

# Prevalence and Risk Factors of PTSD, Depression, and Grief Among Survivors of 2023 Türkiye Earthquake

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**Abstract:** This study investigated the prevalence and risk factors of probable posttraumatic stress disorder (PTSD), depression, and complicated grief among 529 adults residing in a container city, 4 months after the 2023 earthquakes in Türkiye. Participants were assessed using the PTSD Checklist for *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition*, the Hamilton Depression Scale, and the Inventory of Complicated Grief. The prevalence rates of probable PTSD, depression, and complicated grief were 21.4%, 15.9%, and 64.7%, respectively. Logistic regression analyses indicated that PTSD was significantly associated with the loss of a loved one, fear of future earthquakes, and decreased perceived life control. Similarly, depression was associated with being trapped under debris, experiencing fear during the earthquake, and reduced perceived life control. These findings suggest that individuals presenting these risk factors warrant closer follow-up for potential psychological issues. Additionally, the impact of fear related to the earthquake and the role of perceived life control emerge as crucial considerations for psychological interventions.

**Key Words:** Earthquake, posttraumatic stress disorder, depression, grief, Türkiye  
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Earthquakes are natural disasters that lead to destruction, physical injuries, and emotional disorders. Between 1900 and 2013, Türkiye experienced 269 earthquakes, placing it at the forefront of countries affected by such calamities. The most catastrophic event in recent history occurred on February 6, 2023, when a magnitude 7.7 earthquake struck Kahramanmaraş at 04:17, followed by a magnitude 7.6 quake at 13:24. These events, alongside 7,184 aftershocks, as reported by the Disaster and Emergency Management Authority, caused widespread devastation across approximately 10 cities. Official records indicate that 50,783 people lost their lives, 115,353 were injured, and 37,984 buildings collapsed (AFAD, 2023). According to the United Nations Development Programme (2023), the financial toll of this unparalleled disaster is estimated at around USD 84 billion.

The widespread devastation from earthquakes, including material and emotional losses, significantly affects mental health in both the short and long term. Earthquakes can alter interpersonal, family, and social dynamics, leading to psychological distress of varying intensity in many individuals (Aksu and İmrek, 2023). In the immediate aftermath, mental health issues such as acute stress disorder, sleep disturbances, and the worsening of preexisting mental conditions can emerge, with symptoms diversifying over time (Yildiz and Akkoyun, 2023). As time progresses, survivors may face a spectrum of mental health challenges, including anxiety, dissociation, and suicidality (Kessler et al., 2008), as well as alcohol and substance misuse (North et al., 2011), ag-

gressive behavior, and impaired social interactions. These issues may not always align with specific diagnostic categories but significantly impact well-being (Kar, 2006).

In populations exposed to long-term effects of earthquakes, post-traumatic stress disorder (PTSD) is the most anticipated mental health issue (Wang et al., 2000), followed by major depressive disorder (MDD) (Kuo et al., 2003; Salscioglu et al., 2007). Studies have shown varying prevalence rates of PTSD after an earthquake, with figures ranging from 11.9% (Maya-Mondragón et al., 2019) to 55.6% (Hosseinnejad et al., 2022). Similarly, rates of depression following natural disasters, including earthquakes, have been reported to vary from 4.9% to 54% (Cheng et al., 2015; Tang et al., 2014). This variability can be attributed to several factors, including differences in diagnostic tools, characteristics of the study sample, and the time elapsed since the traumatic event (Armenian et al., 2002). Additionally, the nature of the traumatic event, posttrauma experiences, and various risk factors can also contribute to the observed variations in mental health impacts.

Research suggests a high frequency of depressive symptoms cooccurring with PTSD in individuals affected by natural disasters. Among conditions that coexist with PTSD, depressive disorder is most commonly reported (O'Donnell et al., 2004). Therefore, it is not surprising that the risk factors for both PTSD and depression exhibit similarities. These include the level of exposure to material and emotional destruction (such as injury, witnessing someone's death, experiencing the earthquake alone, severe damage to one's home, the death of family members and friends, and significant material loss), as well as a history of trauma, psychiatric disorders, gender, marital status, and educational level. These have all been identified as significant risk factors for the symptoms of PTSD and depression (Armenian et al., 2002; Brewin et al., 2000; Dobson and Dozois, 2011; Tang et al., 2014).

Most studies on postdisaster mental health have primarily focused on PTSD (Neria et al., 2008; Wang et al., 2000; Zhang et al., 2015). However, the sudden and traumatic nature of deaths during such disasters can exacerbate the natural process of grieving, leading to what is known as complicated grief (CG), a condition that can cause long-term adaptation difficulties (Hargrave et al., 2012; Shear et al., 2005). The prevalence of CG among individuals who have lost relatives after a traumatic event has been reported to range between 8.47% and 71%. Factors contributing to the risk of experiencing CG, similarly to depression and PTSD, include gender (with females being at higher risk), financial loss, sustaining physical injuries from the earthquake, and the loss of a close family member (Eisma et al., 2019).

