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The Effect of Job Stress on the Severity of Coronavirus Disease Symptoms in Iranian Hospital Nurses

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ABSTRACT

Introduction: Nurses' job stress during coronavirus disease is very high, which weakens the immune system. Furthermore, job stress plays an important role in the symptoms and clinical severity of this disease. Therefore, this study was conducted to determine the effect of job stress on the severity of coronavirus disease symptoms in hospital nurses in Iran.

Materials and Methods: This cross-sectional descriptive-analytical study was carried out on 400 nurses with a history of coronavirus disease in hospitals in Tehran, Iran, in 2021. Demographic and occupational information and clinical status of the subjects were collected from medical records and self-reports. The level of job stress in the subjects was determined using Osipow questionnaire with Cronbach's alpha coefficient of 0.83. Finally, the data were analyzed using ANOVA and the Pearson test in SPSS 19 software.

Results: The results of this study showed that the mean level of job stress increases with age, body mass index (BMI), and working hours ($P < 0.05$). Also, the mean level of job stress was higher in contractual and smoking nurses ($P < 0.05$). In this study, 20% of the subjects had severe job stress. Job stress decreased blood oxygen and increased the duration of shortness of breath and cough, gastrointestinal disorders, weakness and lethargy, and headache and dizziness in the subjects ($P < 0.05$).

Conclusion: Job stress in nurses experiencing coronavirus disease increases the severity and complete recovery time of coronavirus disease. It also increases the duration of the disease symptoms such as shortness of breath and cough, gastrointestinal disorders, weakness, headache, and vertigo.

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Introduction

Job stress is a psychological condition resulting from a sense of inconsistency between capacities and situations and is a non-specific response to all factors that can affect the immune system. Studies have shown that stress can reduce the efficiency of the immune system and thus increase the readiness of living beings to suffer from various diseases such as cancer, heart disease, diabetes, asthma, obesity, gastrointestinal disorders, memory loss, and eventually premature death [1-3].

According to studies, stress in the workplace and daily life gradually weakens and inhibits the activity of the immune system. As a result, human beings become susceptible to a variety of mental and physical diseases. This is due to a complex interrelationship between the brain and the immune system [4-6].

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In general, previous studies in the field of psychoneuroimmunology have examined the interaction between psychological, neurological, and immunological changes (changes in the immune system that occur as a result of chronic stressful work-related conditions). Stress affects the immune system variables, and in the long run, it damages the immune system and causes many diseases [7, 8].

On the other hand, although the exact mechanisms of interaction between the innate immune system and COVID-19 disease have not yet been elucidated, innate immune responses and related cell types play an important role in the symptoms and clinical severity of the disease [9, 10]. According to studies, COVID-19 disease, like SARS-CoV-2 virus, mainly infects airway, alveolar epithelial cells, vascular endothelial cells, and macrophages. The close interaction between the SARS-CoV-2 virus and the individual immune system leads to the varied clinical manifestations of COVID-19. While adaptive immune responses are necessary to clear the SARS-CoV-2 virus, innate immune cells such as macrophages may in some cases contribute to disease progression. Macrophages have shown significant production of IL-6, suggesting that it may be involved in hyperinflammation in coronavirus disease. Macrophage activation syndrome may explain high serum CRP levels, which is not usually present in viral infections. In compatible immune responses, cytotoxic DC8 + T cells have been shown to exhibit functional burn patterns such as NKG2A, PD-1, and TIM-3 expression. Given that SARSCoV-2 restricts antigen delivery by regulating MHC class I and II molecules, the immune responses are inhibited by T cells and the role of humoral immune responses is enhanced. Finally, the IgA response appears to be stronger and more stable than the IgM response. In addition, IgM and IgG antibodies show similar dynamics in COVID-19 disease [11, 12].

Although job stress is an important factor in weakening the immune system, there is a lot of ambiguity about the main reason for the important role of the immune system in the development of coronavirus disease in people. Also, job stress in hospital nurses is very high and there is limited information about its role on coronavirus disease. Therefore, this study was carried out to determine the effect of job stress on the severity of coronavirus disease symptoms in hospital nurses in Iran.

Materials and Methods

This cross-sectional, descriptive-analytical study was carried out on 400 nurses with a history of coronavirus disease in four hospitals in Tehran, capital of Iran, in 2021. According to the formula for determining the sample size in studies and based on correlation coefficient (R = 0.19) from previous studies, the number of subjects was obtained as 337. However, to increase the study accuracy, the number of samples increased to 400. The nurses were selected by random sampling from four COVID-19 wards, so that 100 people were selected from each hospital. The inclusion criteria were having at least three years of work experience and a history of shortness of breath and hospitalization due to coronavirus disease over the past year. The exclusion criteria were suffering from diseases such as asthma, chronic bronchitis, diabetes, congenital cardiovascular diseases, known cardiovascular diseases, known anxiety-stress disorder, pulmonary disorders or the use of antihypertensive drugs, and blood pressure before employment.

