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VALIDATION OF THE FEAR OF EARTHQUAKE SCALE: ASSOCIATIONS WITH PERSONAL EARTHQUAKE PREPAREDNESS AND ANXIETY EMOTIONS[1]

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ABSTRACT

This article aims to validate the earthquake fear scale after the 2023 Kahramanmaraş earthquake and examine its relationships with anxiety emotions and personal earthquake preparedness. For this purpose, the factor structure of the earthquake fear scale was analyzed. A mediation model was constructed to examine whether personal earthquake preparedness as a behavioral response addresses the effect of earthquake fear on anxiety emotions in the short term. Regression models were used to examine the relationships of earthquake fear with anxiety emotions, behavioral belief and personal earthquake preparedness. The factorial results indicate that the earthquake fear scale is valid and reliable for use in future studies. The linear regression results indicate that anxiety emotions predispose earthquake survivors to earthquake preparedness. The ordinal logistic regression results show that fear is significantly associated with personal earthquake preparedness and anxiety emotions. The hierarchical regression results confirm that somatic fear explains a higher percentage of additional variance in anxiety emotions than cognitive fear after controlling for socio-demographic variables. Implications and recommendations for earthquake preparedness are provided.

Keywords: *Earthquake, Fear, Preparedness, Anxiety.*

Jel Classification Codes*: C38, C83, D91, H84, I12, I3.*

1. INTRODUCTION

The Kahramanmaraş earthquake in February 2023, which measured M7.9 on the Richter scale, produced high intensities. Approximately 55,000 deaths were reported by government officials. Earthquake survivors learnt that Turkey was an earthquake-prone country and that future earthquakes could be extremely destructive and traumatic along hundreds of active fault lines across the country. After the earthquake, most buildings and houses suffered damage. An organized earthquake preparation process was not implemented in accordance with earthquake regulations. Experts believe that Turkey's relaxed construction practices and the legislature's reluctance to adapt to modern standards contribute to the fragility of the built environment in the face of such natural disasters. Such experiences promote earthquake preparedness. This study sheds light on the effects of individual earthquake preparedness on

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earthquake psychology in the context of behavioral beliefs. It is also an original study in terms of investigating whether earthquake psychology promotes earthquake preparedness.

An earthquake is an unexpected, life-threatening event that causes fear and anxiety. Neuroscience research suggests that fear and anxiety are interrelated because both are adaptive emotional responses to threatening events (Hofmann, Ellard, & Siegle, 2012). Fear of earthquakes, as physiological and cognitive responses, occurs during or immediately after earthquake exposure (Bovin & Marx, 2011; Massazza, Brewin, & Joffe, 2021) and develops anxiety (Greenwood, Thompson, Opp, & Fleshner, 2014). Destruction, loss of life, and distress are associated with higher earthquake intensities (Sumer, Karancı, Berument, & Gunes, 2005; Salcioglu, Basoglu, & Livanou, 2003; Dai et al., 2016). Since earthquake exposure is associated with fear (Goltz et al. 2020), greater exposure to a disaster has been consistently associated with a higher probability of post-traumatic stress disorder (Kuwabara et al. 2008). Fear intensity has been reported to be the strongest predictor of post-traumatic stress disorder beyond destruction and loss of life (Livanou et al. 2005; Heetkamp and de Terte 2015; Salcioglu, Ozden, & Ari 2018). Psychological distress was found to be more severe in victims with stronger fear immediately after the earthquake and aftershocks (Kuwabara et al. 2008). High prevalence rates of fear and anxiety have been reported (Mavruk, Cam, & Sengul, 2024; Joffe et al. 2013).

Previous literature demonstrated that the relationships among earthquake fear, preparedness, and anxiety were complex and multidimensional. The possibility of encountering threatening and challenging situations makes it meaningful to include psychological variables such as anxiety in preparedness theories (Paton, 2019). Some studies found that fear of earthquakes had positive and negative effects on earthquake preparedness. The relationship between fear and preparedness was depended on the levels of fear and damage experienced. While higher fear is associated with lower preparedness, those who have experienced traumatic losses may avoid preparation (Ao et al. 2021, Öztekin and Örki, 2023). Çınğı and Yazgan (2022) found that fear of earthquake was negatively associated with earthquake preparedness. On the other hand, Ao et al. (2021) found that fear and anxiety could lead to preparedness. Similarly, Rüstemli and Karancı (1999) reported that earthquake preparedness could be predicted by earthquake fear. Although the uncertainty of threatening events triggers fear and develops anxiety, disaster coping skills and preparedness can influence psychological responses (Sadeghi and Ahmadi, 2008; Mutianingsih, Mustikasari and Panjaitan, 2020). Based on the above studies, this study put forward hypothesis H1: Fear and anxiety of earthquake would predispose earthquake survivors to earthquake preparedness.

