

Sleep Quality in Healthcare Professionals After Kahramanmaraş Earthquake

Kahramanmaraş Depremi Sonrası Sağlık Çalışanlarında Uyku Kalitesi

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ABSTRACT

Objective: On 6 February 2023, a catastrophic and lethal earthquake centred in Kahramanmaraş occurred with unprecedented intensity. The objective of this study was to analyse the relationship between post-traumatic symptoms, psychological symptoms and sleep quality in healthcare professionals following the earthquake.

Method: In the present study, which was designed as a cross-sectional investigation, 100 healthcare professionals who had been exposed to the Kahramanmaraş earthquake and who were employed at Harran University Hospital since the second week following the earthquake were included in the study. The participants were requested to complete the Event Impact Scale, the Pittsburgh Sleep Quality Scale and the Symptom Checklist-90.

Results: The present study comprised 52 (52%) female and 48 (48%) male participants, with a mean age of 30.2 ± 6.8 years. Statistically significant differences in total sleep quality scores were found to be associated with the presence of a damaged house, a history of medical illness, unhappiness, nightmares, and insomnia. The event impact scale total score ($\beta=.39$, $p<.001$) significantly predicted total sleep quality, as indicated by path analyses. A detailed evaluation of the event impact scale and symptom checklist-90 was conducted according to the subheadings of the scales. The results revealed a significant association between depression symptoms ($\beta=.28$, $p<.001$) and re-experiencing score ($\beta=.26$, $p=.002$), hyperarousal score ($\beta=.23$, $p=0.003$) and having a history of medical illness ($\beta=.23$, $p=0.005$) were found to significantly predict the total sleep quality score.

Conclusion: Psychological symptoms, posttraumatic stress symptoms, and sleep quality were revealed to be negatively associated in our study. It is critical to warn and advise healthcare professionals, particularly those who have been exposed to secondary traumas, about mental symptoms and sleep disturbances.

Keywords: Earthquake, healthcare professionals, post-traumatic stress symptoms, sleep quality

ÖZ

Amaç: 6 Şubat 2023'te meydana gelen Kahramanmaraş merkezli yıkıcılığı ve öldürücülüğü bu şiddetle olan bir deprem daha önce yaşanmamıştır. Bu çalışmanın amacı, depremin ardından sağlık çalışanlarında travma sonrası semptomlar, psikolojik semptomlar ve uyku kalitesi arasındaki ilişkiyi analiz etmektir.

Yöntem: Kesitsel araştırma olarak planlanan çalışmamıza, Kahramanmaraş depremine maruz kalan ve depremden sonraki ikinci haftadan itibaren Harran üniversitesi Hastanesinde çalışan sağlık çalışanlarından 100 kişi çalışmaya dahil edilmiştir. Kişilerden, Olay Etki Ölçeği, Pittsburgh Uyku Kalitesi Ölçeği ve Semptom Kontrol Listesi -90 doldurması istendi.

Bulgular: Çalışmaya yaş ortalaması 30,2 ± 6,8 yıl olan 52 (%52) kadın 48 (%48) erkek dahil edildi. Katılımcıların kaldığı evin hasarlı olması, tıbbi hastalık öyküsünün olması, mutsuzluk, kabus, ve uykusuzluk şikayetlerinin olması; toplam uyku kalitesi açısından istatistiksel olarak anlamlı farka neden olmuştur. Kurulan yol analizlerinde; olay etki ölçeğinin total puanının ($\beta=.39$, $p<.001$) toplam uyku kalitesini anlamlı şekilde yordadığı görülmüştür. Olay etki ölçeği ve semptom kontrol listesi -90 ölçeklerin alt başlıklarına göre ayrıntılı olarak değerlendirdiğimizde ise; depresyon belirtilerinin ($\beta=.28$, $p<.001$), yeniden yaşama puanının ($\beta=.26$, $p=0.002$), aşırı uyarılma puanının ($\beta=.23$, $p=0.003$) ve tıbbi hastalık öyküsü olmasının ($\beta=.23$, $p=0.005$) toplam uyku kalitesi puanını anlamlı şekilde yordadığı görülmüştür.

Sonuç: Çalışmamızda psikolojik belirtiler, travma sonrası stres belirtileri ve uyku kalitesinin negatif ilişkili olduğu ortaya konmuştur. Özellikle ikincil travmalara maruz kalan sağlık personelinin ruhsal belirtiler ve uyku bozuklukları konusunda uyarılması ve bilgilendirilmesi kritik önem taşımaktadır.