The demographic and occupational information of the subjects was completed by them in a checklist designed for this purpose, which included age, gender, education, marital status, body mass index (BMI), monthly income, work experience, average working hours per day, smoking or not-smoking, and shift work.

Information about coronavirus disease in the subjects was collected based on their medical records as well as self-report. This information includes the number of days treated in the hospital, the type of symptoms and complications, the minimum percentage of blood oxygen, and the period of first symptoms until complete recovery.

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Job stress of the subjects was determined using the Osipow job stress questionnaire [13]. This questionnaire consisted of 60 questions in 6 subgroups (10 questions to each subgroup). The answers were based on a 5-point Likert scale and the answers were scored from 1 to 5. The total score of all questions was calculated and interpreted by the questionnaire guide. A score of 60-119 was placed in the mild stress group, a score of 120-179 in the mild to moderate stress group, a score of 180-239 in the moderate-severe stress group, and a score of 240-300 was placed in the severe stress group. The validity and reliability of this questionnaire has already been evaluated in Iran with a Cronbach's alpha coefficient of 0.83 [14].

The data had a normal distribution based on the results of Kumologov-Smirnov test with an error level of less than 0.05. Therefore, comparison and relationship of variables were analyzed using One-Way ANOVA and the Pearson tests with 95% confidence level in SPSS 19 software.

Ethical issues

This study, as a part of research results (research ethics code: IR.BMSU.REC.1399.135), was supported by Baqiyatallah University of Medical Sciences.

Results

The results of this study showed that the mean age of the subjects was 33.65 ± 5.4 years. Also, the subjects' mean BMI score was 26.6 ± 4.41. The subjects' mean score of work experience was 8.75 ± 6.7 years. According to Table 1, the mean level of job stress was significantly related to age, BMI, work experience, daily working hours, type of employment, and smoking (P < 0.05). The mean level of job stress increased with age, BMI, work experience, and working hours. Also, the mean level of job stress was higher in contractual and smoking nurses. More details are given in Table 1.

Figure 1 shows the prevalence of job stress in the subjects. The results show that 35% of the subjects had the least job stress (mild stress) and 20% had the highest job stress (severe stress).

Table 1: The characteristics of demographic and occupational information of the subjects and their relationship with the average days of hospitalization

Variable		Job stress score		Frequency (%)	P-value
		Mean	Standard deviation		
Age (Year)	20-30	154	± 14.3	178 (44.5)	P < 0.05
	31-40	100	± 7.2	136 (34)	
	41-50	103	± 12.1	84 (21)	
Gender	Male	142	± 9.3	231(57.75)	P > 0.05
	Female	152	± 4.9	169 (42.25)	
Education Level	Under graduate	137	± 5.5	257 (64.25)	P > 0.05
	Post graduate	148	± 11.7	143 (35.75)	
BMI	< 24.9	117	± 7.8	113 (28.25)	P < 0.05
	25-29.9	140	± 2.9	238 (59.5)	
	> 30	212	± 13.1	49 (12.25)	
Work experience (Year)	< 5	181	± 15.6	187 (46.75)	P < 0.05
	5-15	147	±5.8	121 (30.25)	
	>15	115	±10.0	82 (20.5)	
Working hours per day	< 8	134	±12.1	214 (53.5)	P < 0.05
	> 8	195	± 12.4	186 (46.5)	
Type of shift work	Day	156	± 6.6	228 (57)	P > 0.05
	Night	139	±9.6	172 (43)	
Employment type	Contractual	195	± 10.2	273 (68.25)	P < 0.05
	Official	137	± 12.0	128 (31.75)	
Smoking status	Smoker	203	± 9.9	147 (36.75)	P < 0.05
	Non-smoker	156	±9.3	253 (63.25)	
Monthly income	< 370 $	170	± 6.7	275 (68.75)	P > 0.05
	> 370 $	165	± 13.7	(31.25) 125	

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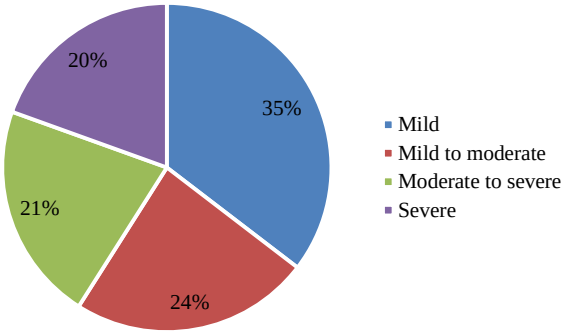

Figure 1: Prevalence of job stress in the studied subjects

All the subjects had previously been under intensive care in the hospital due to respiratory disorders. However, the complications of coronavirus disease in these subjects were slightly different. Weakness and lethargy, headache and dizziness, fever and chills and gastrointestinal disorders had the highest frequency at the onset of symptoms and during hospitalization, respectively. Figure 2 shows the prevalence of symptoms in the subjects.

