.08 | 1003 | | | | |
| Working position (first-line vs. second line) | 6.68 | 1 | 6.68 | 0.05 | 0.82 | 0.0001 |
| Error | 135286.64 | 1035 | 130.71 | | | |
| Total | 135293.32 | 1036 | | | | |
| Working position (physicians, nurses, midwives, others) | 1394.47 | 3 | 465 | 3.59 | 0.01 | 0.01 |
| Error | 133898.85 | 1033 | 130 | | | |
| Total | 135293.32 | 1036 | | | | |

SS: sum of square, DF: degree of freedom, MS: mean square, η^2 : r square is a statistical measure that represent the proportion of the variance for a dependent variable that's explained by an independent variables.

Table 4. Tukey’s post-hoc test for comparison of anxiety scores between age and four working positions groups

| Age Groups | | Mean Difference | Std. Error | Sig. | 95 % Confidence Interval | |
|------------|-------|-----------------|------------|--------|--------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 20-25 | 26-30 | 0.13 | 1.45 | 1.00 | -3.85 | 4.10 |
| | 31-40 | 0.30 | 1.32 | 1.00 | -3.30 | 3.90 |
| | 41-50 | 3.73 | 1.43 | 0.07 | -0.18 | 7.63 |
| | >51 | 3.64 | 1.94 | 0.33 | -1.65 | 8.93 |
| 26-30 | 31-40 | 0.18 | 0.98 | 1.00 | -2.49 | 2.85 |
| | 41-50 | 3.60 | 1.12 | 0.01 | 0.53 | 6.67 |
| | >51 | 3.51 | 1.72 | 0.25 | -1.20 | 8.22 |
| 31-40 | 41-50 | 3.42 | 0.94 | 0.0001 | 0.86 | 5.99 |
| | >51 | 3.33 | 1.61 | 0.23 | -1.06 | 7.73 |
| 41-50 | >51 | -0.09 | 1.70 | 1.00 | -4.74 | 4.56 |

| Working position Groups | | Mean Difference | Std. Error | Sig. | 95 % Confidence Interval | |
|-------------------------|---------|-----------------|------------|------|--------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| Physician | Nurse | -2.85 | 0.93 | 0.01 | -5.23 | -0.47 |
| | Midwife | -2.76 | 1.23 | 0.11 | -5.93 | 0.40 |
| | Others | -2.97 | 1.18 | 0.06 | -6.00 | 0.05 |
| Nurse | Midwife | 0.09 | 1.08 | 1.00 | -2.68 | 2.86 |
| | Others | -0.13 | 1.01 | 1.00 | -2.74 | 2.48 |
| Midwife | Others | -0.21 | 1.30 | 1.00 | -3.55 | 3.12 |

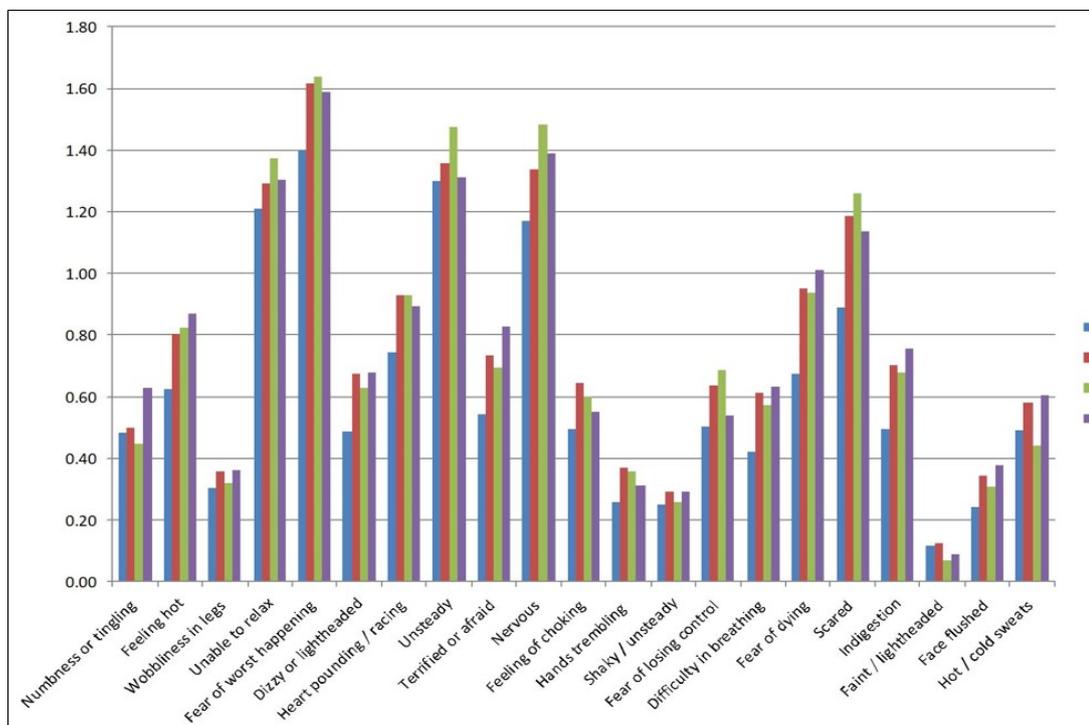


Figure 1. Mean score of each Beck Anxiety Inventory items according to participants working positions

Discussion

This multicenter study was aimed to evaluate the level of anxiety among HCWs in Tehran tertiary hospitals designated for COVID-19 patients. The results can be an indicator of anxiety among Iranian HCWs. We identified the most at-risk group regarding psychological stress and anxiety among hospital personnel amid the COVID-19 pandemic.