The emergence of mental health issues following traumatic events can lead to impairments in individual, family, and occupational functioning and can significantly burden the healthcare system (Al Jowf et al., 2022). It is crucial to predict and promptly identify potential mental health issues in disaster survivors to implement preventive measures and address these problems before they become chronic conditions. Although there is substantial data on long-term mental health issues following a disaster, information on the earlier period is comparatively less. This study aims to investigate the prevalence and risk factors for MDD, PTSD, and CG among survivors living in a container city in Kahramanmaraş, focusing on the early period following the disaster.

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We hypothesized that experiences related to earthquakes, such as being trapped under debris and experiencing fear, the loss of a close family member, financial loss, and less perceived control over life, would positively predict the presence of probable PTSD, depressive symptoms, and grief. Additionally, we expected that engagement in search and rescue operations would negatively predict the likelihood of probable PTSD, depression, and grief.

## METHODS

### Participants and Procedures

Four months following the February 6 Kahramanmaraş earthquakes, the authors visited a container city to initiate a longitudinal survey and a psychotherapeutic intervention program. The aim of the program was to monitor the psychological well-being of earthquake survivors and provide treatment for their psychological issues. The fourth month postearthquake was deemed an opportune time for screening, particularly due to the potential presence of persistent PTSD symptoms, which could be categorized as “chronic PTSD” (Honkanen, 2016). The data presented in this article are from the initial survey conducted from June 1, 2023, to August 1, 2023.

The respondent group consisted of individuals whose homes were severely damaged, rendering them uninhabitable. These individuals resided in a container city, which housed a total of 2098 residents at the time of the research. Although these settlements were intended to be temporary, there was uncertainty regarding the timeline for the residents' return to their homes due to widespread damage in the city. Essential needs, including food, healthcare, and security, were provided at these container cities, which were established in areas designated by the state.

Being between the ages of 18 and 65 and residing in a container city at the time of the research were established as the inclusion criteria. Participants who were not present in Kahramanmaraş during the earthquakes were excluded. All adult residents of the container city were invited to participate in the study by volunteer interviewers, consisting of psychology students and graduates, who visited the containers. If no one was reached at a visited container, additional visits were conducted at least two more times on subsequent days. Since the interviews took place during working hours, the majority of individuals not reached were males. Additionally, many people were commuting to and from their villages. After interviewers clearly explained the research's purpose and the importance of identifying psychological difficulties, written consent was obtained from the participants. Initially, the interviewers administered a sociodemographic data form and the Hamilton Depression Scale (HAM-D), followed by the participants independently completing the self-report measures.

Among the 2098 individuals residing in the container city, 924 were below the age of 18, and 112 were aged 65 or older. Out of the 1062 individuals who met the age criteria, 438 (41.2%) could not be reached at the time of the survey. Interviews were conducted with 624 individuals, of whom 86 (12.5%) declined to participate in the research. Data from nine individuals were excluded from the analysis because they were not residing in Kahramanmaraş at the time of the earthquake. Consequently, 529 trauma survivors participated in this study.

The research was approved through the decision of the Ethics Committee of a training and research hospital with a reference number 2023-09-17 on May 3, 2023.

### Measures

Sociodemographic data and information about earthquake experiences were collected through a semistructured survey designed by the authors. The survey questions related to earthquake experiences covered various aspects, such as being trapped under debris, experiencing financial loss, and participating in search and rescue operations. It also

included assessments of fear of future earthquakes and fear experienced during earthquakes on a scale from 1 to 5, where 1 indicates “never” and 5 indicates “extreme.” Similarly, perceived control over life was evaluated by asking participants to rate, on a scale of 1 to 5, their perceived level of control over their lives, with 1 indicating “no control” and 5 indicating “totally under my control.” Additionally, as a potential consequence of experiencing a traumatic event, the questionnaire inquired whether participants observed an increase in smoking and alcohol consumption after the earthquake, presented as a yes-no question.

### Inventory of Complicated Grief

Inventory of Complicated Grief was developed by Prigerson et al. (1995) to assess the symptoms of CG. The instrument consists of 19 first-person statements concerning the immediate bereavement-related thoughts and behaviors of the client. There are five response options, ranging from “never” to “always.” The Cronbach's alpha of the original version was found to be 0.94, and test-retest reliability was  $r = 0.80$  (Prigerson et al., 1995). Scores over 25 are indicative of ICG requiring clinical care. Erdem Atak et al. (2012) conducted the Turkish validity and reliability study. The Cronbach's alpha for the Turkish form was calculated to be 0.95. For this study, the Cronbach's alpha for the 19-item Turkish form was 0.92, and the split-half reliability coefficient was calculated as 0.81.