Anahtar sözcükler: Deprem, sağlık çalışanları, travma sonrası stres belirtileri, uyku kalitesi

Introduction

Earthquakes are among the most frequent causes of natural disasters in the world. Compared to other natural disasters, earthquakes can cause a tremendous amount of damage within a short time without warning and therefore can affect more people (Altındag et al. 2005). The consequences of an earthquake are generally worse in developing countries compared to developed countries. A meta-analysis in which 116 studies investigating the psychological effects of natural disasters were analyzed reported that 40 of them were in developing countries (Neria et al. 2008). Additionally, adverse health outcomes may be experienced very frequently after an earthquake (Tural et al. 2004). Therefore, there is a need for studies examining the short- and long-term consequences of severe earthquakes on the health of individuals in developing countries.

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Healthcare professionals who provide emergency medical services and respond to individuals affected by earthquakes may witness frightening scenes at the early stages of disasters, such as dead bodies, seriously injured individuals and those trapped under rubble. Therefore, healthcare professionals are highly vulnerable to trauma due to their exposure to such events (Zhang et al. 2012). The incidence of post-traumatic stress disorder (PTSD) was reported to be higher after an earthquake among the professional rescuers who were on duty (Guo et al. 2004, Ozen and Sir 2004). Post-traumatic stress may also be an important cause of sleep disorders (Ghadami et al. 2015, Khazaie et al. 2016). Survivors of the Great East Japan Earthquake with nocturnal sleep problems were reported to find the treatment of insomnia more challenging; these individuals also faced serial nightmares more frequently (Sato et al. 2017). Yet another study revealed a decrease in sleep quality after an earthquake (Tempesta et al. 2013). The symptoms of psychiatric disorders can lead to sleep disturbances; additionally, disrupted sleep, particularly insomnia, can serve as a risk factor for psychiatric disorders, suggesting the presence of a bidirectional relationship. Insomnia is considered to be an independent risk factor and an early sign of various mental disorders, and plays a significant role in their relapses and recurrences (Palagini et al. 2022).

Although a wide range of psychopathologies can be seen after a natural disaster, the most common is thought to be PTSD (Kušević et al. 2021). For this reason, studies conducted after earthquakes are generally focused on the prevalence of post-traumatic stress, anxiety disorder and depression (Zhou et al. 2013), while less attention has been paid to sleep problems and symptoms resulting from sleep problems (Sato et al. 2017). The high level of stress caused by earthquakes, along with documented evidence of deterioration in sleep quality after an earthquake, highlights the importance of evaluating the relationship between sleep quality and the effects of an earthquake. It is also critical to analyze the general confusion and uncertainty along with other problems that may be experienced by an earthquake survivor during the day to determine the cause of sleep problems and prevent any further damage caused by these disorders (Ghadami et al. 2015, Khazaie et al. 2016).

Two earthquakes of 7.8 Mw and 7.5 Mw on the Richter scale took place on 6 th February 2023 with the epicenter in Kahramanmaraş, Türkiye. According to official figures, at least 45,089 people lost their lives and more than 122,000 were injured following the two earthquakes. The earthquake was felt intensely in Kahramanmaraş as well as in the neighboring provinces of Gaziantep, Adıyaman, Hatay, Şanlıurfa, Osmaniye, Diyarbakır, Malatya, Kilis, Adana and Elazığ. After the earthquakes, more than 11000 aftershocks with a magnitude up to 6.7 Mw were reported to have occurred (AFAD 2023). Many hospitals in the region continued to provide service during these tremors despite being affected or damaged by the earthquake. Healthcare professionals continued to help the injured in spite of the ongoing security threat from aftershocks and the traumatic effects of the earthquake (WHO 2023).

Nurses and healthcare professionals are expected to be prepared for disasters. However, a study carried out on nursing students revealed that the level of preparedness for disasters was inadequate and called for disaster preparedness to be included in the curriculum (Kavurmaci 2023). Disaster mental health preparedness is an important mitigation method to protect individuals from the negative psychological effects caused by unexpected natural disasters (Roudini et al. 2017). Such disaster preparedness measures can ensure that healthcare professionals are aware of the psychological problems they may encounter.

A large volume of literature has already established a general association between sleep problems and psychiatric symptoms or disorders (Van Der Kloet et al. 2013, Lauterbach et al. 2011). The effects of the trauma of an earthquake on sleep as well as the waking hours of the affected individuals need to be evaluated in a systematic manner in order to better understand their effects on sleep and to mitigate any ensuing psychopathology. It is also important to examine the link between sleep disorders and psychiatric symptoms more closely. This can help develop and implement psychiatric interventions after disasters for both the survivors and the healthcare professionals helping them.

