



Predicting the Possibility of Post-Traumatic Stress Disorder Based on Demographic Variables, Levels of Exposure to Covid-19, Covid-19 Anxiety and Sleep Quality Dimensions in Health Care Workers

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Abstract

Introduction: Evaluation of health care workers' mental status is critical in the trend of covid-19 pandemic; because it helps to investigate their real needs and expectations and helps them to present useful services. This study aimed to the prediction of possibility of developing post-traumatic stress disorder (PTSD) based on demographic variables, levels of exposure to Covid-19, the anxiety of Covid-19, and dimensions of sleep quality in health care workers.

Methods: A descriptive correlational study was conducted on a sample of 180 health care workers (129 females and 51 males). The researcher-made demographic questionnaire, Pittsburgh Sleep Quality Index, Post Traumatic Stress Disorder, Checklist and Covid-19 Anxiety Scale were recorded. A convenience sampling method was applied, and data was collected through the Google form platform. Data analysis was performed in SPSS version 24 software by using one-way analysis of variance (ANOVA), Scheffe Post Hoc test, independent samples t-test, Pearson correlation, and binary logistic regression.

Results: The results indicated that 51.7% of health care workers showed severe symptoms of post-traumatic stress ($p < 0.05$). The severity of PTSD symptoms varied in different work shifts and levels of education. The morning shifts and master's degrees had the lowest mean scores of PTSD symptoms. There was a significant positive correlation between PTSD symptoms and Covid-19 anxiety and between PTSD symptoms and all dimensions of sleep quality ($p < 0.05$). The Enter logistic regression analysis results showed that sleep medication use ($OR = 3.21$) and covid-19 anxiety ($OR = 1.13$) were risk factors that predicted the severity of PTSD symptoms (percentage correct = 85.5%).

Conclusion: It is suggested extensive attempts have been made to PTSD symptoms screening. Also, informing the health care workers about methods to reduce anxiety is helpful, and it is proposed to administer online workshops to train and increase sleep hygiene.

Keywords: PTSD, Sleep quality, Covid-19 anxiety, Health care workers, Covid-19.

Introduction

Novel Coronavirus (SARS-COV-2) has continued to spread across the world in recent months rapidly. Coronavirus is a large family of viruses that cause respiratory infections from a common cold to more severe diseases, such as MERS and SARS. In other words, The Covid-19 is the newest member of this family; currently, the Covid-19 pandemic is one of

the most crucial public health concerns worldwide¹. The uncertainties and fears associated with the Covid-19 outbreak, along with the high mortality rate, are predicted to lead to increased psychological distress, anxiety, and mood swings. Fear of encountering Covid-19 and unobvious ways

to prevent the spread of infection may have been perceived as traumatic events and led to PTSD.

According to the Fifth Diagnostic and Statistical Manual of Mental Disorders (DSM-5), PTSD is characterized by four groups of symptoms: a) intrusive memories or nightmares related to trauma, b) persistent avoidance of stimuli related to the traumatic event, c) negative changes in cognition and mood associated with trauma and d) changes in arousal and reactivity associated with trauma. In sum, exposure to a traumatic event is one of the conditions for diagnosing post-traumatic stress disorder². A large body of research examining the effects of Covid-19 on psychological status has been reported in general population clarity. The results of a survey conducted in China at the early stage of the outbreak of COVID-19 showed that around 2019 participants who participated in this online study, about 4.6% of them had high levels of PTSD symptoms. In another research of Irish people during the outbreak of Covid-19, 17.7% of them reported PTSD symptoms,³ and in the same study on 3,480 Spanish, 15.8% of them had symptoms of PTSD^{3,4}.

During the COVID-19 outbreak, health care workers are more likely to develop PTSD symptoms than the general population. Because they are exposed to a complex of stressful events daily; These events are an extremely high number of severely ill patients, often-unpredictable course of the disease, high mortality rate and lack of effective treatment or treatment protocols^{5,6}. Many attempts have been made to discover mental status in medical teams. The results of mental status in Norwegian health care workers during the Covid-19 outbreak showed that 27.7% of participants had threshold and sub-threshold symptoms of PTSD. In another study on 863 health care workers from seven provinces in China, 40.2% showed signs of PTSD⁷. Other studies have shown similar results so that in Italy, the researchers found 36.7% of 800 health care workers had symptoms of PTSD⁸.

