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Psychological sequels of flood on residents of southeast Caspian region

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Abstract Flood is the most common disaster in the world and has acute or chronic health consequences including psychological sequels. Post-traumatic stress disorder (PTSD) is one of the main consequences. This study aimed to explore the psychological impacts (PTSD) in two flooded cities of Mazandaran Province, Neka and Behshahr, in the south-eastern Caspian region that experienced flooding in 2012. A cross-sectional community-based study was performed on randomly selected samples of 400 individuals using GIS-based sampling from 139931 residents of the two flooded cities. The PTSS-10 questionnaire was used for data collection. The results showed that the overall stress disorder mean score among the participants was 2.59 out of 6. PTSD prevalence in the affected population was 64%. It was also found that stress scores significantly increased in younger people, male gender, the divorced, the widows or the widowers, and those who lost their properties ($p < 0.05$). Study findings showed that flood is a considerable stressor which develops PTSD. This finding should be taken into account in all four phases of disaster management cycle, and subsequently, specialized post-disaster mental health services must be provided for the afflicted population.

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1 Introduction

The number of disasters and their devastating impacts are increasing in the world (Boruff 2009). "A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope with using its own resources" (The united Nations office for disaster risk reduction 2009). Disasters are categorized into two groups: natural and man-made disasters. Flood is a natural and the most common disaster in the world (Shabanikiya et al. 2014). Over the last 30 years (1981–2011), 300 floods have been recorded accounting for 53% of the total number of disasters (The OFDA/CRED International Disaster Database 2014).

Floods commonly have deep, far-reaching consequences such as destroying houses and buildings and carrying soil away from valuable farming land (Carrel et al. 2009). Floods have also significant health impacts. During the past 30 years, floods killed more than 200,000 people and affected more than 2.8 billion people worldwide (Kunreuther and Michel-Kerjan 2007). Asia is the most flood-affected region, accounting for nearly 50% of flood-related fatalities in the last quarter of the twentieth century (Doocy et al. 2013).

Iran is located in the Middle East which has faced with different types of disasters in recent years (Seyedin et al. 2010). Among the most frequent disasters, namely floods, earthquakes, storms, and drought, the first three are in the disaster management priorities in Iran due to their frequency and consequences (The World Bank 2014). In Iran, 1.4 million people were affected by flood between 2001 and 2002, with more than 400 deaths (The World Bank 2014).

Mazandaran Province, in the north part of Iran and southern part of the Caspian Sea, is a flood-prone area due to overflowing of the various rivers happening during abundant rainfalls. The province occasionally experiences frequent heavy torrents during spring and fall. This may result in flooding which can terminate in extensive damages and disruption. One such incident occurred on September 24, 2012, in the eastern part of Mazandaran Province following severe and continuous rainfall which caused flooding in Neka and Behshahr (Fig. 1). The event led to urban flood resulting in different predicaments including inundation in the main streets and passageways, trafficking problems, penetration of water into houses and stores, injuries of the people present at the flood path, and extensive financial damages.

There are different factors which can be responsible for the formation and spread of the disaster: (1) lack of the required efficiency of the collecting and leading channels of the surface runoff in the two cities, (2) cutting the trees of the southern heights overlooking the two cities (which is a significant factor for reducing or stabilizing the intensity of the flow of the floods or the precipitations), (3) blockages at the entrances of the two rivers caused by tree trunks and their branches and leaves resulting in withdrawing the water of the rivers to the adjacent areas and streets, and finally, (4) lack of proper security and utilities systems in the buildings (Mazandaran province meteorological administration 2014).

After such flooding, health consequences like flood-related injuries and death, as short-term effects, as well as psychological problems such as post-traumatic stress disorder (PTSD), as long-term sequels, can be expected (Hajat et al. 2005).