Preparedness has become even more important as the intensity of recent earthquakes has reached extremely destructive levels. Preparedness can be defined as a learning and action process aimed at reducing the effects of possible disasters. For example, reducing the collapse of buildings will also prevent loss of life. This requires long-term planning and investments to increase the resilience of buildings to major earthquakes. On the other hand, psychological preparedness will help individuals manage and cope with their emotional reactions during a disaster, thus improving cognitive responses and behaviors (Sadeghi and Ahmadi, 2008; Mutianingsih, Mustikasari, and Ria Utami Panjaitan, 2020). People's behavioral beliefs are also an important part of the preparedness process (Becker, Paton, Johnston et al. 2012), because they can promote community to learn the rules to be applied during and immediately after a disaster and receive first aid training, known as knowledge preparation. Based on the above findings, the second hypothesis of this study is H2: Belief that preparedness mitigates destructive earthquake effects reduces anxiety emotions.

The level of anxiety reactions after earthquake exposure can be determined based on fear, where preparedness can play a mediating role. A closed study from Haiti investigated mediation effect of disaster preparedness between earthquake exposure and mental health (anxiety, depression) and found no mediation effect (James, Welton-Mitchell, Noel & James, 2020). A study from India found that disaster education and resources were mediators between anxiety and preparedness (Mıshra and Suar, 2012). A study from Chile found that perception of better preparedness lowered worry and worry mediated the effect of fear on risk perception (Bronfman et al., 2020). Based on the above studies, the third hypothesis is H3: Personal preparedness would not mediate the effect of fear of earthquake on anxiety emotions.

2. METHOD

2.1. Sample Selection and Data Collection

A cross-sectional survey was conducted to measure anxiety emotions of survivors who were directly affected by the 6 February 2023 Kahramanmaras Pazarcık earthquake. The study was approved by the Cukurova University ethics committee with decision number E.1121020. Cross-sectional data were generated using snowball and convenience sampling. Study is designed to survey only individuals from the earthquake region (10 earthquake provinces: Kahramanmaras, Hatay, Adıyaman, Gaziantep, Adana, Kilis, Malatya, Sanlıurfa, Osmaniye, Diyarbakır). Participants were asked to answer the survey questions via the Google form survey link. 552 returns were valid for evaluation use after data analysis, 397 of which were seriously exposed to earthquake.

2.2. Variables

General questions include gender, age, education level, monthly income, house ownership, age of house, household size. Scale measurements are adapted from previous studies and own developed fear scale. Fear of earthquake (FEQ) is independent variable of this study. FEQ, a seven item scale from “I am very afraid of earthquake” to “my heart beats faster when I think I am going to get caught in an earthquake”, is measured based on “Disagree”=0, “Undecided=1”, “Agree=2” (see Table A3). The FEQ questions were adapted from fear of Covid-19 scale (Ahorsu, Lin, Imani, Saffari, Griffiths, Pakpour 2022) to validate an FEQ scale and assess anxiety emotions.

Anxiety emotions scale is adapted from the DASS21 scale (Lovibond and Lovibond 1995). The seven item scale from "dryness in mouth" to "felt scared without any apparent reason" is measured on a four-point Likert scale never=0, sometimes=1, often=2 and almost always=3 which indicates how much the statement applied to participants due to the earthquakes centered in Kahramanmaras on February 6, 2023. The anxiety score is the sum of its items scores.

