

Prediction of Sleep Quality and Insomnia Severity by Psychological Disorders and Acute Stress among Earthquake Survivors in Sarpol-e Zahab, Iran, 2017

Hiwa Mohammadi^{1,2}, Hadi Naghdi³, Naser Yazdani³, Ali Zakiei¹, Farid Najafi⁴, Habibolah Khazaie^{1,5}

¹Sleep Disorders Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran, Departments of ²Neurology and ⁵Psychiatry, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran, ⁴Department of Epidemiology, School of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran, ³Department of Educational Science, Farhangian University, Sanandaj, Iran

ORCID:

Hiwa Mohammadi: <http://orcid.org/0000-0002-2364-9430>

Hadi Naghdi: <http://orcid.org/0000-0002-6265-3790>

Naser Yazdani: <http://orcid.org/0000-0002-5033-4944>

Ali Zakiei: <https://orcid.org/0000-0002-1972-4426>

Farid Najafi: <http://orcid.org/0000-0002-0534-6444>

Habibolah Khazaie: <http://orcid.org/0000-0002-8066-9753>

Abstract

Background: Psychological and health outcomes of natural disasters such as earthquakes affect survivors and health services for a long time. In the present study, posttraumatic stress disorders (PTSD), symptoms of psychopathology, sleep quality, and insomnia disorder were investigated among survivors of earthquake occurred at the Western Iran on November 12, 2017. **Materials and Methods:** This study was conducted on 1031 adult participants from rural and urban areas of Sarpol-e Zahab, a city in Kermanshah Province (Western Iran), who suffered from mental health problems due to the earthquake, a magnitude-7.3 quake, occurred in the Western Iran in 2017. Participants completed the Symptom Checklist 90, Insomnia Severity Index, Pittsburgh Sleep Quality Index, and Self-Rating Scale for PTSD. Data were analyzed using Pearson correlation and multivariate regression analysis by Statistical Package for Social Sciences Software (Version 21). **Results:** A positive correlation was observed between insomnia severity and all psychopathological symptoms. There was a positive correlation between sleep quality and somatization, obsessive-compulsive disorder, depression, and psychoticism. In addition, acute stress was positively correlated with insomnia severity and sleep quality. **Conclusion:** According to the results of the present study, it is recommended that psychological disorders in earthquake victims be considered to enhance their sleep quality.

Keywords: Earthquake, psychological disorders, sleep, stress

INTRODUCTION

Natural disasters such as earthquakes lead to severe psychological pressure and disorders in survivors.^[1-3] When we expose with a disaster like earthquake, we should evaluate the psychological health and status of survivors and determine psychological resources to deal with disaster's outcomes and stress.^[4] It has been documented that the higher the destruction rate resulted from a disaster, the more severe the psychological stress and damages such as posttraumatic stress disorder (PTSD).^[5] The 2017 Iran–Iraq earthquake with the moment magnitude of 7.3 occurred on November

12, 2017, at 21:48 Iran local time. It stroked Ezgeleh and Sarpol-e Zahab, Kermanshah Province, Iran, and city of Halabja, Kurdistan region of Iraq and led to considerable death, injuries, and devastations of houses, health centers,

Address for correspondence: Prof. Habibolah Khazaie, Sleep Disorders Research Center, Farabi Hospital, Dolatabad Blvd., Kermanshah, PO Box: 6719851151, Iran.
E-mail: hakhazaie@gmail.com

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and public buildings. According to the data of the Iranian Legal Medicine Organization, 620 people died and 9388 were injured. Therefore, a high level of harmfulness resulted from the severity of the earthquake and its outcomes, limitation of recourses, and a high level of stress that survivors encountered have been negatively affected most of cognitive, social, behavioral, and psychological functions.

Previous studies have reported a high rate of psychological conditions among earthquakes survivors. Over 80% of earthquakes in Nepal reported psychological disorders among survivors, mostly in the form of PTSD and depression.^[2] Prevalence rates of PTSD and depression were 43% and 30%, respectively, among survivors of 1992 Erzincan earthquake, Turkey.^[1] In Iran, the prevalence of PTSD 1 month after 2003 Bam earthquake was 35.4% among people over the age of 15 years and 47.8% among individuals under the age of 15 years. In addition, behavioral problems were reported 69.4% of women and 68.5% of men under the age of 15 years.^[5] Furthermore, after the 1990 Manjil–Rudbar earthquake in the Northern Iran, 68% of the survivors revealed severe and 23% indicated mild PTSD symptoms.^[6]

