

# Earthquake Survivors And Depression Development: A Case Study Of 12 Years Later Ziarat Earthquake, Balochistan

Abdul Raheem<sup>1</sup>, Dr. Ghulam Murtaza<sup>2</sup>, Dr. Muhammad Ashraf<sup>3</sup>, Prof. Dr. Syed Ainuddin<sup>4</sup>, Jamil ur Rehman Babar<sup>5</sup>, Jamal ul ddin<sup>6</sup>, Syed AzizUddin Agha<sup>7</sup>, Abdul Malik<sup>8</sup>

<sup>1,5,6,8</sup>*Department of Disaster Management & Development Studies University of Balochistan (Corresponding Author 1) [a.raheemalizai@gmail.com](mailto:a.raheemalizai@gmail.com), [abdulmaliksaleem8@gmail.com](mailto:abdulmaliksaleem8@gmail.com), [jamalkakar333@gmail.com](mailto:jamalkakar333@gmail.com), [jrbabar77@gmail.com](mailto:jrbabar77@gmail.com)*

<sup>2,3</sup>*Assist.Prof, Department of Disaster Management & Development Studies University of Balochistan, Quetta [aamach100@gmail.com](mailto:aamach100@gmail.com), [mashrafh75@gmail.com](mailto:mashrafh75@gmail.com)*

<sup>4</sup>*Professor, Department of Disaster Management & Development Studies University of Balochistan, Quetta [syed.ainuddin77@gmail.com](mailto:syed.ainuddin77@gmail.com)*

<sup>7</sup>*Assistant Professor, Department of Psychology, University of Balochistan, Quetta [Balochistan.azizphd@nip.edu.pk](mailto:Balochistan.azizphd@nip.edu.pk)*

**Abstract:** Earthquakes trigger significant psychological impairments in various areas of human development. Studies indicate that exposure to earthquakes enhances psychological disorders, particularly depressive risks. The study's prime objectives are to screen individuals with depression and to see an association between earthquake and depression after 12 years of disaster. The total sample size is 1140 using cluster sampling. The outcome variable depression is screened using the BDI-II cut-off scores. X<sup>2</sup> test is used to compare participants' characteristics for all categorical variables and the Kruskal-Wallis test the ANOVA (One-Way Analysis of Variance) is used for scale variables in this study. To see an association between current depression and an individual's earthquake experience with not having experienced an earthquake as a reference group, logistic regression is employed. In this study, all the tests follow two-sided statistical tests, and inferences with a  $P < 0.05$  have ultimately been accounted statistically significant. Analyses of the study are performed in IBM SPSS statistics 25. Using (CI) confidence interval (95%) and odds ratios (ORs) for earthquake experience and depression association are used, at the time of the earthquake, the results after adjustment for age, gender, income, education, smoking status, drinking, and residence at Ziarat from one to two years after the tremor show that depression risk in the bereaved subgroup is 2.72 times (OR 2.72, CI 95%. 1.20-6.47) higher than that in the group having no experience of an earthquake. nevertheless, there is not reported any statistically significant linkage in the non-bereaved group of earthquake experience. Strengthening the social cohesion of communities may lead to quick recovery from traumatic events. Policymakers and Professional clinicians in the public health domain need to prioritize additional early social support to disasters survivors to reduce mental health problems, particularly in the earthquake-hit areas.