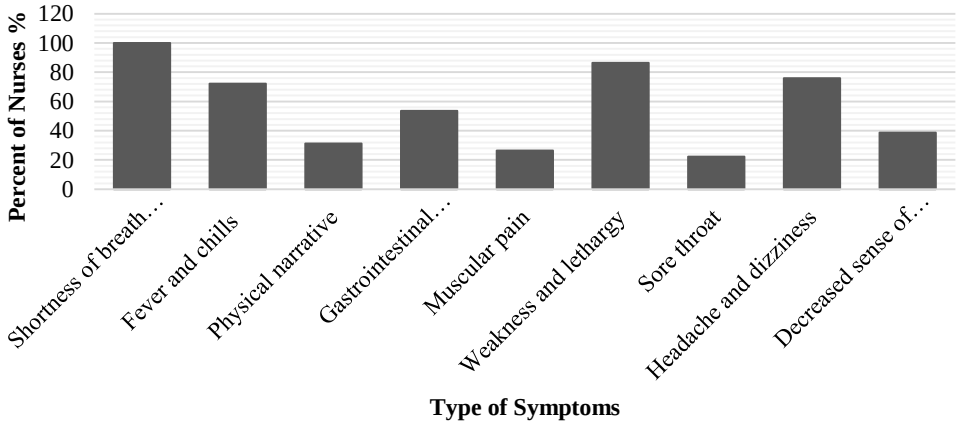

Figure 2: Prevalence of symptoms in the studied subjects

The results of ANOVA test showed that the level of job stress had a significant role in the patients' clinical conditions, which is shown in Table 2.

Table 2: The relationship between job stress and patients' clinical conditions

Patients' clinical conditions	Job stress level				P-value
	Mild	Mild to moderate	Moderate to severe	Severe	
Hospital treatment (hours)	104.4 (± 9.45)	116.6 (± 7.90)	194.8 (± 12.1)	228 (± 11.6)	0.002
Blood oxygen level (%)	89.34 (± 3.5)	89.1 (± 4.54)	82.12 (± 2.48)	74.4 (± 4.45)	0.04
The period of the first symptoms until complete recovery (A full day)	25.5 (± 3.78)	24.6 (± 3.21)	(± 5.9) 31.31	37.4 (± 5.45)	0.01

Table 2 shows that increasing job stress increased hospitalization hours ($P < 0.05$). Also, job stress had a significant relationship with blood oxygen levels of patients ($P < 0.05$), in that increasing job stress caused a decrease in the amount of oxygen ($P < 0.05$). Patients with more stress had a longer time interval between the first symptoms and complete recovery ($P < 0.05$).

The results of ANOVA test and multiple linear regression models showed that the level of job stress affected the onset of symptoms period until complete recovery in the subjects (Table 3).

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Table 3: The relationship between job stress level and mean value of the onset of symptoms period until complete recovery

Type of Symptoms	Job stress level				P-value	Multiple Linear Regression model
	Mild	Mild to moderate	Moderate to severe	Severe		
Shortness of breath and cough	11.65 (± 1.21)	12.95 (± 2.3)	13.1 (± 1.43)	18.42 (± 1.98)	0.01	P-value <0.05
Fever and chills	2.05 (± 0.75)	1.85 (± 0.28)	2.5 (± 0.55)	2.33 (± 0.82)	0.430	
Physical narrative	4.56 (± 1.93)	5.69 (± 1.02)	5.93 (± 1.54)	4.58 (± 1.01)	0.127	
Gastrointestinal disorders	3.53 (± 0.93)	4.2 (± 1.35)	5.45 (± 1.42)	9 (± 1.9)	0.01	
Muscular pain	5.21 (± 1.85)	4.87 (± 1.2)	5.65 (± 2.13)	5.5 (± 0.96)	0.681	
Weakness and lethargy	26.8 (± 1.72)	25.4 (± 2.2)	30.18 (± 2.43)	35.2 (± 2.1)	0.03	
Sore throat	3.4 (± 0.34)	4.71 (± 0.65)	3.89 (± 0.3)	5.21 (± 0.39)	0.213	
Headache and dizziness	3.22 (± 0.1.32)	5.26 (± 1.07)	7.34 (± 1.56)	7.3 (± 0.92)	0.04	
Decreased sense of smell and taste	14.52 (± 3.21)	25.37 (± 3.65)	18.2 (± 2.24)	21.87 (± 2.87)	0.275	