In sum, about predicted variables of PTSD, investigating these factors is of great importance

because it determines who is at edge risk. A quick look at conducted studies shows that many variables related to PTSD during the Covid-19 pandemic are identified, such as mental health, levels of exposure to Covid-19,^{2,9,10} demographic variables,¹⁰⁻¹² and sleep quality^{2,13,14}. But the essential point is to determine the proportion of each of these variables to develop beneficial preventive interventions. Because PTSD symptoms among health care workers are higher than the general population, the current study aimed to predict the possibility of PTSD based on demographic variables, levels of exposure to Covid-19, Covid-19 anxiety, and sleep quality dimensions in health care workers.

Methods

Design, sample size and sampling method

The present study was a descriptive-analytical cross-sectional study from June to July 2020 with the outbreak of Covid-19 in Iran. The study population was all health care workers working in medical centers in Khorramabad, Lorestan, Iran (affiliated with Lorestan University of Medical University (LUMS)). Initially, based on the Green sample size formula¹⁵, the sample size for regression was calculated ($M+104$). M is the number of predictor variables, then to 18 predictor variables in the present study (six demographic variables, four levels of exposure to Covid-19, Covid-19 anxiety, and seven dimensions of sleep quality), negligibly 122 subjects was needed. The sample size was increased to 180 subjects considering the dropout of study participants. Due to reduce social contact to prevent the Covid-19 outbreak, participants were recruited through available sampling and completed surveys by Google form platforms. The inclusion criteria were employed in medical centers, and a cyberspace user and exclusion criteria included dissatisfaction with participation in research and incomplete completion of the questionnaire.

Statistical analysis of data

In descriptive statistics, frequency, mean and standard deviation were used. In inferential statistics, Student's t-test, one-way analysis of variance (ANOVA), Scheffe post hoc test, Pearson correlation, and logistic regression were used to compare and investigate the relationship between variables. The data was analyzed by IBM SPSS Statistic (version 24) (IBM Corporation, Armonk, NY).

Ethical considerations

Participants were fully informed about the purpose of the study and gave them comprehensive information related to the confidentiality of their answers and other information. Also, they were informed that they could withdraw from the study at any moment without giving a reason. Also, the present study was approved by Baqiyatallah University of Medical Sciences (BUMS) with the ethical code IR.BMSU.REC.1399.586.

Instruments

Pittsburgh Sleep Quality Index: Pittsburgh Sleep Quality Index (PSQI) measures subjective sleep quality and sleep patterns among adults over the past month. This questionnaire assesses seven factors of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction and includes 18 items. The subjects respond to a range of responses from less than once per week (score=0), once per week (score=1), twice per week (score=2), and three times or more per week (score=3). A total score higher than 5 indicates poor sleep quality (16). Also, the validity, reliability, and Cronbach's alpha are 0.80, 0.93-0.90, and 0.78-0.82 sequentially¹⁷ in the present study; the reliability was calculated by Cronbach's alpha method about 0.76.

Covid-19 Anxiety Scale: Covid-19 Anxiety Scale (CDAS) was developed by Alipour et al. and has 18 items.¹⁸ It is scored based on a four-point Likert

scale (0: never to 3: always), and all items are summed to provide a total CDAS score. Therefore, the range of scores is between 0 and 54, and a higher score means more Covid-19 anxiety. A score of 0 to 16 means no or mild anxiety level, a score of 17 to 29 indicates moderate anxiety level, and a score of 30 to 54 indicates severe anxiety. The structural validity of the CDAS was confirmed by factor analysis, and its reliability by Cronbach's alpha method was 0.91. In this study, Cronbach's alpha was calculated at about 0.96.

Post-Traumatic Stress Disorder Checklist: Post-Traumatic Stress Disorder Checklist (PCL-5) includes 20 items on a five-point Likert scale. (Scores 0 to 4) and scores range from 0 to 80. PCL-5 consists of four scales of intrusion (criterion B), avoidance (criterion C), negative mood changes (criterion D), and over-arousal (criterion E), which corresponds to the DSM-5 symptoms clusters of PTSD. Cronbach's alpha of the English version of the PCL-5 is 0.95 and 0.94 for the French version. English and French versions of the PCL-5 had appropriate convergent and divergent validity¹⁹. The Persian version of the PCL-5 had acceptable psychometric properties²⁰. Previous studies suggested a variety of cut-off scores ranging between 28 and 37²¹. The cut-off point of the PCL-5 was not found in the Iranian population based on the researcher's findings. According to the mean score of PTSD in the present study, a score ≥ 33 was considered as a cut-off to indicate clinical levels of PTSD. Noticeably, in the present study, Cronbach's alpha was calculated at 0.96.