### PTSD Checklist for DSM-5

PTSD Checklist for DSM-5 (PCL-5) was developed by Weathers et al. (2013) in order to measure PTSD symptoms, taking into account the diagnostic criteria in *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5)*. PCL-5 is a five-point Likert-type self-report scale consisting of 20 items (scored 0–4). The internal consistency coefficient of the entire scale is 0.96 (Bovin et al., 2015). PCL-5 was adapted into Turkish by Boysan et al. (2017), and the internal consistency coefficient of the scale was calculated respectively as 0.94 and 0.97 for the clinical and control groups. Scores over 47 are indicative of PTSD requiring clinical care (Boysan et al., 2017).

### Hamilton Depression Scale

The HAM-D is a 17-item, clinician-rated scale developed by Hamilton (1960) to assess depression severity. It was adapted into Turkish by Akdemir et al. (1996). The Cronbach's alpha was found to be 0.75, and test-retest reliability was  $r = 0.85$ . The arithmetic sum of the scores obtained from each item gives the total score. It is used by clinicians to score the indicators of depressive symptoms in the last week. A score below 7 defines nondepressive, and scores higher than 18 were classified as major depression (Carrozzino et al., 2020; Ozbay et al., 1996).

Since a self-rated scale or a structured interview with predefined questions may not suffice for definitive diagnoses of psychiatric conditions, the prevalence rates for PTSD, depression, and CG reported in this study should be considered as indicative of the potential rates for these conditions.

### Data Analysis

The SPSS 26.0 software for Windows was utilized for statistical analysis. The data were summarized using frequency and percentage for sample description. Descriptive statistics evaluated the sociodemographic characteristics (gender, age, marital status, educational status, occupation), history of smoking and alcohol use, and increases in smoking and alcohol consumption postearthquake. Normality was assessed using histograms, Q-Q plots, and the Kolmogorov-Smirnov test. Due to the absence of a normal distribution in the data, nonparametric tests were carried out. The Mann-Whitney *U*-test was used to examine differences between groups. Binary logistic regression analysis was used to examine the impact of being trapped under debris, engagement in search and

rescue operations, financial loss, loss of a loved one, perceived life control, and fear of earthquakes on PCL-5, HAM-D, and ICG total scores. The logistic regression analysis proceeded in three steps. Initially, earthquake-related experiences were included as potential predictors of probable PTSD, depression, and grief. In the second step (Model 2), the odds ratios (ORs) were adjusted for trauma history as a potential distal factor. In the final step (Model 3), ORs were further adjusted for trauma history and potential confounding variables such as age, gender, marital status, and education status.

RESULTS

A total of 529 residents from the container city were interviewed, of whom 363 (68.6%) were female. The median age was 35.0 ± 11.3 (18–65). Among the participants, 438 (82.8%) were married, 71 (13.4%) had graduated from university, and 257 (48.6%) were unemployed (Table 1). Regarding substance use, 175 participants (33.1%) reported a history of smoking, with 101 (29.3%) indicating an increase in smoking habits following the earthquake. The prevalence of alcohol use was 2.8%, with only 1.1% of participants reporting an increase in alcohol consumption postearthquake (Table 1). The prevalence of probable PTSD was 21.4% (*n* = 113), whereas MDD was reported at 15.9% (*n* = 84). Among the participants, 221 (41.8%) scored within the normal range on HAM-D. Furthermore, 241 (45.6%) of the participants reported the loss of at least one loved one due to the earthquake, and 119 of them completed ICG. Of those, 77 (64.7%) scored above the cutoff score for ICG. A gender-based comparison revealed that females had significantly higher mean scores for