Two main adverse outcomes of disasters such as earthquake are acute stress disorder (ASD) and PTSD.^[7] Both ASD and PTSD share some symptoms, but their duration is different. In ASD, intrusive thoughts caused by the flashback of the experienced event and recurrent nightmares are reported. Stress either acutely or chronically may be the source of the future health problems.^[8] Both ASD and PTSD lead to sleep disturbances. People with ASD and PTSD have problems with falling asleep and sleep maintenance.^[9] Adverse effects of recurrent thoughts and nightmares on sleep quality have been reported previously.^[10] In addition, psychological wellbeing and sleep quality are strongly interconnected.^[11] The relationship between disordered psychological status, ineffective coping strategies, and low sleep quality has been confirmed.^[12] On the other hand, it has been reported that low sleep quality leads to insufficient emotional regulation, disordered thoughts, and motivational disturbances and also increases the risk of physical hazards.^[13] In addition, sleep deficiency may cause sexual problems and cognitive disorders such as attention deficit and memory deficiencies.^[14] Sleep problems were associated with suicidal ideation among adolescent earthquake victims in China, and this association was mediated by depression and anxiety.^[15] Hence, a closed pathological loop may develop among survivors of a natural disaster. On the one hand, psychological and emotional factors such as anxiety and depression arise from natural disasters lead to problems in sleep quality. On the other hand, low sleep quality disturbed psychological, emotional, and social functioning needs for coping with the disaster.^[13,14,16]

Therefore, to evaluate the short- and long-term consequences of 2017 Iran–Iraq earthquake, a longitudinal study was designed after the earthquake to evaluate psychological status and sleep among adult survivors in the urban and rural region

of Sarpol-e Zahab County, Kermanshah Province, Iran, which had more death, injuries, and destructions.

In the present study, the primary data about psychopathological symptoms, PTSD, sleep quality, and insomnia disorder were reported. These data were selected because sleep is highly affected by psychological disturbances, and it affects psychological and emotional regulation.^[11-14] Hence, the present study aimed to examine the relationship between some psychological consequences of earthquakes and sleep quality among earthquake victims to delineate the relationship between psychological symptoms and acute stress on the one hand and sleep quality and quantity on the other hand.

MATERIALS AND METHODS

This cross-sectional correlational study was conducted on earthquake victims in rural and urban areas of Sarpol-e Zahab, Kermanshah Province, Western Iran, after occurring the 7.3-magnitude earthquake in 2017. The data collection procedure started 10 days after the earthquake and continued for 3 weeks.

Participants

A total of 1031 residents in the urban and rural regions of Sarpol-e Zahab participated in this study. Age between 15 and 70 years, not having any physical disabilities, living for at least 5 years in the county, be present in the county during earthquake moment, and having at least 8 years of education were considered as inclusion criteria. Literate people were recruited because of self-rating questioners which were used for data collection. An incomplete questionnaire was considered as exclusion criteria. The sample size was calculated after a pilot study with 100 participants. Using the sample size formula calculation (equation one), and according to correlation coefficient resulted from the pilot study ($r = 0.18$), $\alpha = 0.01$, and $\beta = 0.1$, the size of the sample was calculated as 452 participants. After applying the design effect of 1.9, the sample size was calculated as 895 participants. Considering 20% of sample loss, the sample size was finally considered as 1031. After data collection, 30 participants were excluded due to incomplete questionnaires, and finally, 1001 participants were included in the study.

$$n = \frac{(Za + Zb)^2}{\left(0.5 \times \ln \left[\frac{1+r}{1-r} \right] \right)^2} + 3$$

Equation 1: sample size formula.

Data collection

Data were collected using the Self-Rating Scale (SRS) for PTSD, the Symptom Checklist-90 (SCL90), Insomnia Severity Index (ISI), and Pittsburgh Sleep Quality Index (PSQI).

SRS-PTSD designed based on DSM-IV-TR criteria. The validity of the Persian version of this questionnaire has been reported as $r = 0.90$.^[17] The questionnaire included 19 items including seven

items for re-experiencing category, seven items for avoidance category, and three items for hyperarousal category. ASD was diagnosed if participants respond positively to one question of re-experiencing category, three questions from avoidance category, and two items from hyperarousal category. Higher scores indicate higher levels of stress in the respondent.