Post-traumatic stress disorder (PTSD), probably the most common post-disaster psychiatric disorder (Neria et al. 2008), is characterized by a set of symptoms resulting from exposure to traumatic stressors. The diagnostic and statistical manual of mental disorders [(DSM)-IV] described PTSD as the result of exposure to a traumatic event in which person
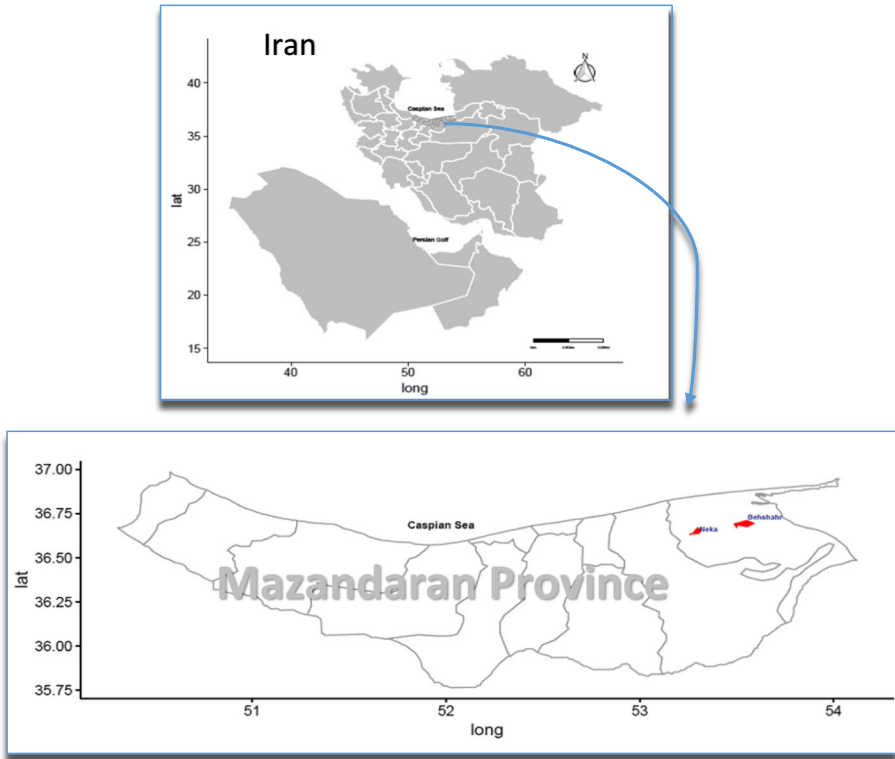
Fig. 1 Map of flooded cities, *red* areas

responds with intense fear, helplessness, or horror (American Psychiatric Association 1994). PTSD develops as a reaction to a traumatic event or an extraordinarily threatening situation, which can then produce three types of symptoms: (1) *re-experiencing symptoms* (flashbacks—reliving the trauma over and over, physical symptoms such as racing heart or sweating, nightmares, and frightening thoughts), (2) *avoidance symptoms* (staying away from places, events, or objects that remind the trauma, feeling emotionally numb, feeling strong guilt, depression, anxiety, lose interest in activities that were enjoyable in the past and trouble in remembering dangerous events), and (3) *hyper-arousal symptoms* (being easily startled, feeling tense or "on edge," sleep problems, and/or angry outbursts). There are two types of PTSD depending on symptoms duration: acute (symptoms persisting less than 3 months) and chronic (symptoms persisting more than 3 months) (National Collaborating Centre for Mental Health 2005).

PTSD lifetime prevalence has been estimated at 5.6% with a 1:2 male-to-female ratio in spite of men reporting greater trauma exposure (Breslau 2001). The highest PTSD risk score was associated with sexual and physical assault, robbery, and multiple trauma experiences (Frans et al. 2005). Different types of trauma displayed a chronicity rate of PTSD within the range of 6.3–68.9% (Hu et al. 2015), and the prevalence rate of PTSD related to natural disasters is currently between 8.6 and 57.3% depending on assessment methodologies, instruments, and timing (Udomratn 2008).

A few studies have addressed PTSD as a consequence of disasters in Iran. Regarding earthquake, results from one study on Bam earthquake survivors showed 58% prevalence of severe mental health problems (Montazeri et al. 2005). In another study, PTSD prevalence was 66.7% among high school students in Bam (Ziaaddini et al. 2009). There is, however, no study or documented information about PTSD among people at flooded areas in Iran although this problem has considerably been probed in different parts of the world (Doocy et al. 2013). Therefore, psychological disorders caused by the frequent floods in Mazandaran, as one of the most flooded areas in Iran, have not been recognized yet.

The present study, therefore, set out to explore the effects of the flood, mentioned above, on the mental health of people living in the southeastern Caspian region in two cities of Mazandaran Province, Neka and Behshahr, by means of measuring the psychological impact, PTSD, among the flood-affected people.

2 Materials and methods

In this cross-sectional study, during December 10, 2013, and January 15, 2014, the samples of the current study were selected randomly from among 139,931 residents of the regions (Table 1) of two flooded cities, namely Neka and Behshahr (50,680 and 89,251, respectively). The flood took place 3 months before the commencement of the study.