**Keywords:** Earthquake, Depression, BDI-II, Logistic Regression, Odd Ratio, Ziarat.

## 1 Introduction

During the course of a year, a major episode in the general population elevated approximately 7 percent of depression (Person et al., 2006), and based on the report of the World Health Organization (WHO), by 2030, across the world, depression has been prognosticated to be one of the major reasons for disabilities. In addition, the debilitating nature of chronic depression complicates the prognosis of acute ailments, aggravates different illnesses, and may result in suicide. Existing literature shows that depression is closely linked with demographic traits e.g. living style, education, gender, health status, smoking and drinking status, and income. Shreds of evidence show that respondents who were exposed to either man-made or natural disasters at an early age are at the increased depression development risks in short term (1-4 years), independent of gender, age, education, income, and any other confounders. Moreover, previous studies have documented that in the immediate aftermath of disaster trauma, some survivors had developed psychological impairments which abated over time in most but only a tiny number of the survivors were diagnosed with long-standing mental disorders. Therefore, to evaluate the effects of disasters on depression development it is necessary to have long-term shreds of evidence.

The long-lasting disaster effects findings on psychological conditions have been blended. Many a study has reported that there is no evident difference between the two (exposed for a long-term and non-exposed for a long-term) but on the other hand, several studies have reported an acute psychological disorder in individuals exposed to a disaster compared to those with non-exposed conditions for more than a decade after any catastrophe and the effect on mental health is doubled if survivors suffer from bereavements. However, the effect of the disaster on depression could vary according to gender and age. Contemporary studies have indicated that

psychological symptoms' overall levels can differ among adults, adolescents, and children due to physiological and cognitional differences among them. In this regard, reaction to a catastrophic event, women comparatively develop more acute and long-term psychological disorder signs. Nonetheless, none of these studies have ever examined the long-term effects of the 2008 earthquake on depression risk development in the Balochistan population, especially Ziarat.

This study gives suitable settings for inquiring about the long-lasting tremor impact on depression development in the population of Ziarat. The Ziarat shaking that occurred in 2008, had a magnitude of 7.5 on the Richter scale, accounted for thousands of deaths, and left millions severely wounded, representing the second deadliest natural catastrophe in the history of Balochistan. The purpose of this study was merely to investigate the long-lasting impacts of the Ziarat earthquake on depression development 12 years later. It was hypothesized that survivors with bereavement would be more likely to develop depression than survivors without bereavement. Furthermore, it was hypothesized that quake exposed individuals would be more likely to experience depression than individuals with the non-exposed condition. Taking into account that gender and age of the respondents may confound the relation between depression development and earthquake experience. The study also performed an analysis that was stratified by gender and age.

## 2 Literature Review

### 2.1 Economic Status and Depression

Depression being a genetic component is an organic disease. Nonetheless, depression manifestation symptoms may also depend on several environmental factors (Burvil, 1995; Hollifield et al., 1997). Cornering these insights into a formula, the observed dependent

depressive symptoms on socio-economic determinants can be modeled in the following way:

Depression = x (Gender, Age, Economic Status, Education, Insurance, Race and Genetics)

In this association, X can be higher for two different reasons. First, there is a high chance of internalizing mental impairments like depression for women compare to men, and exhibit more symptoms of depression than men. Second, persons with lower income commonly face stresses associated with making ends meet that trigger depression and other disorders.

## 2.2 Current Depression Prevalence Assessment

The prevalence of depression signs was screened employing the Beck Depression Inventory Tool (BDI-II), which is a refined self-measuring and self-report psychometric instrument for quick depression assessment and it has persistently

been used in about 5 hundred non-clinical published studies across the world for screening depression strength (Beck et al., 1961; Brunson & Lawrence, 2002; Dozois et al., 1998a; Whiffen, 1997) in a wide range of psychiatric as well as in normal population (Beck & Beamesderfer, 1974). There exist two versions of the Beck Depression Inventory Tool, the 1961 version of BDI (BDI-I) and the 1978 revised version (BDI-II) in which double negative statements and alternative ways of investigating the same queries are eradicated, which were repeated in the first version, and set amenable and clearer questions for self-administration and simple scoring (Cramer & Howitt, 2015). Both of the versions (1961 and 1978) enclose 21-items and in terms of intensities, it is rated between ranges of 0-3. This rating is summated so that depression total scores can be calculated which range from 0-63. The symptoms and depression attitudes 20-items are as follows:

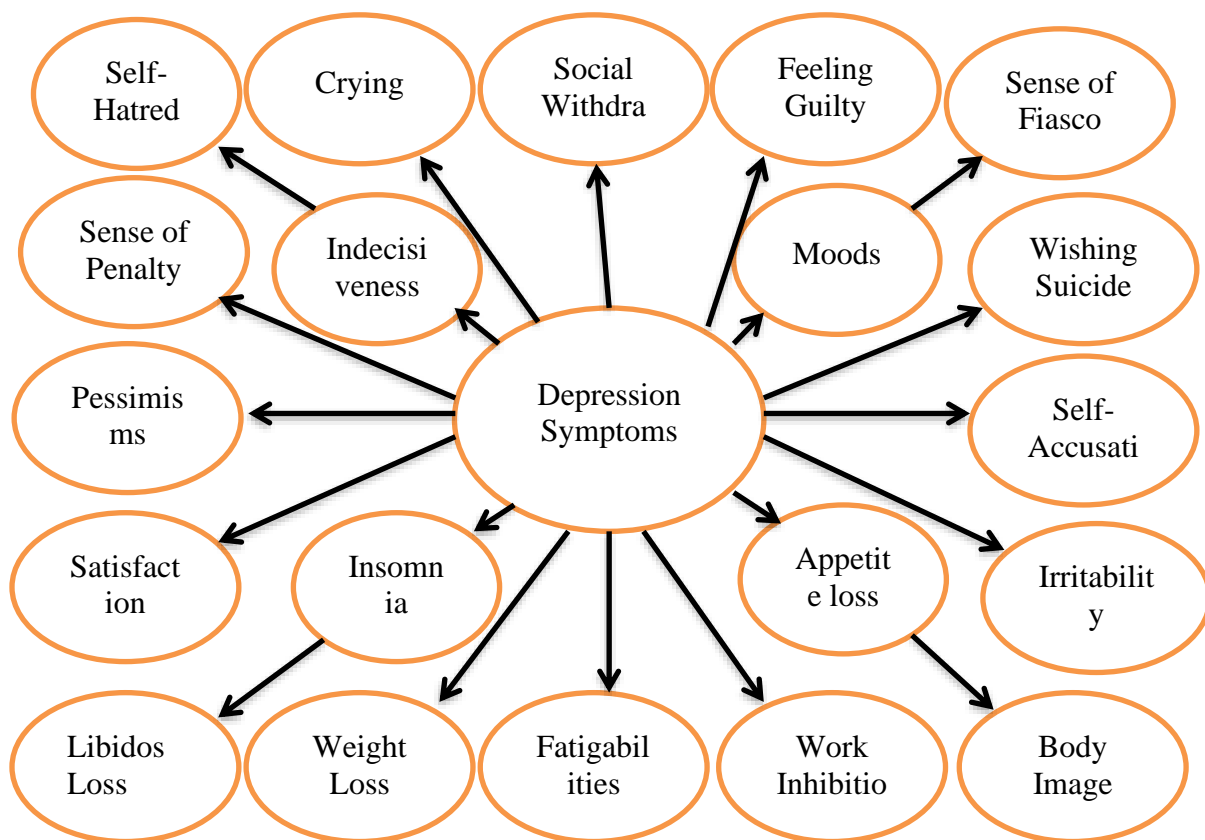


Figure 1: Depression Symptoms

### 3 Method

#### 3.1 Study Area and Participants

The data were gathered from Ziarat district Balochistan, Pakistan which is one of the most earthquake-prone regions due to its location. Ziarat lies  $30^{\circ} 22' 56.8''$  in latitude to the north side and  $67^{\circ} 43' 32.2''$  longitude to the east. The study followed a cross-sectional design; Participants were opted from district Ziarat by applying cluster sampling for the selection of participants due to homogeneity in the social

demographics from May 2019 to June 2020. In the study total of 1140 residents were recruited to part of the study and they were ensured with the choice of abandoning the study at any time. Data about demographics and behavioral traits, cognition, insomnia, self-accusation, sense of fiasco, wishing suicide, etc. have been gathered using a set of self-administered questionnaires at annual follow-up since May 2019. Including the BDI-II self-administered version of 1978, which asks the participants to tell “how they have been feeling for the previous week including the same day”? (Cramer & Howitt, 2015)