Table 1. Percent Distribution of Anxiety Emotions

Anxiety items (N=397)	Never	Sometimes	Often	Almost always
Dryness in mouth	46.7	36.8	11.0	5.5
Difficulty in breathing	40.1	36.8	13.7	9.3
Tremors in body	40.0	24.7	20.3	15.4
Worried about panic and look foolish	53.3	21.4	15.9	9.3
Close to panic	19.2	34.6	28.0	18.1
Irregular heartbeats	26.4	31.9	23.6	18.1
Scared	15.9	39.6	25.3	19.2

Personal earthquake preparedness scale consists of these three items: "Do you know the precautions to be taken before an earthquake?", "Do you know the rules to be applied during and immediately after an earthquake?" and "Have you received any training on first aid before?" These items are measured based on no=0 and yes=1.

Behavioral belief item "belief that preparedness mitigates destructive earthquake effects" is included as explanatory variable in the models. This item is also measured based on no=0 and yes=1.

Of the participants 84% reported that they knew the precautions to be taken before an earthquake; 86% reported that they knew the rules that must be applied during and immediately after an earthquake; 59% did not received any training on first aid before.

2.3. Research Models

Multiple linear regression model is used to examine the relationships between the total scale scores of anxiety, fear of earthquake and personal earthquake preparedness. These scale scores are continuous variables.

$$Y_i = b_0 + \sum_{j=1}^{p} b_j x_{ij} + e_i \qquad (1)$$

Y_i is the response variable for ith observation, x_{ij} is the jth predictor for ith observation and e_i is the error term. b_j is expected increase in Y for one unit increase in x_j with all other predictor variables held constant.

Hierarchical regression model gives insight on how earthquake preparedness influences anxiety. It starts with fear of earthquake in the first model, belief that preparedness mitigates destructive earthquake effects is added in the second model and preparedness is added in the third model. It also gives additional percentage of the variance in anxiety emotions explained by earthquake variables for each model.

Ordered logistic regression model is used for categorical analysis. Odds ratios are estimated to find likelihood of being in higher categories vs lower categories of earthquake preparedness and anxiety emotions. The log odds of P(Y≤j) is

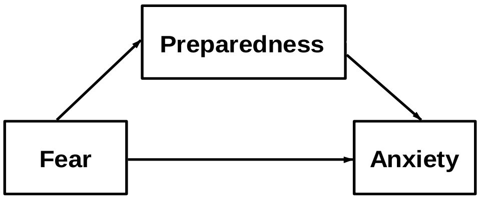
$$\mathrm{logit}P(Y \leq j) = \alpha_{j0} - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_n x_n \qquad (2)$$

where α_{j0} the intercepts and β_n the coefficients, Y is an anxiety emotion as an ordinal outcome with J=1, 2, 3, 4 categories and P(Y≤j) the cumulative probability or Y is earthquake preparedness as a binary outcome with J=0, 1 categories. x_i is socio-demographic and earthquake variables.

Model (2) is used to determine whether the likelihood earthquake fear and anxiety increase preparedness and the likelihood earthquake fear and preparedness increase anxiety.

Mediation model in Figure 1 is used to examine whether preparedness can address the effect of earthquake fear on anxiety in the short run after the earthquake. If preparedness does not mediate the relationship between the fear and anxiety, then there is no need to talk about moderating effect of preparedness. Figure 1 shows the conceptual mediation model.

Figure 1. Conceptual Mediation Model



For partial mediation, the effect of earthquake fear on preparedness, the effect of preparedness on anxiety and the effect of fear on anxiety all must be statistically significant. For full mediation, the last must be statistically insignificant.

2.4. Data Analysis and Diagnostics

Descriptive, factor and regression analyses were used. Descriptive analysis is used to calculate percentile distributions, means, standard deviations, skewness and kurtosis. Correlations between the main variables are estimated for preliminary results. The factor structure of the earthquake fear scale was analyzed to extract and validate the factors. Then, these factors were used in the relationships with anxiety feelings and earthquake preparedness.

Before factor analysis, suitability of data is checked. Correlations between the fear items are all positive, low to moderate 0.24-0.55 (not very low or not very high) and all highly significant (p<0.001). So relationships are meaningful. Determinant of correlation matrix is 0.067 which is greater than the threshold of 0.0001. There is no concern about collinearity or singularity of the matrix. The items are self-consistent which is a good result about construct validity. Cronbach's alpha for the seven fear items was 0.843, indicating good internal consistency. Overall Kaiser-Meyer-Olkin (KMO) value of 0.831 indicates that sample data is adequate for factor analysis. Bartlett test of sphericity shows that correlations between data are sufficient for factor analysis. Both tests show inter-item consistency (factorability). Therefore, it is reasonable to carry out exploratory factor analysis.