An earthquake of such a destructive and lethal intensity as the Kahramanmaraş earthquake has not been experienced in Türkiye previously. It can be safely assumed that the psychological effects of a natural disaster at such a scale will be very intense. The hypothesis of the study is that increased levels of psychiatric symptoms among healthcare workers after the earthquakes are associated with decreased sleep quality. This study is one of the few in the literature that simultaneously examines the impact of psychiatric symptoms on sleep quality among healthcare workers following the Kahramanmaraş earthquakes. In this regard, it aims to contribute to the literature by shedding light on the mental health needs of healthcare workers in the aftermath of disasters and guiding future mental health service planning.

Method

Sample

The current study was designed as a cross-sectional study. The study comprised 100 healthcare workers over the age of 18 who had experienced the Kahramanmaraş earthquake and who had been working at Harran University Hospital since the second week after the earthquake, and who had agreed to participate in the study. Exclusion criteria included individuals who had received psychiatric treatment or had undergone previous psychiatric consultations. This exclusion criterion was applied to avoid confounding factors, ensuring that the psychological symptoms experienced by the participants were directly related to the earthquake and not influenced by prior psychiatric conditions. A total of 35 participants were excluded due to these criteria, resulting in the inclusion of 100 participants in the final analysis. The potential participants were informed about the study in detail and informed consent was obtained prior to their inclusion.

A power analysis was conducted based on a similar study in the literature (Ait-Aoudia et al., 2013) to determine the required sample size for this study. The correlation coefficient between the total PSQI-A score and the IES-R was assumed to be $\rho = 0.58$. With a 95% confidence level ($1-\alpha = 0.95$) and a 95% test power ($1-\beta = 0.95$), the required number of participants was calculated to be 37. To account for potential dropout, a 20% increase in the sample size was applied, resulting in a recommended total of 47 participants. However, considering the possibility of achieving more robust statistical power, it was ultimately decided to include 100 participants in the study.

Procedure

The protocol received approval from Harran University Non-Interventional Clinical Research Ethics Committee (18.09.2023 number 23/17/27). The current research was conducted in accordance with the tenets of the Declaration of Helsinki. The study was initiated on the sixth week after the Kahramanmaraş earthquake. The study participants were asked to fill a sociodemographic data form after a semi-structured interview by a psychiatrist. In addition, the participants were asked to fill in the Impact of Event Scale (IES-R), Pittsburgh sleep quality scale (PSQI) and the Symptom Check List- 90 (SCL-90).

Measures

Sociodemographic Form

Age, gender, educational status, marital status, the location of the earthquake, the individual's experiences related to the earthquake, the manner of continuation of education, psychological symptoms experienced, comorbidities, substance use, and history of psychiatric disorders were investigated with the help of the sociodemographic form.

Symptom Check List-90 (SCL-90-R)

The SCL-90 is a 90-item scale and the questions are grouped into 9 subgroups. The scale consists of questions on somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, anger-hostility, phobia-anxiety, paranoid thoughts, psychotic symptoms and an additional scale mostly related to sleep and eating problems. Each item in the SCL-90 form is evaluated by considering the extent to which the participant had been feeling restless or agitated in the last fifteen days, including the present day, with the scoring carried out as follows: 0=not at all, 1=very little, 2=moderately, 3=quite a bit, 4=extremely. The symptom distribution was evaluated with subscale scores and the score for each subscale was divided by the number of questions. Values below 0.5 are considered to be within the normal range, values ranging from 0.5 to 1 indicate a moderate problem, and values above 1 suggest a severe problem. The general severity index score (GSI; mental symptom level) was generated by dividing the total score of the 90 questions by the total number of questions. A GSI > 1 indicates that the symptoms are at a psychopathological level. SCL-90 was developed by Derogatis et al. in 1976. Its Turkish validity and reliability studies were carried out in 1991 (Dag 1991).

Impact of Event Scale – Revised (IES-R)

The IES-R scale was developed by Weiss and Marmar in 1997 according to the PTSD criteria of the American Psychiatric Association. The scale consists of 22 items, and can be scored between 0 and 4 (where 0=Not at all and 4=Very much). The IES-R consists of 3 subscales: intrusion, avoidance and hyperarousal. A sample item related to the intrusion subscale is as follows: "I have difficulty in maintaining my sleep, having an uninterrupted