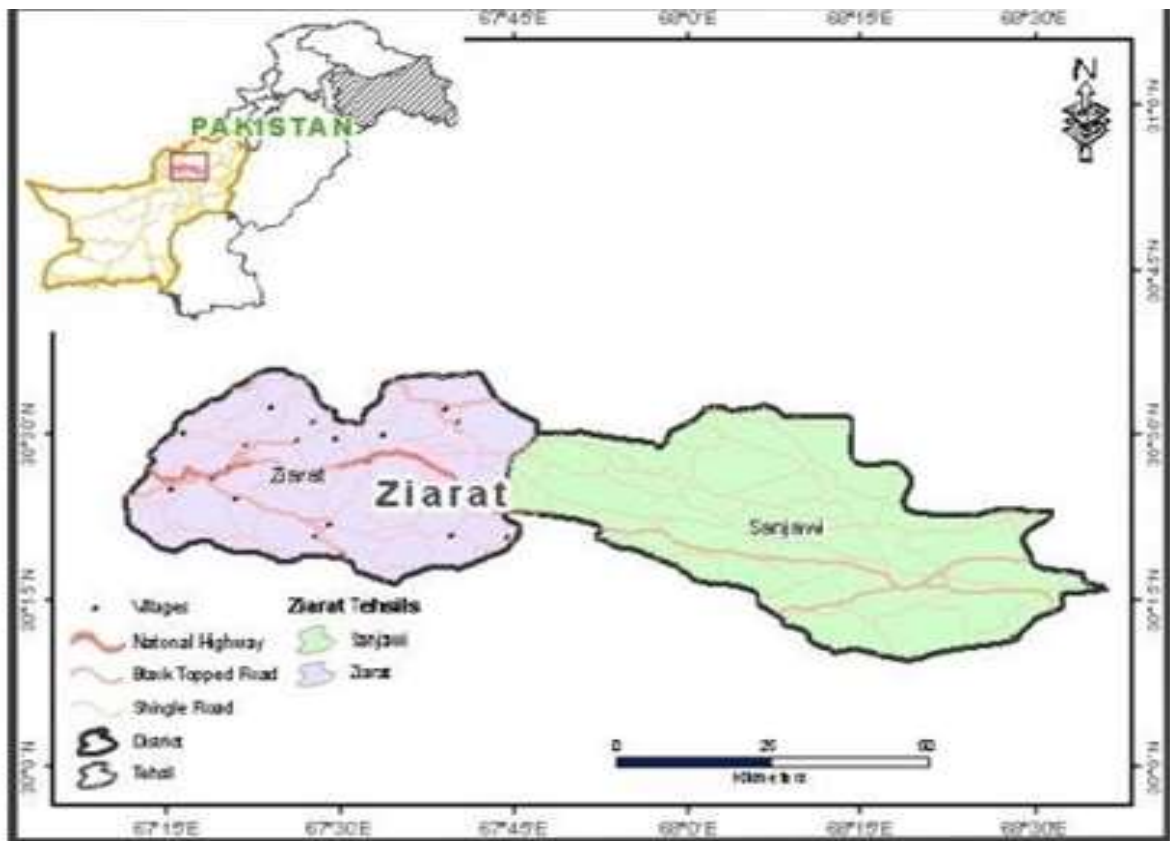


Figure 2: Map of Study Area

#### 3.2 Prospective Depression Covariates Assessment

Predictive covariates opted for the study encompassing elements hypothetically associated with earthquake exposures and depression