Structural equation model is used to construct and run mediation model of preparedness between fear and anxiety. Model fit is determined using RMSEA, CFI, TLI and modification indices are used to improve the model.

The data is checked for outliers in all variables and no outliers are detected. The studentized residuals vs standardized predicted values were evenly distributed across the range of residuals, indicating a linear relationship between main variables. The standardized residuals vs standardized predicted values were also evenly distributed across the range of residuals, indicating that the variance of errors was constant and the assumption of homoscedasticity was met. Frequency distributions and normal P-P plots of regression standardized residuals show normal distributions. Variance inflation factor (vif) is utilized and results indicate vif values ranging between 1.35 and 1.61 with different control variables and explanatory variables. The vif values between 1 and 5 indicates moderate correlation between cognitive or somatic factor and other variables. This is not severe enough to require attention for multicollinearity.

The multicollinearity can be expressed by the coefficient of determination (R_h^2) of a multiple regression model with one explanatory variable (X_h) as the model's response variable and the others (X_i [$i \neq h$] as its explanatory variables. The variance (σ_h^2) of the regression coefficients constituting the final regression model are proportional to the vif $1/(1-R^2)$. If the variance inflation factor and tolerance ($1-R^2$) are greater than 5 to 10 and lower than 0.1 to 0.2, respectively (R^2=0.8 to 0.9), multicollinearity exists (Kim, 2019).

3. FINDINGS

3.1. Descriptive Findings

Younger participants were more afraid of earthquake than the older ones. 34 participants of age 19-24, 40 of age 25-30, 28 of age 31-36, 15 of age 37-42, seven of age 43-48, 24 of age 49-54, and 10 of age 55-60 reported that they were most afraid of earthquake. More women reported fear of earthquake and fear of death, (73.5% and 83.3%) than men (48.5% and 51.5%). About 69% of women and 38% of men reported loss of sleep due to earthquake. 95% of women and 70% of men got anxious and worried when they watched news and stories about earthquakes on social media. Among those who got anxious and worried, 67% was women and 33% was men. Among those who had faster heart beats due to fear of earthquake, 72% were women and 28% were men. 66.7% of women and 39% of men had faster heart beats when they thought about getting caught to an earthquake. About 20% of men and 39% of women reported sweating hands when they thought about earthquake. FEQ1 rates were higher among higher educated participants (80%) and FEQ1 rates were higher than FEQ4 rates for all education levels. 68.7% of those earning below the absolute minimum wage reported FEQ1 whereas 75.7% of those earning above the absolute minimum wage reported FEQ1. Participants living in earthquake regions reported higher FEQ1 (67.6%) and FEQ4 (63.2%) than those living outside the earthquake regions. Due to fear of earthquake, 63% reported loss of sleep in earthquake regions whereas 40% reported loss of sleep in the other regions. Getting anxious and worried when watching news and stories about earthquakes on social media did not show significant difference between living or not living in earthquake regions. 82% of housing size of three was the most afraid of earthquake compared to other housing sizes. FEQ1 rate was lower among those living in the 1999 and before constructed houses (66.7%) than after 1999 constructed houses (72.7%). 81.6% of those living in the 1999 and before constructed buildings and 86.50% of those living in the 1999 and after constructed buildings got anxious and worried when they watched news and stories about earthquakes on social media. 57% reported loss of sleep due to fear of earthquake. 53% of those living in the 1999 and before constructed buildings and 63.20% of those living in the after 1999 constructed buildings reported loss of sleep due to fear of earthquake.

Table 2 shows the percent difference of answers between earthquake exposed and unexposed individuals. The highest differences were observed in having loss of sleep and increasing heart beats with 23 percent and 13 percent.