and deep sleep, my sleep is interrupted." A sample item related to the avoidance subscale is as follows: "I feel as if the event did not happen, and is not real." and a sample item related to the hyperarousal scale is "I feel restless and angry.". The scale has been adapted to the Turkish (Corapcioglu et al. 2006). The cut-off point for IES-R was determined to be 33 points and a higher total score indicates stronger PTSD symptoms. The overall scores derived from the scale were utilized in the current study and the internal consistency coefficient of Cronbach's alpha was calculated as .91 for the entire scale (Creamer et al. 2003).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI scale assesses sleep quality, quantity, as well as the presence and severity of sleep disturbance. The scale includes seven items and a total of 19 questions assessing subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication and impairment in daytime activities. Each response is scored between 0-3 according to symptom frequency. The score is considered to be 0 if no sleep disturbance occurred during the last month, 1 if it occurred less than once a week, 2 if it occurred once or twice a week, and 3 if it occurred three or more times a week. The global score varies between 0-21 and higher values indicate poor sleep quality along with a high level of sleep disturbance. A global score of 5 or above indicates a clinically significant poor sleep quality (Buysse et al. 1991). The validity and reliability studies of the PSQI questionnaire was conducted for Turkish patients (Agargun et al. 1996).

Statistical Analysis

The study data were analyzed with IBM SPSS and IBM AMOS V24 programs. Compliance with normal distribution was analyzed with the Shapiro-Wilk and Kolmogorov-Smirnov tests. Descriptive statistics were presented as mean, standard deviation, and median (min-max) for continuous variables, and as frequencies and percentages for categorical variables. Independent two-sample t-test was utilized to compare data that was normally distributed, while the Mann-Whitney U test was used to compare data that was not normally distributed (e.g., comparison of PSQI scores based on presence of property damage, history of medical illness, presence of nightmares, etc.). The relationships between non-normally distributed data were examined with Spearman's rho correlation coefficient (e.g., SCL-90 subscale scores and IES-R total score, PSQI total score). A path analysis model was applied to evaluate the direct and indirect effects of variables such as age, years of education, total IES-R score, SCL-90 general severity index (GSI), and presence of chronic medical illness on total sleep quality. The selection of variables for the path model was based on both theoretical relevance and empirical findings. Specifically, IES-R and SCL-90-R subdimensions that demonstrated statistically significant associations with PSQI in the bivariate analyses (e.g., intrusion, hyperarousal, and depression), as well as sociodemographic factors previously linked to sleep quality in the literature (e.g., age, years of education), were included in the model. Presence of chronic medical illness was also incorporated due to its known relationship with sleep disturbances. This approach ensured a comprehensive evaluation of potential risk factors influencing sleep quality following the earthquake. Significance level was considered as $p < 0.050$.

Results

The current study included 52 (52%) women and 48 (48%) men with a mean age of 30.2 ± 6.8 years. The participants had a mean duration of education of 17.56 ± 2.74 years and 37% were married. Of the study participants, 88% were living in their own house and 63% were staying with their families. While 6% of the participants were injured during the earthquake, 2% were trapped under a collapsed building and 59% had damage to their properties. Additionally, 23% of the participants had relatives who died in the earthquake. The total PSQI score was 7.83 ± 3.94 . Sociodemographic data and earthquake experiences are summarized in Table 1.

Characteristics	Mean \pm s.deviation	Median (min-max)
Age	30.2 \pm 6.8	28 (21 - 58)
Year of Education	17.56 \pm 2.74	17 (15 - 21)
PSQI Total scale scores	7.83 \pm 3.94	7 (1 - 17)
Gender	n	%
Female	52	52
Male	48	48
Marital Status		
Single	63	63
Married	37	37
Having a child		
No	67	67
Yes	33	33

Level of Education		
High School	12	12
Vocational School	6	6
University	60	60
Master's degree	22	22
Where he/she stays		
Own House	88	88
House of Relatives	3	3
Temporary Housing	9	9
Who he/she lives with		
Alone	24	24
Family	63	63
Friend	13	13
Damage to house		
Damaged	59	59
No damage	41	41
Injury in earthquake		
No	94	94
Yes	6	6
Earthquake collapse		
No	98	98
Yes	2	2
Medical Treatment		
No	96	96
Simple Intervention	3	3
Emergency Medical Intervention	1	1
Does he/she still need medical treatment due to the earthquake		
No	98	98
Yes	2	2
Permanent Physical Damage due to Earthquake		
No	98	98
Yes	2	2
Did he/she think he/she was going to die during the earthquake?		
No	29	29
Yes	71	71
Having had relatives or friends who were hurt or killed in the event		
No	77	77
Yes	23	23
Did he have a proper funeral?		
No	10	10
Yes	13	13
Did he/she attend his relative's funeral?		
No	13	13
Yes	10	10
Witness to others' injury or death		
No	69	69
Yes	31	31
Difficulties in Accessing Aid		
No	66	66
Yes	34	34
Did he/she feel discriminated against?		
No	94	94
Yes	6	6
Are There Any Losses Due To Earthquake		
No	77	77
Yes	23	23
Medical History		
No	92	92
Yes	8	8
Disability Status		
No	96	96
Yes	4	4
Social Support		
Insufficient	48	48.5
Adequate	51	51.5
Experienced any other traumatic event before the earthquake		
No	82	82
Yes	18	18
Alcohol Use		
No	83	83
Yes	17	17
Smoking		
No	72	72
Yes	28	28