development, containing gender, education, age, occupation, income, drinking status, smoking status, and residing in Ziarat one to two years after the tremor. During the quake time, age was taken as a scale variable, and later on, age was

categorized into three categories (16-30, 31-50, and 51-68). The monthly income of each household was categorized as “ $\leq$ \$500, \$500-\$1000” and  $>$ \$1000. Similarly, educational status was also categorized into three classes (Primary, Middle/High to University education). Residing in the district Ziarat one to two years in post-quake was taken in a dichotomous form such as (Yes and No). Individuals’ drinking condition was also taken in dichotomous form, (Yes = currently drinking, and No = Never drank in the past or not drinking currently) similarly smoking status of respondents was divided into “Yes” (currently smoking) and “No” (non-smoker). All the measurements of this study reflected the current values as of data collection.

### 3.3 Earthquake Experience Assessment

Experience with the earthquake was a potential variable of concern in this study. Experience with the tremor and associated bereavement data have been gathered via a structured questionnaire. The following questions were developed to obtain these factors: if he was in the Ziarat earthquake area in 2008 and if he lost any loved ones in the shake. All subjects were classified into three groups based on their response to the questions. 1) No EQ experience, 2) Earthquake with having no experience of bereavement and 3) Earthquake with having experience of bereavement.

### 3.4 Statistical Analysis

According to the individuals' experiences of the earthquake (i.e. does not have experience of the quake, quake with having no experience of bereavement, and quake with having experience of bereavement), their traits were compared employing the X<sup>2</sup> test for all the categorical variables and the Kruskal-Wallis test or the ANOVA (one-way analysis of variance) was applied for scale variables in the study. To see an association between current depression and an individual's earthquake with not having earthquake experience was taken as a reference

group, logistic regression was employed. Four models of multivariate were adjusted: Model one stood as an unfitted model. And for age, the second model was fitted at the time of the quake and respondents' gender. The third model was further fitted for the age, gender, and occupation of the respondents. And the fourth model was fitted for respondents' age, gender, drinking and smoking conditions, education, income, and inhabitation in Ziarat 1-2 years in the post-tremor situation. The study examines relationships stratified by age and gender via using multiple logistic regression models. To evaluate the impact of the Ziarat quake on the depression could be modified by age or/and gender, the study tested gender statistical significance (x) quake and respondents' age (x) quake as an interaction impacts in a multi-adjusted logistic model via employing the Wald Test of post-estimation to ascertain the omnibus p-values for the interaction between shake categories and depression. In the study, all the tests follow two-sided statistical tests, and inferences with a p-value of  $<.05$  have ultimately been considered significant statistically. The analyses of the current study were carried out in IBM SPSS statistics 25.

## 4 Results

### 4.1 Respondents' profile

Table 1 below represents the respondents' characteristics according to their experience of the earthquake, comprised of a total of 786 (68.9%) male and 354 (31.1%) female. Age of the respondents was divided into three different groups, 16-30 (47.9%), 31-50 (43.2%) and 51-68 (8.9%) with (Mean = 33.81 and Std. Deviation = 11.204). The participants belonged to various occupations such as 22.6% were reported housewives, 17.9% were employed in different government sectors, 12.6% had become agriculturist after attainment of their middle school, 2.1% reported businessmen/women, and

44.7% of the participants were found students with current status. Participants' monthly income varied according to their experience with an earthquake. However, a large proportion of the unit of analysis 75.9% was reported having <\$500 per month, 13.5% was reported with \$500 to \$1000 per month and only (10.6%) was seen earning >\$1000 per month. Overall half 576 (50.5%) of the study participants were reported

with smoking status varied based on earthquake experience. Only a tiny number of respondents 84 (7.4%) reported drinking status in the study area which also varied according to their earthquake experience. In the study, overall 696 (61.1%) of participants screened for severe depression which further varied according to their earthquake experience.