Demographic Information Questionnaire: This researcher-made yes / no questionnaire has nine questions in two parts of demographic information included: age, gender, marital status, education level, shift work and any history of drug or alcohol use) and history of exposure to Covid-19 virus (history of Covid-19 disease, having suspicious symptoms, history of close contact to patient and history of the disease in close relatives). This

questionnaire was designed to assess demographic information and levels of exposure to Covid-19 in the research sample.

Results

This study included 180 health care workers (129 females and 51 males). The results showed frequency and percentage distribution of respondents based on age, gender, marital status, educational status, work shift, and drug or alcohol use history (Table 1). Most participants in this study were thirty-five years old (50.6%), were female (71.7%), were married (69.4%), had a bachelor's degree (57.8%), worked in rotating shift (75%), and only 10.6% of respondents had a history of drug or alcohol use.

The results of one-way ANOVA revealed that there were statistically significant differences between PTSD severity and types of shift work. Subsequent post-hoc analysis (Scheffe procedure) was done and suggested that the mean score of PTSD severity indicated higher for the rotating shift work compared to morning shift work (Table 2). The results of one-way ANOVA also showed that there were statistically significant differences between PTSD severity and different degree levels. Scheffe post-hoc test revealed that the mean score of PTSD severity indicated lower for those with a master's than diploma and bachelor's degrees (Table 2). PTSD severity did not differ in age, gender, marital status, and alcohol or drug use history (Table 1).

Table 1. Comparison of severity of post-traumatic stress symptoms based age, gender, marriage, education, shift work and alcohol or drug use history.

Variable	Total frequency (%) 180 (100)	M	SD	t/f	p
Age					
Higher and equal to 35	91(50.6)	33.48	17.73	0.535	0.725
Lower than 35	89 (49.4)	34.37	15.94		
Gender					
Male	51(28.3)	33.54	17.45	-0.18	0.852
Female	12 (71.7)	34.06	16.65		
Marital status					
Single	55 (30.6)	32.21	14.43	-0.97	0.331
Married	125 (69.4)	34.67	17.79		
Education level					
Diploma	22(12.2)	39.22	14.62	6.18	0.001
B.A	104 (57.8)	36.68	15.33		
M.A	35 (19.4)	24.42	15.9		
Ph.D.	19 (10.6)	30.15	21.80		
Shift work					
Morning	41(22.8)	23.78	15.95	11.14	0.000
Evening	4 (2.2)	29.75	20.90		
Rotating shifts	135 (75)	37.12	15.82		
History of alcohol or Drug use	19(10.6)	37.63	17.02	1.01	0.325

Table 2. Post-hoc Scheffé test results for different shift work and educational levels on Covid -19 anxiety

Factor	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Shift work	Morning	Evening	-6.06	5.54	.55	-19.74	7.62
		Rotating shifts	-12.44*	1.88	.000	-17.10	-7.79
	Evening	Morning	6.060	5.54	.55	-7.62	19.74
		Rotating shifts	-6.38	5.37	.49	-19.64	6.86
	Rotating shifts	Morning	12.44*	1.88	.000	7.79	17.10
		Evening	6.38	5.37	.49	-6.86	19.64
Educational level	Diploma	B.A	4.05	2.54	.47	-3.13	11.23
		M.A	14.71*	2.95	.000	6.38	23.05
		Ph.D.	9.24	3.39	.06	-.34	18.83
	B.A	Diploma	-4.05	2.54	.47	-11.23	3.13
		M.A	10.66*	2.11	.000	4.68	16.65
		Ph.D.	5.19	2.70	.30	-2.44	12.83
	M.A	Diploma	-14.71*	2.95	.000	-23.05	-6.38
		B.A	-10.66*	2.11	.000	-16.65	-4.68
		Ph.D.	-5.47	3.09	.37	-14.19	3.25
	Ph.D.	Diploma	-9.24	3.39	.06	-18.83	.34
		B.A	-5.19	2.70	.30	-12.83	2.44
		M.A	5.47	3.09	.37	-3.25	14.19

The results showed that 8.3% of the participants in this study had a history of Covid-19, 58.3% of the participants had a history of Covid-19, 62.2% of the participants had a history of Covid-19 suspected symptoms, 67.8% had a history of close contact with Covid-19 patients, and 51.7% had severe symptoms of post-traumatic stress disorder (pcl5>33) (Table 3).