both probable depression (*p* = 0.001) and PTSD (*p* = 0.003) compared with males, indicating a statistically significant difference (*p* < 0.05). Out of the participants, 129 (24.4%) reported having experienced a traumatic event prior to the study. A total of 63 individuals (11.9%) reported being trapped under debris for durations ranging from 1 hour to 64 hours. Sixteen participants (3%) were hospitalized due to injuries sustained in the aftermath of the earthquake. Furthermore, 134 (25.3%) indicated their active involvement in search and rescue operations following the earthquake. Additionally, 384 participants (72.59%) disclosed that they were experiencing financial setbacks, which impaired their ability to maintain their usual lifestyle. Table 2 presents the parameters of multiple logistic regression models that describe the influence of independent variables on probable PTSD. In Model 1, which includes experiences related to the earthquake, the loss of a loved one (OR = 1.806, *p* = 0.11) and persistent fear of future earthquakes (OR = 1.591, *p* < 0.001) were positively associated, whereas perceived life control (OR = 0.609, *p* < 0.001) was negatively associated with probable PTSD. In Model 2, with the distal factor of trauma history controlled, and in Model 3, with confounding factors such as age, gender, marital status, and educational status adjusted, the aforementioned variables retained their significance. The third model explained 24.1% of the variance in probable PTSD. The results of the binary logistic regression analysis for HAM-D indicated that trapped under debris (OR = 2.760, *p* = 0.004) and fear during the earthquake (OR = 1.446, *p* = 0.17) were positively associated with probable depression, whereas perceived life control (OR = 0.543, *p* < 0.001) was negatively associated. After adjustments for trauma history, age, gender, marital status, and educational status, these variables retained their significance. The third model explained 21.9% of the variance in probable depression (Table 3). The results of the binary logistic regression analysis for ICG indicated that trapped under debris (OR = 3.516, *p* = 0.027) and engagement in search and rescue operations (OR = 4.865, *p* = 0.006) were positively associated, and perceived life control (OR = 0.538, *p* = 0.003) was negatively associated with probable grief. After adjustments for trauma history, age, gender, marital status, and educational status being trapped under debris lost its significance, other variables retained theirs. The model explained 34.6% of the variance in probable grief (Table 4).

TABLE 1. Characteristics of the Participants

| Variables                                     | Values      |
|-----------------------------------------------|-------------|
| Age, median                                   | 35 (18–65)  |
| Gender, <i>n</i> (%)                          |             |
| Male                                          | 166 (31.4)  |
| Female                                        | 363 (68.6)  |
| Marital status, <i>n</i> (%)                  |             |
| Single                                        | 91 (17.2)   |
| Married                                       | 438 (82.8)  |
| Educational status, <i>n</i> (%)              |             |
| Primary school                                | 215 (40.6)  |
| Middle school                                 | 96 (18.1)   |
| High school                                   | 147 (27.8)  |
| University degree                             | 71 (13.4)   |
| History of smoking, <i>n</i> (%)              |             |
| Yes                                           | 175 (33.1)  |
| No                                            | 354 (66.9)  |
| Increase in smoking, <i>n</i> (%)             |             |
| Yes                                           | 101 (19.1)  |
| No                                            | 354 (66.9)  |
| History of drinking an alcohol, <i>n</i> (%)  |             |
| Yes                                           | 15 (2.8)    |
| No                                            | 514 (97.2)  |
| Increase in drinking an alcohol, <i>n</i> (%) |             |
| Yes                                           | 3 (0.6)     |
| No                                            | 275 (52)    |
| Financial loss, <i>n</i> (%)                  |             |
| Yes                                           | 384 (72.59) |
| No                                            | 145 (27.41) |

DISCUSSION

This research primarily focused on the prevalence and predictive factors of probable PTSD, depression, and grief among survivors 4 months after the 2023 earthquakes in Kahramanmaras. The prevalence rates for probable PTSD, determined using PCL-5, were 21.4% and 15.9% for depression in our study. When comparing these findings to studies conducted within the first year following an earthquake, varying prevalence rates for PTSD and depression are notable. In line with our study, two separate studies conducted 6 months after the 2008 Wenchuan earthquake reported a PTSD prevalence of 15.57% (Zhou et al., 2013) and a depression prevalence of 22.9% (Guo et al., 2015). In contrast, studies within our country show higher rates; in temporary settlements in the Marmara region 8 months after the August 17, 1999 earthquake, PTSD prevalence was 43%, with depression at 31% (Başoğlu et al., 2002). One month after the June 27, 1998 Ceyhan earthquake (6.3 on the Richter scale), the PTSD rate was reported as 42% (Altındag et al., 2005). A recent study in the emergency department 3 months post-Kahramanmaras earthquake reported a 51.4% PTSD rate among survivors seeking medical attention (Ilhan et al., 2023). The variation in prevalence rates may be attributable to the time elapsed between the earthquake and when data were collected. Studies conducted in our country, with longer intervals postearthquake, tend to show relatively lower rates of PTSD and depression. For instance, Altındag et al. observed a decrease in PTSD from 42% at 1 month to