**Table 1.** Respondents' Demographics Based on Quake Experience

Variables	Overall	No Experienced	With Bereavement	Without Bereavement	P-Value
<b>Gender, n (%)</b>					0.071
Male	786 (68.9%)	204 (17.9%)	378 (33.2%)	204 (17.9%)	
Female	354 (31.1%)	114 (10.0%)	210 (18.4%)	30 (2.6%)	
<b>Age, n (%)</b>					0.001
16-30	546 (47.9%)	192 (16.8%)	246 (21.6%)	108 (9.8%)	
31-50	492 (43.2%)	114 (10.0%)	282 (24.7%)	96 (8.4%)	
51-68	102 (8.9%)	12 (1.1%)	60 (5.3%)	30 (2.6%)	
<b>Income, n (%)</b>					0.021
<\$500	865 (75.9%)	247 (21.7%)	464 (40.7%)	154 (13.5%)	
\$500-1000	154 (13.5%)	32 (2.8%)	74 (6.5%)	48 (4.2%)	
>\$1000	121 (10.6%)	39 (3.4%)	50 (4.4%)	32 (2.8%)	
<b>Smoking, n (%)</b>					0.007
Yes	576 (50.5%)	246 (21.6%)	186 (16.3%)	144 (12.6%)	
No	564 (49.5%)	72 (6.3%)	402 (35.3%)	90 (7.9%)	
<b>Drinking, n (%)</b>					0.005
Yes	84 (7.4%)	24 (2.1%)	54 (4.7%)	6 (0.5%)	
No	1056 (92.6%)	294 (27.8%)	534 (46.8%)	228 (20.0%)	
<b>Education, n (%)</b>					0.532
Illiterate/Primary School	619 (54.3%)	168 (14.7%)	323 (28.3%)	128 (11.2%)	
Middle/High School	351 (30.8%)	96 (8.4%)	192 (16.8%)	63 (5.5%)	
University/Higher	170 (14.9%)	54 (4.7%)	73 (6.4%)	43 (3.8%)	
<b>Occupation, n (%)</b>					

Student	516 (45.3%)	174 (15.3%)	240 (21.1%)	102 (8.9%)	
Business	24 (2.1%)	0 (0.0%)	24 (2.1%)	0 (0.0%)	
Agriculture	144 (12.6%)	24 (2.1%)	96 (8.4%)	24 (2.1%)	0.07
Govt. Employee	204 (17.9%)	36 (3.2%)	96 (8.4%)	72 (6.3%)	
House Wife	252 (22.1%)	84 (7.4%)	132 (11.6%)	36 (3.2%)	
<b>Depressed, n (%)</b>					0.002
Depressed	696 (61.1%)	132 (11.6%)	378 (33.2%)	186 (16.3%)	
Not Depressed	444 (38.9%)	186 (16.3%)	210 (18.4%)	48 (4.2%)	
Total	1140 (100.0%)	318 (27.9%)	588 (51.6%)	234 (20.5%)	=

**4.2 Cutoff Scores for Depression**

The BDI-II total cutoff scores range from 0-63 in which 0-13 indicate minimal depression, 14-19 indicate mild, 20-28 show moderate and 29-63 show severe depression. And scoring of the scale can probably be calculated either manually or by employing the Pearson Proprietary Software Q-Global (Dozois et al., 1998b). This study followed manual scoring of the scale to the

threshold levels of depression. The results are presented in figure 2 in percent which indicates a serious condition of Ziarat district in terms of depression. 61.1 percent of the participants were found severely depressed, 23.12 percent were moderately depressed, 6.31 percent were mildly depressed and 9.47 percent were found minimally depressed. In the logistic regression models, severely depressed were considered.