Table 2. Frequency Distribution of Fear of Earthquake

Fear items	Percent			%difference (Exp – Unexp)		
	Disagree	Undecided	Agree	Disagree	Undecided	Agree
FEQ1 I am most afraid of earthquake	15.4	17.4	67.6	+0.07	+0.05	-0.12
FEQ2 Thinking about the earthquake bothers me	7.1	7.1	85.7	0	-0.07	+0.07
FEQ3 My hands sweat when I think of the earthquake	50.0	15.9	34.1	-0.06	-0.01	+0.07
FEQ4 I'm so afraid of losing my life in an earthquake	18.1	18.7	63.2	+0.04	-0.03	-0.01
FEQ5 I get anxious and worried when I watch news and stories about earthquakes on social media	6.6	7.7	85.7	+0.023	-0.037	+0.014
FEQ6 I'm losing sleep because of the fear of an earthquake	23.6	13.2	63.2	-0.12	-0.11	+0.23
FEQ7 My heart beats faster when I think I'm going to get caught in an earthquake	23.6	15.9	60.4	-0.107	-0.026	+0.13

Table 3 shows descriptive results of fear items. The mean fear items range between 0.80 and 1.79 based on 0-2 response values. Skewness/kurtosis tests for normality (N=397) shows that all fear items are significantly skewed (joint probabilites are less than 0.0001), which is common for Likert items. FEQ2 and FEQ5 show high negative values of skewness due to high scores on the related items. Sleep loss, faster heartbeats and being most afraid of earthquake show higher factor loadings compared to the other fear items. The mean scores of cognitive items (1, 2, 4, 5) were higher than those of somatic items

(3, 6, 7). Physiological (somatic) items sleep loss and faster heartbeats have higher factor loadings (correlations with the total scale FEQ) than cognitive factor loadings.

Table 3. Summary Statistics

Fear items (N=552)	Mean	sd	Skewness	Kurtosis
FEQ1 I am most afraid of earthquake	1.57	.72	-1.33	3.22
FEQ2 Thinking about the earthquake is bothering me	1.76	.57	-2.30	6.95
FEQ3 My hands sweat when I think of the earthquake	0.80	.89	.41	1.38
FEQ4 I'm so afraid of losing my life in an earthquake	1.46	.77	-.99	2.40
FEQ5 I get anxious and worried when I watch news and stories about earthquakes on social media	1.79	.53	-2.50	8.07
FEQ6 I'm losing sleep due to fear of an earthquake	1.30	.86	-.62	1.63
FEQ7 When I think I'm going to get caught in an earthquake, my heart beats faster	1.29	.86	-.61	1.62
FEQ Total score	10	3.76	-0.82	2.73

3.2. Correlations

Correlation analysis shows that seven fear items hold together in three different groups. When item 3 is correlated with the other six fear items, we notice that items 3, 6, 7 have relatively stronger (0.547 and 0.571) correlations with each other. This is an indication that they are measuring the same construct. Similarly, FEQ4 shows stronger correlation (0.548) with FEQ1, and FEQ2 and FEQ5 group together with low correlations 0,38 and 0,36. When FEQ2 is correlated with the other six items, it shows stronger correlations with FEQ1 and FEQ5. When FEQ5 is correlated with the other six items, it shows stronger correlation with FEQ2. Stronger correlation between FEQ1 and FEQ2 forces FEQ1, 2, 4, 5 to group together as cognitive items. According to theory, a factorial construct should consist of at least three items unless it has a strong theoretical foundation. These groupings are meaningful because they differentiate survivors' earthquake related cognitions and somatizations. So, expectation is two different latent constructs which influence the related items. A supporting evidence comes from anxiety which coexist with fear. A clear picture of two constructs of FEQ is seen when anxiety is correlated with all seven fear items (see Table 4). Although fear and anxiety are distinguished as emotion and cognition on the neurophysiological level, they are shown to be related.

Table 4. Correlations of Anxiety With Fear İtems

	1	2	3	4	5	6	7	8
Anxiety	1.0000							
FEQ1	0,3975	1.0000						
FEQ2	0,2571	0.5429	1.0000					
FEQ3	0,6101	0.3464	0.2387	1.0000				
FEQ4	0,3968	0.5483	0.3768	0.3799	1.0000			
FEQ5	0,2558	0.3714	0.4710	0.2828	0.3608	1.0000		
FEQ6	0,5329	0.5187	0.3681	0.5467	0.4429	0.3749	1.0000	
FEQ7	0,5356	0.4466	0.3878	0.5706	0.4180	0.3437	0.6301	1.0000