TABLE 2. Predictors of Probable PTSD by Binary Logistic Regression

|                            | Model 1        |          |                      | Model 2        |          |                      | Model 3        |          |                       |
|----------------------------|----------------|----------|----------------------|----------------|----------|----------------------|----------------|----------|-----------------------|
|                            | B (SE)         | p        | OR (95% CI)          | B (SE)         | p        | OR (95% CI)          | B (SE)         | p        | OR (95% CI)           |
| Trapped under debris       | 0.522 (0.338)  | 0.123    | 1.685 (0.869, 3.267) | 0.473 (0.341)  | 0.165    | 1.605 (0.823, 3.132) | 0.419 (0.345)  | 0.225    | 1.520 (0.773, 2.987)  |
| Loss of a loved one        | 0.591 (0.234)  | 0.011*   | 1.806 (1.142, 2.855) | 0.563 (0.235)  | 0.017*   | 1.756 (1.107, 2.786) | 0.628 (0.240)  | 0.009*   | 1.874 (1.171, 3.001)  |
| Fear during the earthquake | −0.069 (0.109) | 0.528    | 0.933 (0.753, 1.156) | −0.085 (0.110) | 0.437    | 0.918 (0.741, 1.138) | −0.095 (0.112) | 0.400    | 0.910 (0.730, 1.134), |
| Fear of future earthquakes | 0.464 (0.099)  | <0.001** | 1.591 (1.310, 1.933) | 0.460 (0.100)  | <0.001** | 1.584 (1.303, 1.925) | 0.464 (0.101)  | <0.001** | 1.590 (1.305, 1.938)  |
| Engagement in SAR          | −0.094 (0.285) | 0.743    | 0.911 (0.521, 1.592) | −0.059 (0.285) | 0.835    | 0.942 (0.539, 1.649) | −0.122 (0.307) | 0.691    | 0.885 (0.485, 1.615)  |
| Financial loss             | 0.230 (0.266)  | 0.387    | 1.259 (0.747, 2.121) | 0.239 (0.268)  | 0.371    | 1.270 (0.752, 2.147) | 0.309 (0.273)  | 0.258    | 1.362 (0.797, 2.327)  |
| Perceived life control     | −0.496 (0.098) | <0.001** | 0.609 (0.503, 0.738) | −0.477 (0.099) | <0.001** | 0.620 (0.511, 0.753) | −0.478 (0.100) | <0.001** | 0.620 (0.509, 0.755)  |
| History of trauma          |                |          |                      | 0.505 (0.253)  | 0.046*   | 1.658 (1.009, 2.723) | 0.558 (0.259)  | 0.031*   | 1.746 (1.052, 2.899)  |
| Age                        |                |          |                      |                |          |                      | −0.033 (0.012) | 0.007*   | 0.967 (0.944, 0.991)  |
| Gender                     |                |          |                      |                |          |                      | −0.136 (0.291) | 0.640    | 0.873 (0.493, 1.545)  |
| Educational status         |                |          |                      |                |          |                      | −0.159 (0.124) | 0.209    | 0.856 (0.671, 1.092)  |
| Marital status             |                |          |                      |                |          |                      | −0.009 (0.336) | 0.980    | 0.992 (0.513, 1.917)  |

\* $p < 0.05$ . \*\* $p < 0.001$ ; SAR: Search and Rescue, Model 1 (independent variables):  $R^2 = 0.212$ ,  $p < 0.001$ ; Model 2 (adjusted for distal factors):  $R^2 = 0.222$ ,  $p < 0.001$ ; Model 3 (adjusted for cofounders):  $R^2 = 0.241$ ,  $p < 0.001$ .

13% at 13 months in a follow-up study (Altindag et al., 2005). Similarly, Başoğlu et al. (2004) in an epidemiological study conducted 14 months after the earthquake at the epicenter, reported PTSD and depression rates of 23% and 16%, respectively. Higher rates of PTSD and depression in our country are predominantly observed in studies conducted in the earlier periods following an earthquake.

Our study sample consists solely of residents from a specific container city in Kahramanmaraş, with screening procedures commencing 4 months postearthquake. The fact that participants were residing in a comparatively secure, planned container city—rather than in tents—by the time of the research, combined with the accessibility of regional administrative units and the alleviation of some needs, may have contributed to the relatively lower rates of probable PTSD and depression observed. The literature generally supports the potential positive impact of social support on preventing PTSD (Alipour and Ahmadi, 2020; Feng et al., 2007). Therefore, the social support environment within the container city, along with assistance from governmental and nongovernmental organizations in the region, may have influenced the rates of probable PTSD and depression.

On the other hand, the relatively low rates of probable PTSD and depression observed might also be linked to challenges in accessing the affected sample. Among the container city residents approached, 12.5% declined to participate in the interview. This reluctance could be attributed to avoidance of trauma reminders, a common symptom of PTSD, which involves efforts to avoid thinking about or discussing the disaster (Morgan et al., 2018). Given that individuals who refused participation may have been avoiding discussions about the earthquake, there is a possibility that those who were not interviewed were more traumatized than those who participated. In light of this consideration, our study might have underestimated the actual rates of probable PTSD and depression within the affected community.