Table 3. Frequency (percentage) of variables related to exposure levels to Covid-19 and frequency (percentage) of PTSD symptoms severity by cut-off point

Variable	Total frequency	%
History of Covid-19 disease	15	8.3
history of covid-19 disease in relatives	105	58.3
history of having Covid-19 suspicious symptoms	112	62.2
history of close contact to Covid-19 patient	122	67.8
PCL-5>33	93	51.7

There was a significant positive relationship between Covid-19 anxiety and PTSD symptoms severity ($p < 0.05$), which means that by increasing Covid-19 anxiety, PTSD symptoms severity increased. A significant positive relationship was between sleep quality and PTSD symptoms severity. ($p < 0.05$), which means that by increasing the score of sleep quality dimensions (higher score indicates poor sleep quality) severity of PTSD symptoms increased (Table 4).

Table 4. Mean, standard deviation, and Pearson correlation matrix between sleep quality dimensions, Covid-19 anxiety and PTSD symptoms severity in health care workers.

Variable	M	SD	r
PTSD	33.92	16.83	1
Covid-19 anxiety	19.91	11.75	0.73**
sleep latency	1.04	0.65	0.29**
Daytime dysfunction	.95	.87	0.61**
Sleep duration	1.02	.98	0.37**
Habitual sleep efficiency	.40	.73	0.17*
subjective sleep quality	1.42	0.81	0.62**
Use of sleeping medication	0.55	0.73	0.55**
Sleep disturbance	1.16	0.55	0.51**
** $p < 0.05$ * $p < 0.01$			

Binary logistic regression analyses (method: enter) were used to predict the potential risk factors of PTSD. 180 health care workers were entered in this analysis. The model was significant as evident from the omnibus Chi-square statistics ($p < 0.000$, $df = 26$ and Chi-square= 118.83). This model was a good fit, as evident from non-significant Hosmer–Lemeshow statistics ($P = 0.3$). For normality, skewness and kurtosis were assessed, and both of them were between the range of 2 and -2 (2, -2). All independent variables (demographic variables, history of Covid-19 variables, and sleep dimensions, Table-1) could explain between 48% and 64.5% variance of the dependent variable using Cox and Snell and Nagelkerke R^2 . This model correctly predicted 86% of the probability of PTSD based on predictor variables and the overall prediction accuracy was 85.6%. The Wald criterion

showed that sleeping medication use (odds ratio (OR) = 3.21, 95% confidence interval (CI) =1.22-8.4), and covid-19 anxiety (OR = 1.13, 95% CI =1.04-1.22) significantly predicted a higher likelihood of PTSD and the strongest predictor of PTSD was sleeping medication use OR=3.21 ($P<.05$). Health care workers with severe anxiety were 1.13 times more potential for having PTSD

than those who had low-moderate anxiety. Health care workers that used sleeping medication had a 3.2 higher risk for having PTSD than those who did not use sleeping medication (Table -5). None of the other variables were significantly associated with PTSD risk ($P> 0.05$).

Table 5. Logistic regression predicting the likelihood of PTSD

Predictors	B	SE	Wald	df	Sig	Exp (B)= OR	95% C.I.for EXP(B)	
							Lower	Upper
sleeping medication use	1.167	0.490	5.669	1	0.017	3.21	1.229	8.400
Covid-19 anxiety	0.121	0.040	9.091	1	0.003	1.13	1.043	1.221
Constant	-5.305	2.554	4.314	1	0.038	0.005		
Abbreviations: OR = odds ratio; CI= confidence interval.								

Discussion

The results showed that there were statistically significant differences between PTSD severity and different degree levels. PTSD severity was lower for those with a master's than diploma and bachelor's degrees. These results are consistent with some previous studies, such as the study conducted by Schneider et al. A possible explanation for this finding is that different degree levels indirectly affect economic resources, social status, social networks, and health behaviors. Therefore, health care workers with higher education use better-coping strategies possibly, because they had access to more resources and therefore present less severe symptoms of PTSD. There was also a significant difference between PTSD severity and work shift. PTSD severity was lower in the morning shift. This finding is consistent with studies that emphasize the role of shift work on mental health ²³⁻²⁵. The rotating shift

work may cause sleep and digestive disorders that affect individuals' social and family life and make them vulnerable to mental diseases ²⁶.

