

## Original Article

# Bam Earthquake Survivors' Mental Health Status 12 Years after the Earthquake: A Population-Based Study

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## Abstract

**Background:** Mental health is one of the characteristic benchmarks of public health. This research aimed to evaluate mental health of survivors of the Bam earthquake which occurred in 2003 twelve years after the earthquake in fall of 2015.

**Methods:** The statistical population of this cross-sectional study were people over 16 years of age who were present at the time of the earthquake in the city of Bam. The sample of the study consisted of 1500 people selected from the survivors by multistage sampling. The general health questionnaire-28 was used as a screening tool for mental disorders. The independent sample test, ANOVA test, Welch test, one-sample *t* test and the multiple logistic regression test were used to analyze the data. The analysis of data in the current study was carried out using the SPSS-18 software.

**Results:** Using the GHQ Likert scoring method, the results showed 52% of the people surveyed were suspected of having mental disorders (49.93% of men and 54.27% of women). Somatization and anxiety is more frequent than severe depression in respondents. The obtained statistics revealed that the prevalence of mental disorders amplified with loss of close relatives and age (odds ratio [OR] =1.457 and 1.828 respectively). The results also indicated that widows and divorcees (66.66%), illiterates and drop-outs (57.48%) and the elderly (77.12%) had the highest average in terms of having mental disorders.

**Conclusion:** The results of this study showed more than half of the Bam earthquake survivors are suspected to be suffering from mental disorders. Since natural disaster-related mental illness effects can last for many years, comprehensive screening programs at regular intervals are required. Mental health services should be available to the elderly and people at risk in order to ensure restoration of mental health after a catastrophe.

**Keywords:** Bam, Earthquake, Epidemiology, General health questionnaire (GHQ-28), Mental health

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## Introduction

Natural disasters such as floods, storms, landslides, hurricanes, tornadoes, earthquakes and widespread fires are among events that constantly affect a large group of inhabitants on Earth.<sup>1</sup> The Bam earthquake had a magnitude of 6.6 on the Richter scale and occurred at 5:26 AM in the morning of January 5, 2003 and trembled the city of Bam and its surrounding areas in the eastern part of Kerman province. According to official statistics, this earthquake left over 26 000 victims and 30 000 injured.<sup>2,3</sup>

Mental health is one of the characteristic benchmarks of public health. The state of mental health or the absence of a mental disorder in a person enables people to recognize their adaptableness to stresses of daily life and to participate adequately and effectively in the social framework of

the community in which they resides.<sup>4</sup> A large number of studies on mental health problems associated with earthquakes have been published, whereas important issues with regard to post-traumatic psychopathology remain unsolved. These factors consist of how often survivors have the whole criteria to be diagnosed for mental disorders, which type of disorder is repeatedly associated with the efficacy of the disaster, whether the post-traumatic psychopathology is transient or continuous and whether these psychological responses are limited to social, cultural and economic factors.<sup>5</sup>

By studying the public's mental health status, valuable information in context of treatment, educational and cultural planning and prevention of spread of mental disorders can be provided to authorities, planners and

managers of health centers.<sup>6</sup> Therefore, by accurately estimating the prevalence of mental disorders in greater populations, and then designing and implementing social support and counseling programs, it is possible to treat these disorders and prevent further complications. Countless studies have been done on earthquake survivors after a short interval of a few months to few years, but there has not been any population-based study of survivors of the Bam earthquake conducted at a long interval of twelve years after the earthquake. Therefore, this study was designed and the purpose of this study was to evaluate mental health of this community and to further investigate the extent and possible factors affecting recovery twelve years after facing this traumatic catastrophe.

### Materials and Methods

This is a population-based, descriptive-analytic, cross-sectional study that was conducted in the fall of 2015 (twelve years after the earthquake). The statistical population of this study were people over 16 years of age who were present at the time of the earthquake in the city of Bam. Due to the importance of obtaining reliable results, based on the epidemiologic research of Rahimi et al, we assumed a 23% prevalence of mental disorders, and type one error rate of 5%. The sample size of the study was calculated by the Cochran formula to be 1,500 subjects from the survivors of the Bam earthquake that were selected by multistage sampling; the first stage clustering and the second systematic sampling.<sup>7</sup> After project approval by the Ethics Committee of the Bam University of Medical Sciences, a trained inquiring team consisting of a psychologist and an accompanying person for acquiring the necessary training were sent to relevant areas and after receiving formal consent they attempted to collect information from the respondents. According to the authority's classifications of urban areas, the city of Bam was divided into 10 clusters and five clusters were randomly selected and then systematically from all main streets, one street was selected and at each side of the street 10 persons (each house one person) filled the questionnaire. This research was carried out by a door-to-door approach (home visit). From each house, a member who was over 16 years old, resided in Bam at the time of earthquake and those with the day and month of their birth closest to the day and month of the interview date were selected as participant.