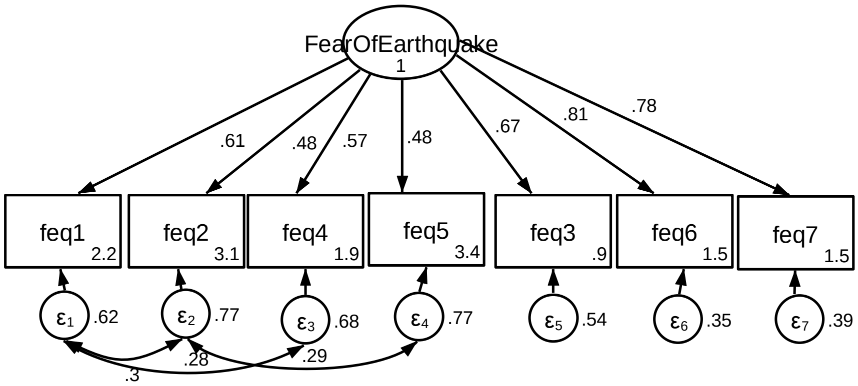
3.3. Factor Analysis

The number of factors underlying correlations among fear items is explored using PCA, scree plot, parallel analysis, minimum average partial correlation and common factor analysis. First, PCA is applied to extract eigenvalues greater than one. PCA and scree plot each suggested a one-factor solution with an eigenvalue of 3.58 accounting for 51% of the variance. The eigenvalue for the first factor is about four times that for the second component. However, the second component has an eigenvalue of 0.99, close to 1, accounting for 14% of the variance. A higher sample size would retain two factors. Cumulative proportion of variance for the first two components is 65%. Furthermore, parallel analysis is carried out to compare the eigenvalues generated from PCA with the eigenvalues randomly generated from simulated data sets. The eigenvalues of PCA which are greater than the randomly generated eigenvalues are retained, which supported a one-factor solution. Average partial correlation analysis shows that the minimum average partial correlation is associated with one component solution. So, one factor may account for relationships among fear items. For common factor analysis approach involving comparison of different factor models, unrotated maximum likelihood (ML) factor analysis is carried out to generate indices associated with different factor models and to determine number of factors. This ML analysis did not determine the number of factors. Running factor analysis with iterated principle factors suggests that the single factor accounts for 43% of the variation (less than 50%) and unrotated factor loadings range between 0.54 (FEQ5) and 0.76 (FEQ6). Orthogonal or oblique rotations of one-factor solution would not change the number of factors, but will increase factor loadings on the items. Since the one-factor solution was doubtful due to ML factor analysis, factor analysis of seven fear items is rotated with orthogonal varimax method. Three factors are retained with loadings greater than 0,40. The first factor consisted of “my hands sweat when I think of the earthquake”, “Sleep loss due to earthquake fear” and “increasing heart beats due to possibility of an earthquake”. The first factor is identified as “somatic”. The second factor consisted of “bothered by earthquake thoughts” and “anxious and worried due to media earthquake information” which are identified as “anxiety cognitions”. The third factor consisted of only two items, “I am most afraid of earthquake” and “I’m so afraid of losing my life in an earthquake”, which are identified as “fear cognitions”. Since theory suggests at least three items for each factor, fear and anxiety cognitions are combined into “cognitive fear”. Thus, the number of factors is reduced to two as “somatic fear” and “cognitive fear”. Although EFA suggested one factor solution, the theory did not validate one factor solution and three factor solutions. Therefore, confirmatory factor analysis is utilized to confirm these two factors.

Table 5 shows that one-factor model has a poor fit with CFI and RMSEA which are below acceptable values. Modification indices (MI) are checked to determine between which two residuals covariances to be added to improve the one-factor model. Based on the highest three MI values, three covariances were added between FEQ1 and FEQ2, FEQ1 and FEQ4, FEQ2 and FEQ5 (Figure 1). CFI is increased from 0.89 to 0.98 and RMSEA dropped from 0.141 to 0.064, which is an acceptable fit.

One factor model (Figure 2) indicates higher standardized coefficients for sweating hands (FEQ3), sleep loss (FEQ6) and increasing heartbeats (FEQ7). Figure 2 indicates standardized coefficients on the links to all fear components.