The variables that resulted in a statistically significant difference in the PSQI scores were damage to property ($p=0.032$), having a history of medical illness ($p=0.013$), unhappiness ($p=0.037$), presence of nightmares (<0.001), and insomnia ($p=0.001$) (Table 2).

	PSQI	p
Gender		
Female	8.40±4.19	0.146
Male	7.20±3.59	
Marital status		
Married	8.35±4.17	0.365
Single	7.52±3.80	
Damage to house		
Damaged	8.47±3.93	0.032
No damage	6.90±3.81	
Medical History		
Yes	11.12±3.48	0.013
No	7.54±3.86	
Complaint of unhappiness		
Yes	8.75±3.74	0.037
No	7.18±3.98	
Complaint of insomnia		
Yes	9.17±3.91	0.001
No	6.68±3.62	
Complaint of nightmares		
Yes	11.04±3.69	<0.001
No	6.92±3.53	

Mann Whitney U testi; PSQI: Pittsburgh Sleep Quality Index

	Mean ± std.deviation	Median (Min - Max)	Test Ist.*	p
SOMA				
No	7.11 ± 3.75	6.00(1.00 - 17.00)	543	0.002
Yes	10.00 ± 3.79	10.00(4.00 - 17.00)		
OCD				
No	6.19 ± 3.38	6.00(1.00 - 15.00)	654.5	<0.001
Yes	9.35 ± 3.84	9.00(1.00 - 17.00)		
SIR				
No	7.14 ± 3.77	6.00(1.00 - 15.00)	635	0.003
Yes	9.66 ± 3.80	9.00(3.00 - 17.00)		
DEPR				
No	6.04 ± 3.24	5.50(1.00 - 15.00)	561	<0.001
Yes	9.66 ± 3.80	9.50(2.00 - 17.00)		
ANX				
No	6.67 ± 3.48	6.00(1.00 - 15.00)	676.5	<0.001
Yes	9.64 ± 3.98	9.00(2.00 - 17.00)		
Anger				
No	7.19 ± 3.62	6.00(1.00 - 15.00)	779	0.022
Yes	9.19 ± 4.31	9.00(1.00 - 17.00)		
PHOBIC				
No	7.29 ± 3.64	6.00(1.00 - 15.00)	545	0.016
Yes	9.86 ± 4.45	9.00(2.00 - 17.00)		
PARA				
No	7.12 ± 3.67	6.00(1.00 - 15.00)	766	0.017
Yes	9.34 ± 4.14	9.00(3.00 - 17.00)		
PSYC				
No	7.46 ± 3.68	7.00(1.00 - 17.00)	446.5	0.065
Yes	9.93 ± 4.80	9.00(3.00 - 17.00)		
AS				
No	6.31 ± 3.40	5.50(1.00 - 15.00)	631	<0.001
Yes	9.61 ± 3.83	9.50(2.00 - 17.00)		
GSI				
No	5.50 ± 2.97	5.00(1.00 - 10.00)	303.5	0.024
Yes	8.28 ± 3.96	7.00(1.00 - 17.00)		

*Mann Whitney U testi ; PSQI: Pittsburgh Sleep Quality Index; SCL-90: Symptom Check List-90; OCD: Obsessive compulsive disorder; SOMA: Somatization SIR: Sensitivity to interpersonal relations DEPR: Depression ANX: : Anxiety, PHOBIC: Phobic anxiety; PSYC: Psychotic symptom PARA: Paranoid symptom AS: Additional symptoms, GSI: General symptom index.

The relationship between SCL-90 subgroup scores and total sleep quality, somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, anger- hostility, phobic-anxiety, paranoid, additional symptoms (sleep appetite guilt) subheadings and GSI was found to be statistically significant ($p=0.002$, <0.001 , 0.003 , <0.001 , <0.001 , 0.022 , 0.016 , 0.017 , <0.001 , and 0.024 , respectively) (Table 3).