The SCL90 is a self-report instrument for the fast assessment of psychological pathology that investigates psychopathology symptoms and psychological problems during the last week.^[18] In addition, it is suitable for screening psychological problems among large populations. The SCL90 comprised 90 questions and nine symptom dimensions: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. It took approximately 15 min to administer and rated on a five-point Likert format ranging from 0 = not at all, to 4 = extremely. For each dimension, scores of related questions were summed and then divided into the number of dimension's questions. The minimum and maximum scores were 0 and 4, respectively. This scale revealed quantitatively the current psychological status of individuals in nine subscales. Mean scores of each subscale can be considered as the symptom profile for that subscale.^[18,19] The reliability and validity of Persian version of this question were confirmed by the previous study.^[20]

The PSQI is a questionnaire examining sleep quality over the past month, including nine items.^[21] The scoring method of Carroll-Smith was used to calculate the total score. The measure consists of 19 individual items, creating seven components that produce one global score, and takes 5–10 min to complete. Components include sleep quality, sleep onset latency (amount of time from initial lights out to sleep onset), total sleep time, sleep efficiency, disturbances, use of sleeping medication, daytime dysfunction, and sleep quality index total. In the present study, the total score of the questionnaire was considered for analysis. The total score ranges from 0 to 21. A score of 0–4 indicates good sleep quality, while a total score

of five or above indicates a poor sleep quality. The Persian version of PSQI has good validity and reliability.^[22-24]

The ISI is a standard questionnaire, which measures the severity of insomnia in the past 2 weeks.^[25] It has seven questions that rated on a five-point Likert format. Minimum and maximum scores of this questionnaire are 0 and 28, and a higher score indicates a serious risk and need for clinical support. Total score categories includes 0–7 = no clinically significant insomnia, 8–14 = subthreshold insomnia, 15–21 = clinical insomnia (moderate severity), and 22–28 = clinical insomnia (severe). Good reliability and validity have been reported for the Persian version of ISI.^[26,27]

Ethical consideration

This study was registered at the Sleep Disorder Research Center of Kermanshah University of Medical Sciences (KUMS) and approved by the Institutional Review Board and Ethics Committee of KUMS, Kermanshah, Iran (ethics approval code: IR.KUMS.REC.1396.561). All participants signed a written informed consent form. For participants under the age of 18, the consent form was signed by their parents. All questioners were anonymous. Participants were assured about the confidentiality of their information, voluntariness of participation in, and withdrawal from the study.

Data analysis

All data analysis was performed by Statistical Package for Social Sciences Version 21 (SPSS 21), SPSS Inc, Chicago, Illinois, USA. Demographic and psychological characteristics of the participants were extracted. The normality of the data was investigated by the Kolmogorov–Smirnov test. Pearson correlation and multivariate stepwise regression analysis were employed for analyzing the association between sleep characteristics and psychological status.

RESULTS

After excluding participants with incomplete questioners,

Table 1: Psychological disorders, acute stress, sleep quality, and insomnia severity in different demographic subgroups

Variable	Category	n (%)	Psychological disorders	Acute stress	Sleep quality	Insomnia severity
Age	15-30	479 (47.90)	102.59±72.70	47.71±15.43	4.29±2.88	5.61±5.25
	31-45	289 (28.90)	121.19±72.96	52.36±15.57	4.52±3.09	6.75±6.41
	46-60	168 (16.80)	103.07±72.44	49.45±16.01	5.16±3.69	6.32±6
	60 to up	55 (5.50)	115.55±70.24	49.70±16.63	7.17±4.35	8.68±6.71
	Unknown	10 (1.00)	-	-	-	-
	<i>P</i>		<0.01	<0.01	<0.01	<0.01
Sex	Male	562 (56.10)	100.88±71.73	47.79±15.59	4.32±2.98	5.73±5.22
	Female	437 (43.70)	115.21±73.29	50.82±15.73	4.96±3.42	6.63±6.28
	Unknown	2 (0.20)	-	-	-	-
	<i>P</i>		<0.01	<0.01	<0.01	0.02
Marital status	Married	605 (60.40)	113.78±72.87	50.70±15.71	4.94±3.61	6.54±6.22
	Single	344 (34.40)	99.48±73.01	47.16±15.58	4.16±2.51	5.59±4.99
	Divorced or widow	43 (4.30)	111.39±64.51	51.09±15.81	5.28±2.76	7.09±5.82
	Unknown	9 (0.90)	-	-	-	-
	<i>P</i>		0.01	<0.01	<0.01	0.03

1001 earthquake survivors were evaluated. Table 1 presents the demographic characteristics of the participants.