Other findings disclosed that 51.7% of health care workers had severe PTSD symptoms. In a study conducted by Zandifar et al. on 894 health care workers in 9 hospitals in Alborz, Iran, more than one third of participants had PTSD symptoms.²⁷ PTSD symptoms in this study and similar studies in Iran were higher compared to studies conducted in Norway (27.7%), China (40.2%), Greece (16.7%), Italy (36.7%), and Singapore (7.7%) ^{7,8,28,29}. One can suggest different reasons, including workload and social and organizational support in diverse countries ³⁰. Considering different cutting points for screening tools ²⁷ and the severity of trauma in Iran,^{27,31} the mortality rate due to Covid-19 is high, which clouds the explanation for the increased severity of PTSD symptoms in the present study. Iran was declared the second Asian country and the sixth country for covid-19 mortality rate for seven

days in the world³². Zandifar et al. explained the lack of medical equipment was associated with a higher prevalence of symptoms of PTSD in Iranian health care workers²⁷. It is recommended that future studies explore the factors influencing the high prevalence of PTSD among Iranians' high-risk population during the covid-19 pandemic.

A positive relationship has been found between change in Covid-19 anxiety and severity of PTSD symptoms, such that increases in covid-19 anxiety were associated with increases in the severity of PTSD symptoms. This result is somewhat consistent with studies that had found a positive relationship between anxiety and PTSD^{33,34}. A possible explanation is that while low levels of anxiety motivated health care workers to protect themselves against the virus, exposure to high levels of anxiety has negative consequences such as sleep disorder,³⁵ emotional problems,³⁶⁻³⁷ and cognitive dysfunction,³⁸ which are the risk for PTSD². Hence, high Covid-19 anxiety may make health care workers more vulnerable to PTSD.

The results demonstrated that there was a significant positive relationship between all dimensions of sleep quality and the severity of PTSD symptoms. This result is consistent with previous studies that showed sleep disorder is essentially contributing to the etiology of PTSD rather than being only a secondary symptom emerging from this disorder³⁹⁻⁴¹. A possible explanation for these results is that impaired sleep before stressful events may confine the cognitive and emotional assets that are needed to manage those¹⁴.

The Enter logistic regression analysis showed that among the predictor variables. Only the use of sleeping medication and Covid-19 anxiety could predict the risk of PTSD, and the use of sleeping medication was a stronger predictor than Covid-19 anxiety. People who use sleep medication are more likely to have severe sleep problems and according to the relationship between sleep disorder, Covid-19 anxiety, and PTSD^{2,42}. It is suggested to pay

attention to the sleep quality of Health care workers more than ever seriously. In the present study, the history of exposure to the Covid-19 virus and demographic variables were not significant predictors of the risk of PTSD. This result is consistent with the study of Zhang et al. that showed sleep status predicted PTSD more than the history of exposure to COVID-19². This is a critical issue because health care workers have to deal with Covid-19 (due to their job position), and their demographic characteristics such as age, gender, and education are almost unchanged. Therefore, it is essential to improve the sleep quality of health care workers. Removing the stigma of referring to psychological services and providing public online sleep hygiene education can be helpful.

Low numbers of health care workers with Covid-19 were one of the limitations of the present study, which affected the accrual estimation of the PTSD risk. Also, online data collection has been applied to minimize any potential risks, which reduces the generalizability of the data. This study was conducted in Khorramabad, Iran. Thus, essential attention should be taken in generalizing and interpreting the results.

Conclusion

Improving sleep quality plays a crucial role in health care workers and boosts their immune system response to different types of infections like Covid-19. The results demonstrated that covid-19 anxiety and use of sleeping medication predicted PTSD, and usage sleeping medication was a stronger predictor of covid-19 anxiety. Since the usage of sleeping medication was the best predictor of PTSD, it is suggested to highlight the role of this variable in future studies more than ever. It was suggested that Online workshops about necessary training and improved sleep quality could decrease Covid-19 anxiety. The high prevalence of PTSD symptoms among health care workers highlights the need for Covid-19 symptoms screening.

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Conflict of Interest Disclosures

The authors of the paper stated that there is no conflict of interest in the present study.

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Authors' Contributions

All authors have actively participated in the presentation of the idea, search for sources, writing and review of the paper, and with the final approval of this paper and accept responsibility for the accuracy of the content presented.

Ethical Statement

The present study was approved by Baqiyatallah University of Medical Sciences (BUMS) with the ethical code IR.BMSU.REC.1399.586.

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