According to Table 3, job stress was significantly associated with shortness of breath and coughs, gastrointestinal disorders, weakness and lethargy, and headache and dizziness ($P < 0.05$). The increase in job stress increased the duration of shortness of breath and coughing, digestive disorders, weakness and lethargy, and headache and dizziness in the subjects. The results of multivariate regression showed that the symptoms of coronavirus were affected by job stress ($P < 0.05$).

Discussion

In this study, the mean level of job stress increased with age, BMI, work experience, and working hours in the studied nurses. The mean level of job stress was also higher in contractual and smoking nurses, and 20% of the nurses had the highest level of job stress (severe stress). In patients with more stress, the time interval between the first symptoms and complete recovery was longer. Furthermore, job stress reduced blood oxygen levels in the studied patients. In general, the increase in job stress led to an increase in the number of days involved with shortness of breath and coughing, gastrointestinal disorders, weakness and lethargy, headache and dizziness in the nurses.

Although the exact mechanisms of interaction between the innate immune system and COVID-19 disease have not yet been elucidated, innate immune responses and related cell types play an important role in the symptoms and clinical severity of the disease [9]. Also, the results of a study by Palumbo ML et al. showed that chronic stress disrupts the body hormones and ultimately increases the risk of diseases [15].In the present study, the negative effects of job stress are evident on the severity and complications of coronavirus disease. Thus, the results of studies have shown that the direct effect of job stress on the immune system may be exerted by pituitary-hypothalamic peptides and the sympathetic branch of the central nervous system. Stress can affect the immune system through two-way communication between the central nervous system and the endocrine system [16, 17].

It was also reported in a study by Akimbekov et al. that any type of job stress causes a sharp increase in the secretion of adrenocorticotropin from the anterior pituitary gland, thus increasing the secretion of cortisol. Cortisol also has a weakening effect on the immune system [18].

According to other reports, job stress plays a significant role in the development of mental, cardiovascular and respiratory diseases or is affected during the treatment of these diseases. The current study concluded that the severity of job stress is affected by the severity, symptom type,

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and duration of involvement of coronavirus symptom in the nurses. The probable cause is that the suppression of the immune system is due to stress. On the other hand, there are ambiguities about the complex interrelationships between the brain and immune system activity that can be affected by job stress [19-21].

Studies by Eunha Shim et al. [22] and Daniel Ibrahim et al. [23] indicated that many factors including stress, pulmonary disorders, diabetes, and heart disease can affect the severity of coronavirus disease symptoms. Bita Shahrvini et al. reported that many factors including comorbidities, demographic and occupational factors can affect the improvement and severity of coronavirus disease symptoms, so that the presence of a comorbidity has a negative role in the severity of coronavirus disease [24]. On the other hand, the elderly and obese people are at high risk for coronavirus disease, which is probably due to their weakened immune system; a conclusion that is consistent with the present study. It is important to note that there are ambiguities in the mechanism of action of the COVID-19 virus on the host body, for which the researchers in this study have not found an exact reason.

Studies have shown that the risk of death from COVID-19 in people with mental disorders is about twice as high as in healthy people. However, the chance of death from COVID-19 in people with mental disorders and in the age range of 60 to 79 years is more than 4 times [25]. On the other hand, another study showed that people with mental disorders are more prone to stress, which may make people more vulnerable to respiratory infections due to COVID-19 [26, 27]. In the current study, there was a strong relationship between job stress and severity and duration of involvement with shortness of breath and coughs, as well as digestive disorders, weakness and lethargy, and headache and dizziness, which could be due to the negative effects of stress on the nervous system.

One of the limitations of this study is the lack of attention to personality and genetic types of subjects and other variables affecting the complications of coronavirus disease in the subjects. Also, recall bias in self-reporting is another limitation of the study, and there was no way for researchers to collect this type of data.

Conclusion

The results of this study showed that job stress is high in nurses experiencing coronavirus disease. Moreover, job stress increases the severity and recovery time of the disease symptoms such as shortness of breath and coughs, digestive disorders, weakness and lethargy, and headache and vertigo. Due to the high risk of coronavirus disease in nurses, it is recommended that preventive actions be taken to reduce job stress caused by individual and organizational factors of the work environment in hospital nurses.

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Conflict of interest

The authors declare that there is no conflict of interests.

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