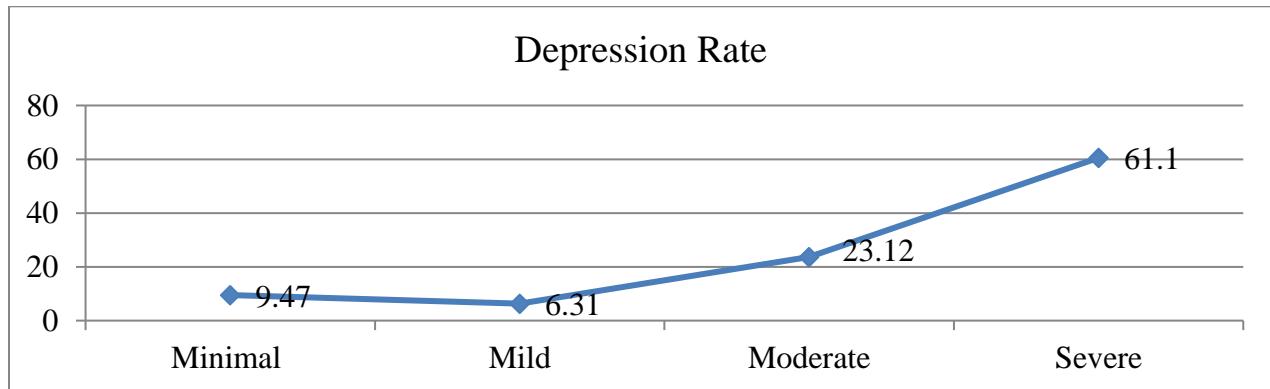


Figure 3: Depression Rate of Participants

**4.3 Earthquake Experience and Depression Association**

Confidence interval (95%) and odds ratios (ORs) for having quake experiences and development of depression association are portrayed below (Table 2). In this regard, after fitting the model for age, gender, income, education, smoking, present drinking conditions, and residence in the

Ziarat 1-2 years in post-earthquake conditions. Depression risk in the bereaved subgroup has been reported 2.72 times (OR 2.72, CI 95%. 1.20-6.47) greater than the group with having experience of no quake. Though, results did not report any statistically significant linkage in the non-bereaved group with having experience of the quake.



**Table 3.** Odds Ratios (ORs) for EQ Experience and Depression Association

	Not Having Experience of EQ (n=132, 18.96%)	Having Experience of EQ with Bereavement (n=378, 54.31%)	Having Experience of EQ without Bereavement (n=186, 26.72%)
Model 1	1	1.39 (0.98–2.10)	2.48 (1.42–4.68)
Model 2	1	1.41 (1.11–2.13)	2.60 (1.32–4.58)
Model 3	1	1.71 (0.90–2.85)	2.77 (1.25–6.48)
Model 4	1	1.67 (0.94–3.10)	2.72 (1.20–6.47)

Model 1. It indicates an unfitted model.  
Model 2. It indicates to model fitted for age and gender.  
Model 3. It indicates to model fitted for age, gender, and occupation.  
Model 4. It indicates to the model fitted for age, gender, drinking and smoking condition, income, education, and inhabitation in Ziarat 1 to 2 years even after the tremor.

## 5. Discussion

In the study, it was witnessed that even after 12 years of the Ziarat shake, the survivors have comparatively a higher risk of depression development. Further, long-lasting impacts of quakes on depressions development were observed amongst the survivors with bereavement (Cozza et al., 2020) women and participants over 20 years old. This study happens to be the first work that investigates the effects and linkage between quake experience and individuals' depression development 12 years later the Ziarat tremor. Literature has proved that traumatic events in adolescence and youth could lay determining impacts on the structural construction of the brain, the hypothalamic-pituitary-adrenal axis, and the sympathetic nervous system responsively, particularly in preschool children, resulting in various psychological issues and stress responses. However, in this study, the participants were classified into three age categories "16-30", "31-50" and "51-68" to see the long-term effects of the 2008 earthquake on their mental health. In this regard, significant statistical relation was seen in individuals of all groups but particularly in