To calculate the sample size, EPI info program version 7 was used and the following assumptions were considered: The expected frequency of PTSD was 56 per 100,000 population (World Health Organization 2004); the worst acceptable frequency was +2% (0.02); the confidence level was set at 95%; and the power was set at 80%. The sample size, calculated accordingly, was 380 which was rounded to 400 to ease the subsequent calculations. Observing the different proportions of the populations of the two cities, the sample sizes of Neka and Behshahr were calculated as 145 and 255, respectively.

As the usual and suitable sampling method for the disaster-stricken areas is cluster sampling (World Health Organization 1999), this method was used in this study as well. The whole number of residents (139,931) of the two regions was randomly divided into 41 clusters using ArcGIS 9 (for Neka and Behshahr, 15 and 26 clusters, respectively, based on the population proportions). In the next step, 10 households from each cluster were selected using systematic random sampling. In order to measure the stress scores, the PTSS-10 standard questionnaire was used which consisted of two parts; the first part contained demographic questions, and the second part consisted of ten PTSD-related questions scored from zero (never) to six (always) (Katibah Maghrabi 2012). The scale based on the severity level was then divided into three categories: mild (scores <24), moderate (scores 24–37), and severe (scores >37). Moderate and severe groups, i.e., scores equal to and more than 24, were considered as having PTSD (Khattak and Khattak 2014).

Table 1 Geographical locations of the population

Neka		Behshahr	
36°38′51.01N	53°17′35.57E	36°41′9.90N	53°32′51.21E
36°38′45.40N	53°17′52.04E	36°40′52.88N	53°32′50.33E
36°38′54.62N	53°18′01.87E	36°40′55.60N	53°33′29.35E
36°38′58.57N	53°17′49.47E	36°41′10.59N	53°33′28.38E

N north, *E* east

The questionnaire was translated into Persian language and back-translated into English to ensure its lexical equivalence. The final Persian version was reviewed by a group of psychologists for face and content validity in the Iranian community. Demographic characteristics such as age, literacy level, gender, property loss, living in the flood path, and concurrent injuries were considered in order to explore the associated factors related to stress. Along with the questionnaire, an informed consent was also delivered to the participants. It consisted of having the right of accepting or rejecting of entering the study as well as other usual legal rights of the participants and the researchers.

A group of selected students at Mazandaran Helal Applied Sciences Educational Institute, who volunteered to cooperate as questionnaire administrators, were firstly acquainted with the instrument and how to complete it and, subsequently, were dispatched to the two cities under study. The inclusion criteria for the participants of the study were determined to be as follows: being above 18 years of age, living in the urban area of Behshahr and Neka, and staying at home during the incidence of flood. The exclusion criteria were suffering from previous mental disorders or other diseases which could affect mental conditions.

The derived data were analyzed using SPSS V. 14. To find the impacts related to the variables including age, city of residence, sex, living in the flood path, property loss, and concurrent injuries, the data were analyzed via independent sample T test. The variables of literacy level and marital status were related to the groups containing very small size of samples ($n = 8$) and hence not subject to normal distribution. The data of these groups, therefore, were analyzed normality test using Kolmogorov–Smirnov statistic that was meaningful and showed there was not normal distribution. Subsequently, nonparametric independent samples Kruskal–Wallis test was used to explore the difference between the groups. p value was considered to be significant at a level less than 0.05.

3 Results

It was found that average age (SD) of the participants was 39 (12) with minimum of 19 and maximum of 73 years old. More than half (59.5%) of the participants were found to be males, 85.25% were married, and only 21.75% had academic education (Table 2).

The majority of the participants, $n = 368$ (92%), noted that they had lost their properties during the flood. A few of them, $n = 55$(13.8%), indicated that they had been injured, and none of them had lost their relatives.

The overall stress disorder mean score (SD) among the participants was 2.59 (0.54) out of 6, and the sum of scores in 10 items was 25.94 (5.36) 3 months after flooding (Table 3). The mild PTSD group consisted of 144 (36%) subjects with small difference with severe PTSD group's score (Fig. 2). Based on the cutoff point according to which the scores equal to or more than 24 are attributed to having PTSD (Schüffel et al. 1998), in our study, those suffering from PTSD consisted of moderate (29.25) and severe (34.75) groups for whom overall PTSD prevalence was found to be 64% in the flooded area.

Table 3 shows the mean score for each item in the questionnaire. It is seen that the highest remarkable stress scores belong to nightmares, fear of places and situations, sleep problems, and irritability with total PTSD mean scores of 4.05, 3.94, 3.9, and 3.18, respectively.