According to cutpoints of SCL90, 541 participants (54.20%) had a problem in somatization subscale and 550 participants (55.10%) had difficulties in obsessive-compulsive subscale. In addition, 510 (50.10%), 622 (62.30%), 498 (49.80%), 512 (51.30%), 498 (49.80%), 506 (50.70%), and 473 (47.30%) participations reported impaired interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism, respectively. In addition, 541 participants (54.10%) reported ASD based on SRS-PTSD. On the other hand, according to the result of ISI, 101 participants (10.10%) reported moderate and 46 participants (4.60%) reported severe insomnia symptoms. In addition, according to the result of PSQI, 237 participants (23.70%) reported low sleep quality. All investigated variables were descriptively presented in Table 2 with mean, range, and standard deviation.

Association between psychological disorders and acute stress on the one hand, and sleep quality and insomnia severity, on the other hand, were analyzed by Pearson correlation coefficient [Table 3]. According to the result, positive correlations observed between all psychological disorders and insomnia severity. Moreover, a significant correlation revealed between sleep quality and somatization, obsessive-compulsive disorder, depression, and psychoticism. Results also revealed that a significant positive correlation found between acute stress on the one hand, and insomnia severity and sleep quality on the other hand.

Moreover, a stepwise regression analysis was used to predict insomnia severity and sleep quality based on the psychological disorders and acute stress [Table 4]. Aspects of psychological disorders and acute stress can predict 29% of the variance of insomnia severity. Therefore, it can be concluded that, from among independent variables, acute stress (effect size of 0.40), psychoticism (-0.68), depression (0.47), somatization (0.41), and obsessive-compulsive disorder (-0.25) can separately predict insomnia severity. Results also showed that the variables of psychological disorders and acute stress could predict 16% of the variance of sleep quality, and acute stress (effect size of 0.22), psychoticism (-0.77), depression (0.32), and somatization (0.33) could separately predict sleep quality.

DISCUSSION

The present study aimed to examine the relationship between psychopathological symptoms, acute stress, and sleep quality in Kermanshah earthquake victims. As a severe stressor, earthquake seriously affects all functional dimensions, including psychological and emotional functions.^[1,2,10] Psychological pressures may directly and indirectly lead to psychological and health problems. Ignoring psychological problems among earthquake victims may lead to chronic physical, psychological, and social disorders.^[5,6,10] According to the results, high numbers of participants reported impaired symptoms of SCL90 subscales (from 47.30% for psychoticism

Table 2: Descriptive characteristics (mean, range, and standard deviation) and comparison of variables between male and female

Variables	Mean±SD			P
	Total	Women	Men	
Psychological disorders				
Somatization	16.76±11.68	17.80±11.89	15.44±11.30	<0.01
Obsessive-compulsive	13.83±9.49	14.67±9.56	12.73±9.31	<0.01
Interpersonal sensitivity	11.66±8.31	12.22±8.41	10.92±8.15	0.02
Depression	19.11±0.12	20.33±11.27	17.53±10.77	<0.01
Anxiety	13.48±9.75	14.39±9.86	12.32±9.50	<0.01
Hostility	8.01±5.76	8.38±5.83	7.56±5.64	0.03
Phobic anxiety	9.14±6.53	9.89±6.67	8.19±6.24	<0.01
Paranoid ideation	7.90±5.95	8.29±5.95	7.41±5.89	0.02
Psychoticism	12.39±9.46	12.96±9.45	11.67±9.45	0.04
Acute stress				
Dissociation	11.01±5.18	11.34±5.31	10.58±4.99	0.02
Re-experiencing	12.03±3.98	12.32±3.95	11.64±3.97	<0.01
Avoidance	9.66±4.01	9.86±4.11	9.39±3.86	0.06
Arousal	16.80±5.63	17.29±5.66	16.16±5.52	<0.01
Total score	49.51±15.72	50.82±15.73	47.79±15.59	<0.01
Sleep quality	4.67±3.25	4.96±3.42	4.32±2.98	<0.01
Insomnia severity	6.25±5.85	6.63±6.28	5.73±5.20	0.02

SD: Standard deviation

Table 3: Correlation coefficients of psychological disorders and acute stress with sleep quality and insomnia severity