Individuals suffering from mental disability, dementia or psychosis were excluded from sampling. An initial questionnaire containing demographic information on gender, age, marital status, education level, and questions about family loss was completed. Then, the GHQ-28 was completed by the trained team on all subjects.

The GHQ-28 has 28 items and each item is accompanied by four possible answers: Not at all, Not More than usual, Rather more than usual and much more

than usual. This questionnaire is a validated and reliable evaluation tool in sociological studies. The questionnaire is a screening tool for epidemiological studies of psychiatric disorders developed by Goldberg in 1972 with the purpose of designing and identifying psychiatric disorders in various healthcare settings and different situations. This questionnaire is one of the most well-known tools for screening mental disorders that has had a significant impact on the advancement of behavioral and medical research.<sup>8-10</sup>

Using the traditional scoring method, the cutoff score for the sample is 6. With this cut-off, the sensitivity and specificity of the test were 84.7% and 93.8%, respectively. The best cutting scores using the Likert score method for the subjects of the study is 23, with the sensitivity and specificity of the test being 70.5% and 92.3%, respectively. In this study, the Likert method was used to calculate the data. The findings of this study showed that with these cut-off points, 71.7% of patients with somatic symptom disorders, 81.5% of patients with anxiety disorders, 57.2% of patients with social dysfunction and 84.9% of patients with severe depression were correctly screened and detected. Two Subscale questions of severe depression and anxiety/insomnia show more of individuals states of mind than other 2 subscales of somatization and social dysfunction.<sup>11</sup> The analysis of variance (ANOVA) test was used for the mean difference between the two groups and the Welch's *t* test was used for equality of variances. One-sample *t* test was used to obtain the mean GHQ difference with the standard score of GHQ. Independent Samples Test to determine the difference in GHQ score means between the two groups reporting the death of one of the family members compared to the group that did not report any deaths was considered. Multiple logistic regression test was used to find the most influential factors. The analysis of data in the current study was carried out using the SPSS-18 software.

### Results

Demographic characteristics on the prevalence of suspected cases of mental disorders in the studied population in Bam is presented in Table 1. This table's data show that in total, 52% of the people surveyed were suspected of having mental disorders (49.93% of men and 54.27% of women). The highest susceptibility to mental disorder in each of the variables was related to the age group of 60 and older (77.12%); divorcees and widows (66.66%); illiterates and school drop-outs (57.48%). 1,025 participants in this study (68.3%) reported one or more of their family member's death, where 56.29 percent (compared to 42.7% who did not have a close relative die) were suspected of having a mental illness.

The average prevalence of psychiatric disorders in women was higher, but according to the independent samples test, there was no significant difference between

**Table 1.** Prevalence of Mental Disorders in Terms of Demographic Variables

		Sample Size (n)	Frequency (GHQ >24)	PR (%)
Gender	Male	787	393	49.93
	Female	713	387	54.27
	Total	1500	780	52
Marital status	Single	1317	697	52.92
	Married	136	55	40.44
	Divorced	12	8	66.66
	Widow	30	20	66.66
	Total	1495	780	52.17
	Missing	5	0	-
Education	Illiterate-drop out	769	442	57.48
	Graduate	511	245	47.94
	Associate degree	97	37	38.14
	Bachelor degree	94	43	45.74
	Post graduate	13	5	38.46
	Total	1484	772	50.02
	Missing	16	8	-
Age	16-20	70	18	25.71
	21-40	777	347	44.66
	41-60	534	323	60.49
	>60	118	91	77.12
	Total	1499	779	51.97
	Missing	1	1	-
Relative loss	Yes	1025	577	56.29
	No	475	203	42.7
	Total	1500	780	52

PR, Prevalence Rate.

men and women regarding mental disorders ( $P$  value = 0.048).

Findings for the mean of mental disorders can be found in Table 2. Widows and divorcees ( $P$  value = 0.001), high school graduates and school drop-outs ( $P$  value < 0.001), and those in the 60 years and older age group had the highest mean for mental disorders ( $P$  value < 0.001), and this difference was significant by the ANOVA test ( $P$  < 0.05). Evidently, according to the results, all averages are higher than standard.

The results of the one-sample  $t$  test showed that there was significant difference between the community of the study and the standard mean ( $P$  value < 0.001).