In our study, 29.3% of participants who were smokers reported an increase in smoking habits following the earthquake, whereas only 1.1% reported an increase in alcohol consumption. Previous evidence indicates that catastrophic events like earthquakes can influence smoking and alcohol use patterns (Osaki et al., 2020; Sato et al., 2022), with factors such as complete home destruction and living in temporary housing being associated with increased smoking (Osaki et al., 2020). Therefore, participants residing in containers may represent a high-risk group for elevated smoking rates. In contrast, the lack of a significant increase in alcohol consumption could be attributed to religious and cultural influences on drinking behaviors (Shimizu et al., 2000), deviating from what is commonly reported in the literature. Our findings highlight the importance of implementing smoking control measures in disaster-affected areas as a long-term priority.

Furthermore, our analysis explored factors potentially associated with probable PTSD and depression. After adjusting for trauma history, age, gender, marital status, and educational status, all independent variables maintained their significance, indicating that the associations between earthquake-related experiences and probable PTSD, depression, and grief are not merely influenced by demographic factors. This outcome underscores that these associations are directly related to recent earthquake exposure, rather than to cumulative trauma experiences alone.

The death of a close family member has been identified as a variable related to PTSD in numerous studies (Boztas et al., 2019a, 2019b; Eksi et al., 2007), consistent with our findings. A study examining bereaved survivors 6 months after an earthquake, a time frame similar to our study, found that losing a child during the disaster was the strongest predictor of PTSD severity (Hu et al., 2016). Our study confirms that being trapped under debris significantly predicts probable depression, aligning with previous findings. Livanou et al. (2002) discovered through research in Türkiye after the 1999 earthquake that being trapped under debris contributed to a higher severity of depression and PTSD. Our findings underscore the impact of experiences related to earthquakes on mental health, reinforcing the existing body of literature on the subject.

TABLE 3. Predictors of Probable Depression by Binary Logistic Regression

|                            | Model 1        |          |                      | Model 2        |          |                      | Model 3        |          |                      |
|----------------------------|----------------|----------|----------------------|----------------|----------|----------------------|----------------|----------|----------------------|
|                            | B (SE)         | p        | OR (95% CI)          | B (SE)         | p        | OR (95% CI)          | B (SE)         | p        | OR (95% CI)          |
| Trapped under debris       | 1.015 (0.351)  | 0.004*   | 2.760 (1.388, 5.487) | 0.952 (0.356)  | 0.007*   | 2.592 (1.290, 5.206) | 0.952 (0.362)  | 0.008*   | 2.590 (1.275, 5.261) |
| Loss of a loved one        | 0.062 (0.259)  | 0.810    | 1.064 (0.641, 1.769) | −0.002 (0.264) | 0.995    | 0.998 (0.596, 1.674) | 0.011 (0.266)  | 0.968    | 1.011 (0.599, 1.704) |
| Fear during the earthquake | 0.369 (0.155)  | 0.017*   | 1.446 (1.068, 1.958) | 0.346 (0.154)  | 0.025*   | 1.413 (1.044, 1.912) | 0.373 (0.158)  | 0.019*   | 1.452 (1.065, 1.981) |
| Fear of future earthquakes | 0.105 (0.097)  | 0.279    | 1.111 (0.918, 1.345) | 0.091 (0.099)  | 0.359    | 1.095 (0.902, 1.329) | 0.122 (0.100)  | 0.223    | 1.130 (0.928, 1.376) |
| Engagement in SAR          | −0.057 (0.312) | 0.854    | 0.944 (0.512, 1.741) | 0.009 (0.315)  | 0.977    | 1.009 (0.545, 1.870) | −0.163 (0.336) | 0.629    | 0.850 (0.440, 1.643) |
| Financial loss             | −0.083 (0.285) | 0.771    | 0.920 (0.526, 1.609) | −0.093 (0.288) | 0.747    | 0.911 (0.518, 1.604) | −0.074 (0.294) | 0.802    | 0.929 (0.522, 1.652) |
| Perceived life control     | −0.610 (0.111) | <0.001** | 0.543 (0.437, 0.675) | −0.590 (0.112) | <0.001** | 0.554 (0.445, 0.690) | −0.592 (0.114) | <0.001** | 0.553 (0.443, 0.691) |
| History of trauma          |                |          |                      | 0.809 (0.269)  | 0.003*   | 2.246 (1.327, 3.801) | 0.816 (0.273)  | 0.003*   | 2.261 (1.325, 3.858) |
| Age                        |                |          |                      |                |          |                      | −0.008 (0.013) | 0.533    | 0.992 (0.967, 1.018) |
| Gender                     |                |          |                      |                |          |                      | −0.499 (0.320) | 0.119    | 0.607 (0.324, 1.137) |
| Educational status         |                |          |                      |                |          |                      | −0.270 (0.142) | 0.058    | 0.764 (0.578, 1.009) |
| Marital status             |                |          |                      |                |          |                      | −0.530 (0.354) | 0.134    | 0.589 (0.294, 1.178) |