Table 4. Comparison of IES-R total score according to SCL-90 subgroups				
	Mean \pm std.deviation	Median (Min - Max)	Test Ist.	p
SOMA				
No	19.73 \pm 12.79	18.00(0.00 – 49.00)	-3.8741	<0.001
Yes	31.12 \pm 12.53	34.00(7.00 – 57.00)		
OCD				
No	16.56 \pm 12.57	14.00(0.00 – 49.00)	613.5002	<0.001
Yes	28.13 \pm 12.16	28.00(3.00 – 57.00)		
SIR				
No	19.33 \pm 12.63	17.00(0.00 – 49.00)	-4.2981	<0.001
Yes	31.14 \pm 11.97	34.00(1.00 – 57.00)		
DEPR				
No	14.62 \pm 11.24	13.50(0.00 – 49.00)	401.0002	<0.001
Yes	30.14 \pm 11.45	31.50(7.00 – 57.00)		
ANX				
No	16.69 \pm 11.85	16.00(0.00 – 49.00)	-6.4281	<0.001
Yes	31.79 \pm 10.82	33.00(13.00 – 57.00)		
Anger				
No	18.69 \pm 12.26	17.50(0.00 – 49.00)	-4.5681	<0.001
Yes	30.84 \pm 12.72	34.00(3.00 – 57.00)		
PHOBIC				
No	19.09 \pm 11.97	18.00(0.00 – 49.00)	-5.7231	<0.001
Yes	35.71 \pm 11.30	38.00(13.00 – 57.00)		
PARA				
No	19.47 \pm 12.38	18.00(0.00 – 49.00)	-3.5201	0.001
Yes	29.19 \pm 13.90	33.50(1.00 – 57.00)		
PSYC				
No	21.38 \pm 13.12	19.00(0.00 – 49.00)	-2.1451	0.034
Yes	29.40 \pm 14.69	36.00(1.00 – 57.00)		
AS				
No	16.63 \pm 12.08	15.50(0.00 – 49.00)	-5.3651	<0.001
Yes	29.57 \pm 11.94	29.50(1.00 – 57.00)		
GSI				
No	8.75 \pm 10.15	6.00(0.00 – 37.00)	149.5002	<0.001
Yes	24.73 \pm 12.92	24.00(0.00 – 57.00)		

¹ Independent samples t test, ² Mann Whitney U test; IES-R: Impact of Event Scale – Revised; SCL-90: Symptom Check List-90; SOMA: Somatization OCD: Obsessive compulsive disorder, SIR: Sensitivity to interpersonal relations DEPR: Depression ANX: Anxiety, PHOBIC: Phobic anxiety; PSYC: Psychotic symptom PARA: Paranoid symptom AS: Additional symptoms, GSI: General symptom index.

The relationship between SCL-90 subheadings and IES-R scale, somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety anger and hostility, phobic anxiety, paranoid, psychoticism, additional symptoms (sleep appetite guilt) subheadings and GSI was found to be statistically significant ($p<0.001$, <0.001 , <0.001 , <0.001 , <0.001 , <0.001 , <0.001 , <0.001 , 0.001 , 0.034 , <0.001 , and 0.001 , respectively) (Table 4).

The correlation analysis between the subheadings of the PSQI and the subheadings of the IES-R scale are summarized in Table 5. Intrusion ($r=.496$ $p< 0.01$), avoidance ($r=.261$ $p< 0.01$), hyperarousal ($r=.581$ $p< 0.01$), and IES-R total score ($r=.501$ $p< 0.01$) showed statistically significant positive correlations with total sleep quality. Additionally, a strong and significant correlation was identified between total sleep quality and other components of sleep quality.

Table 5. Correlations between PSQI subscales and IES-R subscales

	1	2	3	4	5	6	7	8	9	10	11	12
1. The intrusion (IES-R)	1											
2. The avoidance (IES-R)	.507**	1										
3. The hyperarousal (IES-R)	.790**	.484**	1									
4. IES-R Total scale scores	.889**	.775**	.877**	1								
5. Subjective sleep quality	.470**	.282**	.539**	.526**	1							
6. Sleep latency	.287**	.198*	.289**	.307**	.513**	1						
7. Sleep duration	.496**	.149	.471**	.442**	.470**	.419**	1					
8. Habitual sleep efficiency	.269**	.065	.363**	.263**	.360**	.370**	.565**	1				
9. Sleep disturbance	.264**	.218*	.288**	.299**	.462**	.381**	.246*	.053	1			
10. Sleeping medication use	.092	-.014	.119	.084	.082	.220*	.179	.092	.216*	1		
11. Daytime dysfunction	.467	.234*	.411**	.426**	.464**	.345**	.426**	.336**	.351**	.227*	1	
12. PSQI Total scale scores	.496**	.261**	.581**	.501**	.732**	.735**	.736**	.628**	.566**	.331**	.686**	1