The group reporting the death of one family member showed significantly higher GHQ score means than the group that did not report any death ( $P$  value = 0.002).

Table 3 data are the results of a multiple logistic regression test, which shows that the two influential factors in GHQ are the loss of close relatives and age whereas the ratio of the risk for mental disorders in people over 40 years of age is 1/828, and in those who have one or more loss in close

**Table 3.** Estimated Logistic Regression Coefficients and Odds Ratio in 2 Influential Factors

		P value	OR	95% CI for OR	
				Lower	Upper
Step 6 <sup>a</sup>	Relative loss (yes)	0.027	1.457	1.043	2.035
	Age (y) >40	0.001	1.828	1.270	2.631
	Constant	<0.001	0.343		

**Table 2.** The Results of ANOVA Test on the Variables of the GHQ Questionnaire

		Mean	Sample Size(n)	SD
Gender ( $P = 0.001$ )	Male	31.57	740	16.40
	Female	33.30	675	16.51
	Total	32.39	1415	16.47
Marital status ( $P < 0.001$ )	Single	32.57	1251	16.45
	Married	28.50	124	15.50
	Divorced	40.00	10	17.78
	Widow	41.65	26	17.24
	Total	32.43	1411	16.48
	Missing	34.93	725	17.10
Education ( $P < 0.001$ )	Illiterate-drop out	30.55	485	15.58
	Graduate	27.02	89	14.60
	Associate degree	27.97	90	14.41
	Bachelor degree	26.90	11	15.06
	Post graduate	32.40	1400	16.47
	Total	23.63	65	11.17
	Missing	29.48	736	15.86
Age ( $P < 0.001$ )	16-20	35.61	502	16.42
	21-40	42.09	111	16.05
	41-60	32.38	1414	16.47
	>60	33.90	969	16.62
	Total	29.12	446	15.66
	Missing	1	1	-
Relative loss ( $P = 0.002$ )	Yes	1025	577	56.29
	No	475	203	42.7
	Total	1500	780	52

SD, Standard deviation

relatives, the risk ratio is 1/457.

Moreover, The findings of this study showed that, in terms of the subscales of the GHQ, 50% of the studied subjects were suspected of somatic symptoms (48% of men and 52.31% of women), 49.86% were suspected of anxiety (47% of men and 53% of women), 48.33% were suspected of social dysfunction (47.77% of men and 48.94% of women) and 39.86% were suspected of having severe depression (28.97% of men and 43.47% of women (Table 4).

### Discussion

The results of this study showed more than half of the Bam earthquake survivors are suspected to be suffering from mental disorders. The prevalence rate of psychiatric disorders, conducted by Noorbala et al on 36000 people in Iran in 2015 (the year of this study) using the GHQ-28, estimated psychiatric disorder prevalence rate to be 23.44 percent.<sup>12</sup> As demonstrated in this study, the prevalence of suspected psychiatric disorders is 52% among Bam earthquake survivors, which is more than double the

**Table 4.** Frequency and Percentage of Individuals in GHQ-28 Subscales According to Standard Score

		Sample size(n)	Somatic Symptoms Q1-Q7	Anxiety/ Insomnia Q8-14	Social Dysfunction Q15-21	Severe Depression Q22-28
Gender	Male	787	378 (48.03)	370(47.01)	376(47.77)	228(28.97)
	Female	713	373 (52.31)	378(53.01)	349(48.94)	310(43.47)
	Total	1500	751 (50.06)	748(49.86)	725(48.33)	598(39.86)
Marital status	Single	1317	672 (51.02)	662(50.26)	644(48.89)	529(40.16)
	Married	136	48 (35.29)	55(40.44)	54(39.7)	42(30.88)
	Divorced	12	9 (75)	9(75)	8(66.6)	9(75)
	Widow	30	20 (66.6)	21(70)	19(6.33)	18(60)
	Total	1495	749 (50.01)	747(49.96)	725(48.49)	598(39.86)
	Missing	5	2 (-)	1(-)	0(-)	0(-)
Education	Illiterate-Drop out	769	443 (57.6)	425(55.26)	410(53.31)	355(46.16)
	Graduate	511	229 (44.81)	237(46.37)	226(44.23)	178(34.83)
	Associate degree	97	33 (34.02)	35(36.08)	36(37.11)	25(25.77)
	Bachelor degree	94	32 (34.04)	39(41.49)	40(42.55)	30(31.91)
	Post graduate	13	5 (38.46)	5(38.46)	6(46.15)	4(30.77)
	Total	1484	742 (50)	741(49.93)	718(48.38)	595(40.09)
	Missing	16	9 (-)	7(-)	7(-)	6(-)
Age	16-20	70	16 (22.85)	20(28.57)	20(28.57)	12(17.14)
	21-40	777	322 (41.44)	335(43.11)	319(41.05)	259(33.3)
	41-60	534	321 (60.1)	306(57.3)	302(56.55)	254(47.56)
	>60	118	91 (77.12)	86(72.88)	83(70.33)	72(61.02)
	Total	1499	750 (50.03)	747(49.83)	724(48.30)	597(39.82)
	Missing	1	1 (-)	1(-)	1(-)	1(-)
Relative loss	Yes	1025	558 (54.43)	562(54.83)	529(51.61)	447(43.61)
	No	475	193 (40.63)	186(39.16)	196(41.26)	151(31.8)
	Total	1500	751 (-)	748(-)	725(-)	598(-)