Figure 2. One-Factor Model Improved



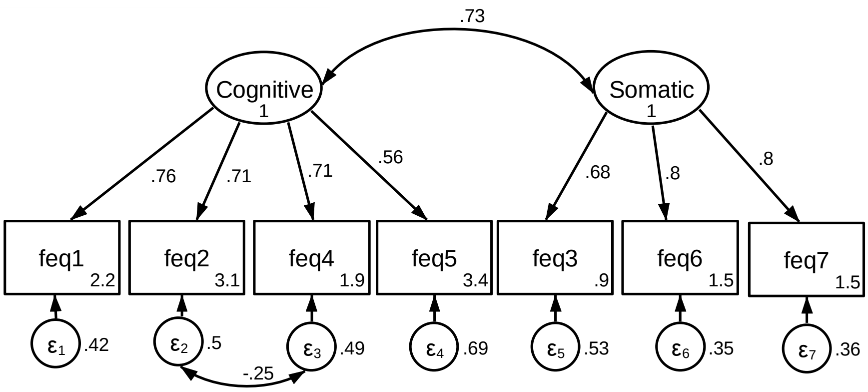
Two factor model (p<.01) with cognitive and somatic factors (see Figure 3), has an acceptable fit with RMSEA (.073), but it is improved by adding a covariance between FEQ2 and FEQ4 because the correlation between the residual variances was stronger (MI=10.29, p<.001). Table 5 indicates that the two factor model has a better fit than one factor model.

Table 5. CFA Fit

Fit Statistics	Chi2(df)*	RMSEA(90%CI)	CFI	SRMR
One factor model	84.45(14)***	0.141(.11-.17)	0.89	0.060
One factor model improved	22.38(11)*	0.064(.02-.10)	0.98	0.037
Two factor model	30.54(13)**	0.073(.04-.11)	0.97	0.035
Two factor model improved	23.47(12)*	0.062(.02-.10)	0.98	0.032

***<.001, **<.01, *<.05

Figure 3. Two-Factor Model Improved



3.4. Concurrent Validity

To determine concurrent validity, correlations between the variables are used. Table 6 shows that FEQ was significantly positively moderately correlated with anxiety emotions. The strongest correlation of FEQ was with anxiety emotions. Correlation results indicate that self-reported FEQ has correlation with anxiety only. The belief that preparedness mitigates destructive earthquake effects has a negative and significant correlation with anxiety. This is an indication of lowering anxiety. Although the belief seems to increase preparedness, association is not statistically significant.

Table 6. Correlations

	1	2	3	4	5	6	7	8	9
Fear	1.000								
Anxiety	0.623**	1.000							
Cognitive Fear	0.878**	0.439**	1.000						
Somatic Fear	0.904**	0.660**	0.590**	1.000					
Preparedness	0.091	0.124*	0.114	0.05	1.000				
Precautions before an earthquake	0.078	0.107	0.081	0.06	0.757**	1.000			
Knowledge of earthquake rules	0.015	0.007	0.034	-0.006	0.700**	0.595**	1.000		
First aid training	0.088	0.129*	0.110	0.050	0.645**	0.122	0.024	1.000	
Belief that preparedness mitigates destructive earthquake effects	-0.021	-0.136*	0.046	-0.077	0.117	0.110	0.115	0.036	1.000

*p<0.05, **p<0.01

3.5. Regression Findings

Multiple regression results showed that the effects of somatic and cognitive fear on anxiety emotions were highly significant. Somatic fear and cognitive fear explained 43% and 19% of the variation in anxiety emotions. Controlling for socio-demographics and earthquake variables such as construction year did not change the effect. Anxiety (b=0.023, p<0.05) and behavioral belief (b=0.387, p=0.05) together increased personal earthquake preparedness in both multiple and univariate regression models. However, fear emotions did not significantly increase earthquake preparedness. These results show that anxiety emotions rather than fear motivate survivors to earthquake preparedness. This rejects H1. Therefore, preparedness did not mediate the effect of fear on anxiety. This supports H3. However, an increase in the belief that preparedness mitigates destructive earthquake effects reduced anxiety emotions (b=-2.40, p<.001) and increased personal earthquake preparedness (b=1.20, p<.05). The first result supports H2. Interestingly, correlation between the belief and preparedness was not statistically significant. For more detailed findings, categorical effects are analyzed using ordered logistic regression models.