The highest anxiety levels were found in female HCWs who were less than 40 years of age. The lowest anxiety levels were seen in physicians, followed by midwives, nurses, and other working positions, respectively. These findings were consistent with previous studies, in which nurses and women were found to have more severe anxiety symptoms (11,12). In our study, younger ages were associated with higher levels of anxiety. This might be associated with higher educational levels and higher work experience of the older staff in high-stress hospital environments, leading to a better understanding of COVID-19 and knowing how to use PPE effectively. This finding is consistent with Øyane *et al.*'s study; they found a negative association between years of work experience and anxiety in Norwegian nurses (13).

BAI was used to evaluate the level of anxiety among our population in Tehran hospitals. Kaviani *et al.* showed that the Persian version of BAI has good psychometric properties to assess anxiety levels among Iranian (9). Anxiety levels were higher in nurses than in physicians. This can be due to physicians' higher educational and information levels about the disease. Another explanation might be due to greater patient contacts, greater risk perception, longer working hours, and lack of adequate PPE among nurses (14,12).

In total, 18.1% of participants experienced severe anxiety, 21.5% moderate anxiety, and 31.8% mild anxiety. Overall, about 40% of all participants experienced moderate to severe anxiety levels; consistent with our results, Lai *et al.* studied 34 hospitals in China and found anxiety in 44.6% of HCWs during the COVID-19 epidemic (12). Also, in severe acute respiratory syndrome (SARS) and H1N1 influenza epidemics, a significant proportion of HCWs displayed high anxiety levels (15,16,17). In total, 71.4% of HCWs had some degree of anxiety, which is similar to previous studies on HCWs during the SARS and Middle East respiratory syndrome (MERS) epidemics. Alshafi *et al.* reported that 61.2% of HCWs had anxiety about exposure to MERS-CoV (18). Koh *et al.* reported that 56% of hospital staff had increased work-related stress during the SARS epidemic (19).

Although the psychological response of HCWs to an outbreak is complicated, the reason why young people and those with lower intermediate technical titles had higher anxiety can be due to their lack of control and authority over their work and fear of upcoming changes in their work. Other sources of distress may include fear of contagion, feelings of vulnerability, concerns about the health of themselves and their family, perceived

stigma, and being isolated (20). Therefore, these factors might be present in our population and should be addressed as well.

COVID-19 surge has caused new changes in the circumstance, which demands an excessive load of work by HCWs. It is challenging for HCWs to confront the new situation, predisposing them to anxiety-related disorders. By recognizing the most vulnerable HCWs, it is essential to provide more support for this group to cope with the emerging situation. Some factors, including social appreciation, greater family/friends support, hospital psychological support, providing adequate PPE, and personnel training can help cope with this situation (14,21).

This study had some limitations. Firstly, we only evaluated the anxiety levels of HCWs, without considering other psychological disorders. Secondly, the study was done in a short period (six days) and about one month after the onset of the COVID-19 pandemic in Iran, while the anxiety level of HCWs may vary at different times during the pandemic. There is currently little research on this topic with smaller sample size; thus, we could not compare the results of our study extensively with previous studies. Authors (22) have compared 528 participants of HCWs with non-HCWs and reported that nursing students were more stressed than formal and contractual nurses. Also, therapeutic HCWs were more stressed than non-therapeutic workers. However, the present study specifically evaluated anxiety levels of 1,038 HCWs who were in charge of taking care of COVID-19 patients and demonstrated that higher levels of anxiety were associated with women under the age of 40, and the lowest levels of anxiety were associated with physicians, followed by midwives, nurses, and other working positions.

Researchers (23) have reported the relationship between corona-induced anxiety and caring behaviors of 166 nurses who were working in two hospitals in the city of Kerman and suggested that coping strategies and resilience skills can be helpful during the pandemic in order to reduce nurses' anxiety. However, the present study consists of 1,038 HCWs, including 514 nurses, with results being more generalizable to all HCWs.

Conclusion

It seems that Iranian HCWs experienced a high level of anxiety in the COVID-19 outbreak. One of the essential measures taken in each epidemic is providing supportive care to maintain the mental well-being of HCWs, especially in high-risk groups, including younger HCWs, women, and nurses.

Author Disclosure and Contributions

MA, MK, and MG made substantial contributions in the designing and the concept of the study. MA had major contribution in interpretation of data and writing the main manuscript draft. FD, NS, PN had a role in writing the manuscript and interpretation of the data regarding the questionnaire design and collection. SV and EF had substantially revised the manuscript. All authors read the entire manuscript and checked for the accuracy of the data, protocol method, and analysis.

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Conflict of Interest

The authors declared no conflict of interests.

Abbreviations

COVID-19: coronavirus disease of 2019

HCWs: Health care workers

PPE: personal protection equipment

BAI: Beck Anxiety Inventory

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