*p < 0.05 **p < 0.01 Spearman's r test correlations; PSQI: Pittsburgh Sleep Quality Index; IES-R: Impact of Event Scale – Revised

The relationship between age, years of education, IES-R total score, SCL-90 general score and sleep quality was examined in the path analysis. The IES-R total score ($\beta = .39$, $p < .001$) could significantly predict total sleep quality. The other variables did not reach statistical significance. Moreover, 29% of the total sleep quality could be explained by these variables. A more detailed evaluation according to the subheadings of the scales indicated that depression symptoms ($\beta = .28$, $p < .001$), intrusion ($\beta = .26$, $p = 0.002$), hyperarousal score ($\beta = .23$, $p = 0.003$) and having a history of medical illness ($\beta = .23$, $p = 0.005$) could significantly predict the total sleep quality score. These variables explained 31% of the total sleep quality scores (Table 6).

Table 6. Investigation of factors affecting PSQI score by path analysis

		Variables	β_1	β_2	S. error	Test statistic	p	R ²
PSQI	<---	IES_R	0.39	0.113	0.031	3.599	<0.001	0.290
PSQI	<---	SCL-90	0.176	0.112	0.07	1.607	0.108	
PSQI	<---	Age	-0.136	-0.078	0.049	-1.601	0.109	
PSQI	<---	Year of Education	-0.062	-0.088	0.121	-0.727	0.467	
PSQI	<---	ANX (SCL-90)	-0.085	-0.471	0.464	-1.014	0.310	
PSQI	<---	DEPR (SCL-90)	0.284	1.254	0.370	3.385	<0.001	
PSQI	<---	SOMA (SCL-90)	0.073	0.430	0.491	0.877	0.381	
PSQI	<---	Anger (SCL-90)	-0.154	-0.805	0.436	-1.845	0.065	
PSQI	<---	The intrusion (IES-R)	0.260	0.170	0.055	3.101	0.002	0.313
PSQI	<---	The avoidance (IES-R)	-0.105	-0.076	0.060	-1.262	0.207	
PSQI	<---	The hyperarousal (IES-R)	0.251	0.192	0.064	3.012	0.003	
PSQI	<---	Medical History	0.233	3.288	1.178	2.792	0.005	

β_1 : Standardised beta coefficient, β_2 : Unstandardised beta coefficient; PSQI: Pittsburgh Sleep Quality Index; IES-R: Impact of Event Scale – Revised; SCL-90: Symptom Check List-90 ANX: Anxiety DEPR: Depression SOMA: Somatization

Discussion

To the best of our knowledge, the current study is one of the first studies to evaluate the psychiatric symptoms experienced by healthcare professionals after the Kahramanmaraş earthquake and their relationship with sleep quality. Our investigation revealed a clear empirical proof of sleep disturbances and psychiatric comorbidities among the survivors of the Kahramanmaraş earthquake who were healthcare workers and continued with their employment and service at the hospital.

The sleep-wake system is among the most vulnerable to deregulation after traumatic events such as earthquakes (Wang et al. 2021). Therefore, sleep quality of disaster victims is an important issue in both epidemiological and psychiatric studies. Sleep disturbance is not only commonly observed among people exposed to disasters, but also among frontline and emergency professionals who provide support and assistance to the survivors (Jang et

al. 2020). Healthcare professionals are at a high risk of experiencing comparable psychological symptoms as individuals who have experienced earthquakes or aftershocks or who have suffered losses. Work stresses and work-related experiences may predict the presence of PTSD symptoms after such a disaster (Geronazzo-Alman et al. 2017).

The results of the current study strongly indicated the presence of an overall poor sleep quality among the study subjects. This finding is consistent with previous studies that have reported the incidence of insomnia and other sleep disorders after a natural disaster (Tempesta et al. 2013, Varela et al. 2008). Itoh et al (2022) reported that the prevalence of insomnia was 9.7% after an earthquake. We observed that the incidence of insomnia was 2.7 times higher in the current study at 25.7% compared to the pre-disaster period and this increase was mostly observed at the center of the disaster area. Individuals whose homes were destroyed, who were injured or who lost family members due to the earthquake suffered more from insomnia and decreased sleep quality. Ensuring personal safety is the first step in providing psychological help. Thus, an individual who is not mentally well cannot be expected to feel safe (Ruzek et al. 2007). We observed that individuals who suffered from damage to property had the worst sleep quality, most likely due to the lack of a feeling of safety.