prevalence of these disorders in the general population.

In a 2007 study conducted by Toyabe et al, 2 years after the Japanese 6.8 Richter earthquake in Niigata-Chuetsu on survivors using the GHQ-12, it was found that 39.03% of survivors were suffering from psychological distress.<sup>13</sup> As it was shown, a significant percentage of survivors, based on the Toyabe study, were suspected of having a psychiatric disorder, although this rate is much lower than the results of the present study. In a study that was carried out 5 months after the Bam earthquake, about 916 survivors of the earthquake were analyzed using the GHQ-12 tool, and the results showed that 58% of the participants suffered from severe psychiatric disorder. This is largely consistent with the current investigation showing 52% of the survivors to be suspected of having a mental disorder even after 12 years past this overwhelming earthquake. Little improvement has been made in the mental health status of this community with the extensive mental health care provided in this area.<sup>14</sup> Carr et al studied terms of psychological distress in a 2-year period after the Newcastle earthquake and recognized that GHQ-12 scores had fallen dramatically 12 months after the earthquake. Nevertheless, it tended to gradually decrease over time.<sup>15</sup>

In a study by Nakamura et al for 5 consecutive years after the earthquake in Yamakushi, it was shown that the overall prevalence of psychological distress decreased gradually from 2005 to 2008, but subsequently increased from 2008 to 2009. Although the short-term effects of

earthquake on mental health are well documented, there is little research on long-term effects of these events. Nakamura et al. suggest that large earthquakes could affect mental health of survivors for a long time, even up to 7 years, and therefore, long-term follow-up studies should be considered in this regard.<sup>16</sup> Furthermore In a study by Bland conducted 7 years after the earthquake in Italy, the psychological consequences of earthquake are long-lasting and seem to be related to earthquake consequences in terms of damage and loss.<sup>17</sup>

The study in Italian town of Camerino 8 years after the earthquake showed no evidence of earthquake-related psychological damage. Plausible reasons could be the mildness of the earthquake (5.5 Richter), strong community support in overcoming a mental disorder, the lengthy time period between the earthquake and the time of study and the ability of the people to maintain or restore mental health in the long term.<sup>18</sup> The mentioned earthquake was so mild that nobody died at the time of the earthquake although the death of a close relative in our study after the age of more than 40 was one of the most important risk factors in suffering from a mental illness, therefore, this explains its discrepancy with our study. Furthermore, Camerino is a rural area with a population of 7036, which enjoys strong social cohesion of a rural community and that probably contributes to overcoming of mental disorders in this population.

Moreover, this study showed that the prevalence of

susceptibility to psychiatric disorders in women is more than that of men although the difference between them was not significant and is consistent with the study by Montazeri et al carried out 5 months after the earthquake.<sup>14</sup> This higher rate of prevalence in women can be related to biological factors, gender role, occupational and environmental stress, and limited sources of satisfaction in women.<sup>19</sup> Since there is no significant difference between men and women in terms of prevalence of suspicion of mental disorders, it is possible to point out the growth trend of men at risk of mental disorders. This trend is probably due to factors such as population growth, the changing role of men in the community and the pursuit of employment.<sup>12</sup>

Furthermore, this study showed a significant correlation between age and suspicion of mental disorders and that corresponds with the results of other studies in this area.<sup>10,12,13,14,20</sup> The higher prevalence of mental disorders in the elderly might be related to reasons such as retirement, dysfunction and menopause along with anxiety due to biological changes and solitude of the elderly.<sup>12,13</sup> In a study by Jia et al on survivors of the 2008 Sichuan earthquake, there were more general psychiatric complications in the elderly compared to the younger survivors (42% compared to 25%). Being old, grievance for a member of the family or a friend and having feelings of guilt is significantly associated with an increase in general psychiatric morbidity<sup>21</sup> and the use of mental health services has reduced the risk of these symptoms.