groups 31-50 years of age. One illustration is that various ages have got different social network needs. Such networks are closely associated with the development of depression (Rosenquist et al., 2011). Mostly underage and adolescents' needs are met by their parental care and some family members (McFARLANE, 1987). Adults, on the other hand, require support from social interaction in their communities, neighborhood, and the workplace in addition to their family support (Bland et al., 1997). The advent of excruciating earthquakes devastated the previously built economic stability and social networks of the community. The economic foundation destruction, as well as social networks, causes some mental health disorders among individuals of a particular area.

In addition to this, underage survivors recuperate from any disaster more quickly and easily than older ones do. Access to mental health interventions and insensitivities to the meaning of disaster trauma and nature (GREEN et al., 1991) in the early post-disasters stages (Wang et al., 2013) could immensely contribute to the recuperation from psychological disorders among adolescence and adult survivors. Concerning



participants' gender, a significant link between experiencing earthquake and depression development was found in women. In several previous disaster studies, a similar result has been found, which indicates that a woman may be at a higher depression development risk than a man when it comes to experiencing disasters including earthquakes (GREEN et al., 1994; Guo et al., 2017; Rasmussen et al., 2020). Individual differences such as differences in personality, physiology, ruminating process, and social role between men and women may result in differences in gender with the association of disaster and depression (Feingold, 1994; Nolen-Hoeksema & Harrell, 2002). A longitudinal study on Alexander Kielland oil platform collapse after 27 years the disaster is consistent with this study's findings also showed that survivors had a high risk of depression than those who were not exposed (Boe et al., 2011). Another longitudinal study of the Piper Alpha oil platform after 10 years of follow-up also presented similar results indicating a long-lasting rise in mental health issues in participants compared with non-exposed participants (Hull et al., 2002).

In contrast, only two studies were found indicating that there is the little long-term impact of a disaster on depression (GREEN et al., 1994; McFarlane & Van Hooff, 2009). The contradiction of results could be illustrated via disaster's severity i.e. the earthquake of Tangshan resulted in more devastation than the Australian bushfires or the Buffalo Creek dam collapse disasters. The Tangshan tremor reduced her to ruins in no time, with approximately 4 lakh casualties and 85 percent of buildings collapse (Huixian et al., 2002; Zhi-Yong, 1987). The survivors were not only afflicted with the loss of their adobes but also with fear and tension, the loss of relatives, social network ruination, and brought a sense of despair among survivors (Armenian et al., 2000; Carr et al., 1997). Disaster long-term effects on depression are to depend on traumatic experiences. In this

study, a significant association between the two has been found in participants with bereavement but not in without bereavement even after 12 years of the Ziarat earthquake.

## 6. Conclusion

Earthquakes trigger significant psychological impairments in various human development areas. Studies indicate that exposure to earthquakes enhances psychological disorders, particularly depressive risks (American Psychological Association, 2013). However, the results of our study show relevance to further work on depression among earthquake survivors. E.g. Japan, China, and Haiti earthquake survivors were all afflicted by higher depressive rates in short terms (Cerdá et al., 2013; Guo et al., 2014). Even though the severity of the earthquake and timing of the earthquake, survivors' ethnicity, and environment of living style were all significantly heterogeneous, the earthquake stressors were similar (Hikichi et al., 2016; North & Pfefferbaum, 2013). 12 years later the Ziarat tremor experience had statistically been linked with depression in the district in bereaved survivors. This study provides shreds of evidence that could back up the researcher's hypothesis that the effect of the 2008 Ziarat earthquake persists after 12 years. In this regard, strengthening the social cohesion of communities may lead to quick recovery from traumatic events. Policymakers and Professional clinicians in the public health domain need to prioritize additional early social support to disasters survivors to reduce mental health problems, particularly in the earthquake-hit area.

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