\* $p < 0.05$ . \*\* $p < 0.001$ ; SAR: Search and Rescue, Model 1 (independent variables):  $R^2 = 0.175$ ,  $p < 0.001$ ; Model 2 (adjusted for distal factors):  $R^2 = 0.201$ ,  $p < 0.001$ ; Model 3 (adjusted for cofounders):  $R^2 = 0.219$ ,  $p < 0.001$ .

TABLE 4. Predictors of Probable Grief by Binary Logistic Regression

|                            | Model 1        |        |                       | Model 2        |        |                       | Model 3        |        |                       |
|----------------------------|----------------|--------|-----------------------|----------------|--------|-----------------------|----------------|--------|-----------------------|
|                            | B (SE)         | p      | OR (95% CI)           | B (SE)         | p      | OR (95% CI)           | B (SE)         | p      | OR (95% CI)           |
| Trapped under debris       | 1.257 (0.569)  | 0.027* | 3.516 (1.154, 10.716) | 1.130 (0.585)  | 0.053  | 3.097 (0.984, 9.743)  | 1.086 (0.633)  | 0.086  | 2.962 (0.857, 10.239) |
| Loss of a loved one        | −0.152 (0.911) | 0.867  | 0.859 (0.144, 5.126)  | −0.121 (0.939) | 0.897  | 0.886 (0.141, 5.581)  | −0.051 (0.963) | 0.958  | 0.951 (0.144, 6.278)  |
| Fear during the earthquake | 0.197 (0.155)  | 0.204  | 1.218 (0.898, 1.651)  | 0.198 (0.156)  | 0.205  | 1.219 (0.897, 1.655)  | 0.175 (0.164)  | 0.288  | 1.191 (0.863, 1.643)  |
| Fear of future earthquakes | 0.271 (0.144)  | 0.059  | 1.311 (0.990, 1.737)  | 0.273 (0.146)  | 0.061  | 1.314 (0.988, 1.747)  | 0.262 (0.150)  | 0.081  | 1.299 (0.968, 1.743)  |
| Engagement in SAR          | 1.582 (0.580)  | 0.006* | 4.865 (1.560, 15.170) | 1.663 (0.584)  | 0.004* | 5.275 (1.678, 16.585) | 1.672 (0.620)  | 0.007* | 5.324 (1.579, 17.951) |
| Financial loss             | 0.682 (0.494)  | 0.167  | 1.978 (0.751, 5.206)  | 0.662 (0.501)  | 0.186  | 1.939 (0.726, 5.177)  | 0.816 (0.534)  | 0.126  | 2.262 (0.795, 6.437)  |
| Perceived life control     | −0.620 (0.208) | 0.003* | 0.538 (0.358, 0.809)  | −0.631 (0.213) | 0.003* | 0.532 (0.350, 0.807)  | −0.665 (0.216) | 0.002* | 0.515 (0.337, 0.786)  |
| History of trauma          |                |        |                       | 0.748 (0.553)  | 0.176  | 2.112 (0.715, 6.243)  | 0.743 (0.573)  | 0.195  | 2.102 (0.684, 6.460)  |
| Age                        |                |        |                       |                |        |                       | −0.020 (0.023) | 0.384  | 0.980 (0.937, 1.025)  |
| Gender                     |                |        |                       |                |        |                       | 0.090 (0.595)  | 0.879  | 1.095 (0.341, 3.517)  |
| Educational status         |                |        |                       |                |        |                       | 0.094 (0.226)  | 0.677  | 1.099 (0.705, 1.712)  |
| Marital status             |                |        |                       |                |        |                       | 0.209 (0.614)  | 0.734  | 1.232 (0.370, 4.106)  |

\* $p < 0.05$ . SAR: Search and Rescue, Model 1 (independent variables):  $R^2 = 0.315$ ,  $p < 0.001$ ; Model 2 (adjusted for distal factors):  $R^2 = 0.332$ ,  $p < 0.001$ ; Model 3 (adjusted for cofounders):  $R^2 = 0.346$ ,  $p < 0.001$ .