We did not observe any significant difference in sleep quality as a function of age or years of education in the current study. Several studies have consistently reported that sleep quality can decrease with age (Del Brutto et al. 2016, Ensrud et al. 2012). The lack of a significant relationship between age and sleep quality was most likely because the participants were all in a similar age group in the current study.

Sleep disturbances have been proven to be important precursors of chronic diseases (e.g. heart disease, diabetes and osteoporosis), risky behavior (e.g. alcohol use) and psychiatric symptoms (e.g. diseases of the nervous system and PTSD) (Foley et al. 2004, Mehari et al. 2014). Sleep quality was reported to be considerably worse in patients with medical illnesses compared to those without. Furthermore, path analysis indicated that a history of medical illness was a significant predictor of poor sleep quality in the current study. The etiology of insomnia includes chronic diseases, especially in the cardiovascular, respiratory, gastrointestinal, renal and musculoskeletal systems (Sateia et al. 2017). The participants of the current study mostly reported cardiovascular and respiratory problems, supporting the literature. Mental disorders are also strongly implicated in the etiology of sleep disorders (Sateia et al. 2017, Roth 2007). Sleep quality was found to be significantly worse in patients with psychological complaints such as unhappiness and individuals who reported sleep disturbances and nightmares. Psychiatric examination of individuals with psychiatric complaints are likely to reveal the presence of sleep disturbances. Indeed, we observed positive correlations between sleep quality and psychiatric symptoms; thus, sleep quality deteriorated as obsessive-compulsive, somatization, depression, interpersonal sensitivity, anxiety anger hostility, phobic anxiety, paranoid thinking, sleep appetite guilt symptoms increased. These data suggest that sleep complaints may be a viable indicator of deterioration in mental health. Individuals who complained of insomnia after an earthquake were reported to experience greater psychological distress (Itoh et al. 2022). Psychological and emotional factors, including anxiety and depression caused by natural disasters can lead to problems with sleep quality. Additionally, low sleep quality can impair emotional, psychological and social functionality that are necessary to cope with a disaster (Mohammadi et al. 2019). However, longitudinal follow-up studies are needed to reach any firm conclusions on these relationships.

The most common response to a traumatic event is to relive it, along with avoidance of stimuli that are reminiscent of the trauma. Other responses include cognition and mood symptoms, and increased arousal symptoms. We observed a positive association between PTSD and other psychiatric symptoms in the study group. The path analysis indicated that both the IES-R total score and the IES-R scale sub-scale scores of intrusion and hyperarousal could significantly predict sleep quality. Furthermore, trauma symptoms and sleep quality were found to be negatively correlated. An association between the severity of the symptoms of depression, anxiety and PTSD and lower quality of sleep after an earthquake has been reported (Kim and Lee 2021). Findings of recent studies have led to the development of a more comprehensive model that replaces the traditional model and suggests that sleep disturbances are not only a symptom of PTSD, but that PTSD itself is an important factor in the emergence and progression of sleep disturbances (Weber and Wetter 2022). Additionally, a higher prevalence of sleep disorders among patients showing symptoms of post-traumatic stress has been reported along with indications of a bidirectional relationship between the two conditions (Kartal et al. 2021).

There are some limitations in the current study that need to be considered. The most important limitation is the lack of a sociodemographically matched control group. It should also be noted that the study was conducted at a single center and therefore the results cannot be extrapolated to the wider population. The psychological status of the participants prior to the earthquake was not evaluated; however, individuals with current psychiatric

illnesses and those under treatment were excluded from the study. The cross-sectional design of the study created limitations in determining the causal relationships between the variables. In particular, the lack of a longitudinal follow-up design precluded any assessment of how changes in sleep quality may progress over time.

Conclusion

Sleep quality was found to be negatively associated with adverse mental and post-traumatic stress symptoms. Path analyses revealed that depressive symptoms, along with re-experiencing and hyperarousal symptoms were associated with worse sleep quality. In addition, having a medical illness was assessed as a risk factor for sleep quality. In line with these data, it can be predicted that individuals who describe adverse mental symptoms and additionally have medical illnesses are at a high risk of sleep disturbances following major disasters such as earthquakes. Sleep disorders may play an important role in the etiology of mental disorders and may also be an indicator of deteriorating mental health. It is therefore important that healthcare professionals, especially those who are also exposed to secondary trauma, should be warned and informed about adverse mental symptoms and sleep disorders. Since healthcare professionals are an important part of disaster response activities, they should undergo psychological screening for mental disorders before and after such disasters. As a result of these screenings, risk groups can be identified and psychological support can be provided to individuals at risk. We also believe that it is necessary to organize training programs for all healthcare professionals that aim to increase their stress management skills and psychological resilience, and to teach them how to express their emotions and feelings.

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