Two months after the Ahar earthquake in Eastern Azerbaijan Province of Iran in 2012, Askari et al conducted a quantitative research on a sample of 801 survivors indicating that the Middle age group had more psychological symptoms than other age groups. They also noted that the relationship between psychological age and post-trauma may be more complex than the simple question of old people versus young people with more or less psychological symptoms.<sup>22</sup> In our study, it was shown that, while age increases, probability of mental disorders also intensify, as those over 60 years of age had the highest mean for mental disorders. It is justifiable to say that this group was in the middle age group of people 12 years ago, therefore, it is probable to say that the middle age group of people are more vulnerable to disaster and therefore require further mental health care and attention after a catastrophe.

In this study, the risk of mental illness increased with age and death of a close relative. Evidently, as a limitation to our study, we did not investigate the extent to which mental health services were used in the population studied. Nonetheless, older people seem to have used fewer psychiatric services. It appears that further investigation in this field is essential to examine the causes of post-disaster vulnerability to mental disorders and age-related disorders.

In this study, the prevalence of susceptibility to

psychiatric disorders was higher in illiterate- school drop-outs and high school graduates than in other groups. The lowest rate of mental disorders is among those who have higher and postgraduate education, which conforms to most of studies conducted in this area. Cultural and social constraints in applying effective methods of adaptation to stressful situations might be the reason to justify the greater risk of mental disorders among illiterate and less educated individuals than those with higher education.<sup>12,20</sup>

The high prevalence of suspicion of having mental disorders among divorcees and widows in this study can be related to economic, cultural and social problems of this group.<sup>12</sup> Given the low prevalence of suspicion of mental disorders in married people, marriage can be seen as a protective factor in disaster survivors.

This study found that people who lost one of their close relatives significantly underwent severe psychological problems relative to those who did not. The results of this research are in line with a study that was carried out within a short time after the earthquake in Bam.<sup>14</sup> It is important to note that survivors who have lost their family should be swiftly screened by the BAM mental health care system.

Findings of this study suggest that the prevalence of somatic symptoms and anxiety is greater than severe depression and the prevalence of these disorders in women is greater than that of men. Which is in line with the study conducted by Noorbala et al in 2015 in Kerman province.<sup>20</sup> It was concluded that social stressors, economic problems and social changes are the main reasons for this important issue in this province. Similarly, in an investigation by Rashidi Nejad et al in Bam, depression received the lowest scores while anxiety received the highest score. The authors relied on the notion that the Bam earthquake is one of the greatest disasters in the world, where the survivors were confronted with PTSD.<sup>23</sup> This suggests that the survivors of this great catastrophe not only suffered serious trauma at the time of the earthquake, but also endured pressure, stresses and economic and social difficulties instigated by it in following years.

The limitation of this study is that people who were not affected by the earthquake and live in Bam were not investigated. On the other hand, the use of mental health services in the studied population were not investigated. Longitudinal and review studies in the context of mental health in Bam seems essential and considering the psychological complications in this area, it is highly recommended.

The results of this research revealed that widows and divorcees, illiterates and drop-outs, the elderly, and those who lost one of their family members had the highest average in terms of mental disorders. Among them, individuals over their 40's and those who had lost their families were associated with the highest risk of mental illness. Therefore, it is suggested that further investigations should be carried out on narrower age groups in order to

recognize the most vulnerable age precisely. Moreover, further research on survivors who witnessed the loss of a family member in terms of exactly which family member or number of deaths in a family is recommended. These outcomes may help identify survivors with increased risk of complications and mental disorders. Since natural disaster-related mental illness effects can last for many years, comprehensive screening programs at regular intervals should be required to be carried out to assess the mental health status of survivors in order to facilitate the identification of patients with mental disorders. Additional mental health services should be distributed to the elderly and people at risk in order to ensure the restoration of their mental health after an earthquake.

#### Authors' Contribution

PD designed, supervised and wrote the manuscript, Data gathering with MB and AAA, Data Analysis and statistical methods with MB and BA, critical feedback and consultation with AAN and MES.

#### Conflict of Interest Disclosures

The authors have no conflicts of interest.

#### Ethical Statement

This is an original work, and all authors have contributed to this article and the consent was obtained from all participants. This research has not partly or as a whole been submitted to any other journals for publication.

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