Although the literature has established a relationship between fear experienced during an earthquake and PTSD (Zhang et al., 2015), our study found that fear during the earthquake predicted probable depression. This finding is significant, suggesting that exposure-based treatments, known to be effective for PTSD (Başoğlu et al., 2007), could be beneficial not only for individuals exhibiting traumatic stress symptoms but also for those with depressive symptoms. Additionally, the persistent fear of future earthquakes was identified as a predictor of PTSD, reaffirming findings from previous research (Kuwabara et al., 2008; Roncone et al., 2013). At the time of screening, aftershocks were still occurring in the region. In line with existing literature, the continued exposure of individuals in an area already affected by the initial earthquake to these aftershocks could exacerbate trauma symptoms by intensifying the fear of future earthquakes. Overall, psychological interventions targeting fear may serve as an effective approach for addressing psychological issues in individuals following traumatic experiences.

Perceived life control is a fundamental factor in understanding individual differences in outcomes following stress. The literature suggests that perceived control over a traumatic event can predict symptoms of PTSD (Cankardas and Sofuoğlu, 2019; Frazier et al., 2004), and higher levels of perceived control may bolster resilience against traumatic stressors (Elliot et al., 2018). Furthermore, the perception of control over negative events is inversely related to the increase in depression (Brown and Siegel, 1988). Beyond control over a specific traumatic event, perceived life control has also been significantly associated with PTSD symptoms and psychosocial impairment (Palyo and Beck, 2005). Consistent with this evidence, our study found that lower perceived life control predicted both probable PTSD and depression. Given the unchangeable nature of stressors like trauma, interventions focusing on enhancing an individual's perception of overall control over their life, rather than on the traumatic event itself, may prove beneficial in improving psychological functioning.

Although our screening occurred early for a DSM-5 diagnosis of CG, the significance of early grief symptoms has been well documented. Komischke-Konnerup et al. found that high grief symptoms at 2 months predicted high PTSD and depressive symptoms at 6 months (Komischke-Konnerup et al., 2023). Similarly, Boelen and Lenferink (2022) demonstrated that meeting criteria for prolonged grief disorder before the first anniversary of a loss indicates a risk of experiencing full-blown prolonged grief disorder subsequently. Based on this evidence, 241 individuals who had experienced a loss were interviewed. Due to the uncontrollable and variable conditions within the container city, only 119 individuals who reported issues related to their loss completed ICG. Of these, 64.7% (77 individuals) scored above the cutoff for CG. This proportion aligns with previous studies on bereaved survivors: 1 year after the Sichuan earthquake (Li et al., 2015) and 18 months post-Wenchuan earthquake in China (Hu et al., 2015), which reported CG prevalence rates of 71.1% and 79%, respectively.

In our study, lower perceived control over one's life following a traumatic event, such as an earthquake, has been linked to grief, exhibiting similarities to PTSD and depression. Furthermore, our study identified participation in search and rescue operations as a significant predictor of grief. Research on the effects of participating in these operations has largely centered on local search and rescue workers, with findings showing that such involvement leads to higher instances of PTSD and depression (Sakuma et al., 2015; Unal Kılıc, 2014). However, research on the local population's experience is notably absent. Like PTSD and depression, active participation in search and rescue efforts may intensify grief symptoms, thus heightening the overall risk of mental health issues.

This study has several limitations. First, due to the extensive impact area of the earthquake, our sample, drawn from individuals residing in a specific container city who suffered significant material losses and familial bereavements, was relatively small and may not fully represent the broader affected population. Those residing in urban centers

postearthquake were excluded, potentially limiting the generalizability of our findings to all affected individuals. The cross-sectional design of this study precludes causal interpretations, and a longitudinal follow-up would offer a deeper understanding of the disorders' progression and influencing factors. The reliance on self-reported scales for evaluating PTSD and grief introduces a risk of subjective bias. Additionally, the predominance of female participants may skew the findings and limit their applicability across genders. Not assessing preexisting mental health conditions and employment status prior to the earthquake, due to logistical challenges, omits potential confounders from our analysis. Furthermore, the high prevalence of grief observed might be overestimated since ICG was only completed by those reporting loss-related difficulties, emphasizing the need for cautious interpretation of these results.

## CONCLUSIONS

Despite its limitations, this study provides insightful data on the prevalence and potential risk factors for probable PTSD, depression, and grief following a catastrophic earthquake. Our findings suggest that individuals exhibiting risk factors such as being trapped under debris and experiencing the loss of a loved one warrant closer follow-up and monitoring for the emergence of psychological issues. Moreover, the degree of fear experienced during and after the earthquake, along with individuals' perceptions of life control, could serve as crucial focal points in psychological assessments aimed at prevention or therapeutic intervention.

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*The authors have seen and approved the manuscript being submitted.*

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