The mean stress score was found to be significantly higher among younger people, males, those living in the flood path, those living in Neka, and those who had lost their

**Table 2** Study population demographics and experiences

Demographics	City		
	Neka	Behshahr	Total
Sex			
Male	81	157	238
Female	64	98	162
Marital status			
Single	24	27	51
Married	117	224	341
Other*	4	4	8
Literacy level			
Illiterate	3	5	8
Diploma or less	108	197	305
Academic	34	53	87
Faced with flood stream directly			
Yes	129	222	351
No	16	33	49
Loss of properties			
Yes	132	236	368
No	13	19	32
Injuries to family members			
Yes	25	120	145
No	49	206	255
Total	145	255	400

* Divorced, widow, or widower

Table 3 Mean and total score of post-traumatic stress syndrome items

Items in the questionnaire	Neka mean (SD)	Behshahr mean (SD)	Total mean (SD)
Sleep problems	4.01 (1.42)	3.84 (1.7)	3.9 (1.6)
Nightmares	4.08 (1.29)	4.04 (1.24)	4.05 (1.4)
Depression, I feel dejected/down-trodden	2.52 (1.38)	2.17 (1.49)	2.3 (1.46)
Jumpiness, I am easily frightened by sudden sounds I hear or sudden movements I see	2.28 (1.31)	1.83 (1.44)	2 (1.42)
The need to withdraw from others	1.63 (±1.01)	1.29 (1.03)	1.42 (1.04)
Irritability, that is, I am easily agitated/annoyed and angry	2.94 (1.34)	3.31 (1.51)	3.18 (1.46)
Frequent mood swings	1.59 (0.99)	1.28 (0.97)	1.39 (0.98)
A bad conscience, blame myself, have guilt feelings	2.43 (1.35)	2.44 (1.67)	2.44 (1.57)
Fear of places and situations, which remind the disaster scene	3.68 (1.31)	4.09 (1.41)	3.94 (1.39)
Muscular tension	1.57 (0.97)	1.21 (0.96)	1.34 (0.98)
Overall mean PTSD score	2.67 (0.51)	2.55 (0.54)	2.59 (0.54)
Sum of PTSD score in 10 items	26.73 (5.12)	25.49 (5.46)	25.94 (5.36)

Fig. 2 Stress severity level of people in flooded area after 3 months
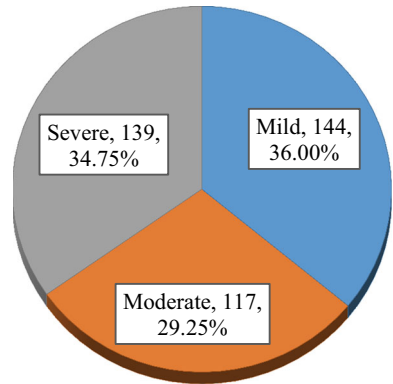
properties ($p < 0.05$). The divorced, the widows, or the widowers had also greater PTSD score meaningfully compared with the other to two groups of single and the married ($p < 0.05$) (Tables 4 and 5).

Table 4 Mean stress scores differences among interviewees according to exposure/consequence or demographic specifications

Exposure/demographics	Post-disaster stress score		
	Mean	SD	*p* value
Age	39	12	0.000
City			
Neka	2.67	0.51	0.026**
Behshahr	2.55	0.54	
Literacy level			
Illiterate	2.41	0.32	0.378*
Diploma or less	2.59	0.53	
Academic	2.62	0.55	
Marital status			
Single	2.52	0.49	0.004*
Married	2.59	0.54	
Other***	3.15	0.31	
Sex			
Male	2.65	0.55	0.007**
Female	2.5	0.49	
Faced with flood stream directly			
Yes	2.65	0.5	0.000**
No	2.3	0.67	
Lost properties			
Yes	2.61	0.51	0.002**
No	2.3	0.66	
Injured			
Yes	2.62	0.46	0.61**
No	2.58	0.55	

* Kruskal–Wallis test

** Independent sample *T* test

*** Divorced, widow, or widower

Table 5 Mean stress scores differences test (nonparametric independent samples Kruskal–Wallis test) among marital status

Test Sample 1–Sample 2	Test Statistic	Std. error	Std. test statistic	Sig.	Adj. Sig.
Single–married	−15.129	17.323	−0.873	0.382	1
Single–divorced, widow, or widower	−145.302	43.877	−3.312	0.001	0.003
Married–divorced, widow, or widower	−130.174	41.270	−3.154	0.002	0.005

4 Discussion

WHO plainly states that those who are engaged with the preparation programs or delivery of services in the disasters or emergencies have not yet adequately dealt with the psychological aftermaths of flooding although it is generally accepted that natural disasters, like floods, can influence mental and psychological health of the affected people seriously (World Health Organization 2001).