Independent variables	Insomnia severity	Sleep quality
Psychological disorders		
Somatization	0.77*	0.11*
Obsessive-compulsive	0.32*	0.08**
Interpersonal sensitivity	0.26*	0.03
Depression	0.24*	0.11*
Anxiety	0.34*	0.06
Hostility	0.29*	0.01
Phobic anxiety	0.21*	0.02
Paranoid ideation	0.22*	0.02
Psychoticism	0.14*	-0.07**
Acute stress		
Dissociation	0.77*	0.23*
Re-experiencing	0.46*	0.26*
Avoidance	0.42*	0.04
Arousal	0.19*	0.20*
Total score	0.45*	0.22*

*Correlation is significant at the level of 0.01, **Correlation is significant at the level of 0.05

to 62.30% for depression). According to the results, the rate of depression among the participants (62.30%) was higher in the present study, compared to previously investigated earthquake survivors.^[1,2] In addition, 54.10% of the participants reported ASD, which was higher than those reported in the previous studies.^[28-30] It has been reported that ASD can predict future

Table 4: Regression analysis for predicting insomnia severity and sleep quality based on psychological disorders and acute stress

Criterion variable	Step	Summary of model	Predictor variable	B	β	P
Insomnia severity	5	$R=0.54$	Acute stress	0.14	0.40	<0.01
		$R^2=0.29$	Psychoticism	-0.38	-0.68	<0.01
		$F=66.32$	Depression	0.23	0.47	<0.01
		$P=<0.01$	Somatization	0.19	0.41	<0.01
			Obsessive-compulsive	-0.14	-0.25	0.01
Sleep quality	4	$R=0.40$	Acute stress	0.04	0.22	<0.01
		$R^2=0.16$	Psychoticism	-0.24	-0.77	<0.01
		$F=36.03$	Depression	0.09	0.32	<0.01
		$P=<0.01$	Somatization	0.09	0.33	<0.01

PTSD^[28] and attention to this high rate of ASD is more important for the management of PTSD in the future.

Sleep disorders are a serious outcome of earthquake, which may lead to functional disturbances on the one hand and be affected by psychological disorders on the other hand.^[10,13,14,16] The results of the present study revealed a significant correlation between psychological disorders and insomnia severity. Moreover, a significant positive correlation was observed between PTSD and insomnia severity. These results confirmed by a previous study reported higher psychological disorders among people with the traumatic experience. This study also revealed poor sleep quality among those with psychological disorders.^[31] In addition, poor psychological health has been related to poor sleep quality among nurses working at intensive care unit.^[32] On the other hand, a significant association between poor sleep quality and depression has been reported.^[33] Poor sleep quality also has been significantly associated with low-positive and high-negative emotions.^[34] In addition, Lund reports that the low-positive emotions are a good predictor for sleep quality.^[35] In the present study, a severe stressor (earthquake) disrupted the psychological-emotional functions and sleep quality and quantity of victims. Still, an important finding delineated here is the predictive power of somatization, obsessive-compulsive disorder, depression, and psychoticism, as well as re-experiencing, dissociation, and arousal components of acute stress for sleep quality and quantity. These components are mainly divided into two groups: somatization on the one hand, and depression, obsessive-compulsive disorder, and acute stress on the other hand. This shows that two categories of variables can seriously affect sleep quality and quantity. One group mostly causes physical issues, while the other causes cognitive issues.

According to the present study, each psychological disorder threatening mental health is separately a good predictor for insomnia severity. However, combined with acute stress, they strongly predict insomnia severity and low sleep quality. The serious effect of acute stress on sleep revealed continues disrupted emotional regulation and subsequent sleep problems. Confirming this notion, previous studies reported a high acute stress after earthquake among the Iranian populations.^[5]

According to mutual effects of sleep quality and psychological symptoms, psychological damages must receive pharmacotherapy and psychotherapy to improve lower sleep quality. Then, improved sleep quality leads to better emotional, psychological, cognitive, and social functioning. A follow-up study on the sample is recommended to clarify the status of earthquake victims in terms of psychological variables, sleep quality, and their mutual effect over time.

Results of the present study should be interpreted according to its limitations. The sample was not recruited according to the random selection method. As self-rated scales were used for data collection, just educated people were recruited, and the result would not generalized to noneducated people. In addition, psychological state of participants before the disaster was unknown.

CONCLUSION

Psychological disorders and sleep quality, including insomnia severity, were inter-correlated among Sarpol-e Zahab earthquake victims. The prevalence of ASD is high among the participants. Screening the population who suffered from the earthquake for psychological disorders, and providing sufficient psychological health resources is highly recommended.

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Conflicts of interest

There are no conflicts of interest.

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