The findings of the current study point out that everyone having experienced any type of exposure to the flood and its disastrous consequences in the stoutest Caspian region has suffered from some degrees of PTSD. However, the proportion of the prevalence of PTSD in the population under study (64%) was less than the proportion of the people experiencing the incident directly (87.75%), suggesting that not all the people having direct contact to the flood have been affected by the psychological sequels of the event. On the other hand, the proportion of PTSD in the population under study (64%) is five times more than the highest prevalence of PTSD in the general population who have not experienced any such incidences (lifetime prevalence of 9.2–13.6% depending on the methodology) (Atwoli et al. 2015).

In the current study, the overall PTSD mean score was 2.59. The finding is less than the findings of a similar study in Saudi Arabia with the mean PTSD score of 3.5 (Katibah Maghrabi 2012). The difference between these two studies with scores of acute PTSD may be explained by the absence of mortality and the 3-month interval from the flooding in our study compared with the considerable number of deaths, as the main stressor, and the 1-month interval in Katibah Maghrabi's study.

Previous studies on adult survivors of disasters inferred a high prevalence of PTSD, generally within the first year after the events. The prevalence of PTSD in the first year after any type of disaster ranged between 25 and 75%. Most studies of adult survivors showed PTSD prevalence between 30 and 60% (Galea et al. 2005), and specifically in Asia, the highest prevalence rate of PTSD related to natural disasters was 57.3% (Udomratn 2008). Regarding flood, PTSD can persist in afflicted people up to 13 years with considerable rate of 15.4% (Hu et al. 2015).

In the present study, males had significantly higher PTSD score compared to females in contrast to many other studies in which females had higher PTSD scores (Christodoulou et al. 2003; Frans et al. 2005; Acierno et al. 2007; Zhang et al. 2012; Doocy et al. 2013) except for one study in which there was no difference in PTSD scores between the two genders (Khattak and Khattak 2014). This diversity can be due to different social and cultural backgrounds, study methodology, or other unknown factors that need to be explored further.

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It has also been found that people, who had lost their properties during the flood or were not supported by their families, such as the widowed, the widowers, or the divorced, suffered from more stress and had greater PTSD scores. These findings are consistent with the results of a number of other studies in different parts of the world (Reacher et al. 2004; Telles et al. 2009).

There was no significant difference in PTSD score between the injured (mean = 2.62) and the uninjured (mean = 2.58) in our study ($p > 0.05$), indicating that both groups perceived the same stress level. This result differs from the results of other studies in this field that reflected different levels of stress scores in these two groups (Liu et al. 2006; Katibah Maghrabi 2012).

Although PTSD was calculated 3 months after the flood onset, the scores were still high (34.75%). These results are in agreement with the findings of other studies in which PTSD score was high after considerable period of time to 1 year (Jonkman et al. 2009; McLaughlin et al. 2011; Katibah Maghrabi 2012) and also up to 13 years after flood (Hu et al. 2015).

Our goal was to investigate PTSD after specific disasters, i.e., flood, which might suggest a direction for research and intervention in disaster management. However, there were particular limitations which are worthwhile to be mentioned here: Firstly, although disasters occur worldwide and are studied globally, there are cross-cultural limitations in use of PTSD assessment instruments that have originally been designed and validated in developed countries, especially in the USA. This fact brings about caution about inferences that can be drawn from studies using those instruments. Secondly, to assess PTSD, the diagnostic and statistical manual of mental disorders [(DSM)-IV] was used in our study. Considering the dynamic nature of sciences, probable changes in diagnosing criteria for PTSD in the future which may normally occur over time can make the cross-study comparisons challenging. Thirdly, longitudinal or cohort studies are needed to evaluate long-standing PTSD in flood (chronic PTSD). However, this study was limited by lack of facilities for long-term PTSD monitoring of affected population.

5 Conclusion

Our findings emphasized the importance of paying attention to psychological consequences of disasters as acute and chronic medical conditions. Psychological sequels in general and PTSD in particular should be taken into consideration in all phases of disaster management cycle including preparedness, response, and recovery (Federal Emergency Management Association 2013). It is, moreover, of paramount importance to pay particular attention to younger people, males (who usually expose themselves more impudently to dangers), those living in the flood path, those deprived of partners, and those who lost their properties. There is also a need for intervention strategies for conducting large-scale post-disaster mental health screening.

It can be concluded that PTSD should be regarded as one of the chief issues in designing response measures. As floods occur frequently in the developing countries due to various problems (World Health Organization 2001), the affected population of these countries are in great need for attention and care. To help accelerate the recovery process, appropriate and timely treatments along with other therapies are required to prevent or, at least, to diminish the psychological sequels of flooding.

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