Ordered logistic regression results indicate that the effect of being most afraid of earthquakes on knowing earthquake rules (OR=1.57, p>0.05) and the effect of knowing earthquake rules on feeling scared without any apparent reason were significant (OR=2.20, p<0.01). The effect of being most afraid of earthquakes on feeling scared was also significant (OR=3.65, p<0.01). The effect of being bothered by earthquake thoughts on being first aid trained (OR=1.70, p<0.05) and the effect of being first aid trained on trembling in hands and on difficulty breathing were significant. Earthquake survivors with higher levels of bothering earthquake thoughts were predisposed to take first aid training. The effects of being bothered by earthquake thoughts on trembling in hands and on difficulty breathing were also significant.

The hierarchical regression results showed that fear explained 39% of the variance in anxiety emotions and the change in R^2 was statistically significant (p<0.01). The belief that preparedness mitigates destructive earthquake effects explained an additional 1.30% of the variance in anxiety emotions and the change in R^2 was significant (p<0.05). Preparedness explained an additional 1% of the variance in anxiety emotions and the change in R^2 was significant (p<0.05).

6. DISCUSSION

This study gives insight on psychological effects of an earthquake on preparedness, which contributes to earthquake literature by showing the importance of behavioral belief in reducing anxiety emotions after a devastating earthquake experience. This study showed that without the belief that preparedness mitigates destructive earthquake effects, personal earthquake preparedness did not reduce anxiety emotions of the 2023 Pazarcık earthquake survivors.

Based on the theory, EFA suggested one factor for FEQ, but underlying structure of the fear scale based on CFA suggested two latent constructs of somatic and cognitive fear each linked to related fear items. Latest studies on the Kahramanmaras earthquake confirmed the validity of the same FEQ scale as one or two factors. Interestingly, this study is caught up with a borderline case for the number of factors retained, perhaps due to sample size. Staying with the theory, Mavruk, Çam and Şengül (2024) decided to go with one factor model. The two factor model had a better fit than one factor model, which was in line with Sarı, Taşdelen-Karçkay and Tarcan (2023). This factorial structure was consistent with the Norwagian version fear of covid-19 scale (Iversen et al 2021). Fear of earthquake scale was valid and reliable to be utilized in self-reported psychological distress studies in Turkey. This was consistent with Satıcı, Okur, and Deniz et al. (2024) and Usta, Torpus, Kanbay, et al (2024).

All the fear items were significantly skewed with a range of -2.50 - +0.41, contradicting Curran et al. (1996), Hair et al. (2010) and Bryne (2010). In the absence of multicollinearity (via the variance inflation factor), regressing each extracted factor of fear of earthquake on anxiety emotions showed that the effects of somatic fear and cognitive fear both were significant. Controlling for variables such as gender, monthly income, and year of construction did not significantly change these effects in multivariate regression models.

Consistent with Bronfman et al.(2020) fear emotions did not significantly influence earthquake preparedness. Personal earthquake preparedness did not mediate the relationship between fear of earthquake and anxiety, which is in line with James, Welton-Mitchell, Noel, & James (2020), who showed that disaster preparedness did not mediate the relationship between earthquake exposure and anxiety. Although earthquake survivors reported high levels of personal earthquake preparedness, it was not adequate to influence overall anxiety emotions. This would be due to not feeling adequately prepared to decrease anxiety emotions, which is consistent with Takahashi and Kitamura (2016). Consistent with (Kuwabara et al. 2008), anxiety was higher among earthquake survivors with higher fear of earthquake. Also consistent with Ao et al. (2021), Rüstemli and Karancı (1999), Sadeghi and Ahmadi (2008), Mutianingsih, Mustikasari, and Panjaitan (2020), fear of earthquake (being most afraid of earthquake and being bothered by earthquake thoughts) and anxiety predisposed earthquake survivors to personal earthquake preparedness (e.g., to take first aid training and to know earthquake rules). This result was inconsistent with Öztekin and Örki (2023) and Çınğı and Yazgan (2022), who found negative relationships. Consistent with Becker, Paton, Johnston et al. (2012), belief that preparedness mitigates destructive earthquake effects increased personal earthquake preparedness and reduced anxiety emotions.

7. CONCLUSION AND RECOMMENDATIONS

In this study, the validity of the earthquake fear scale was tested to investigate the factors predicting anxiety emotions of earthquake victims living in the earthquake zone after the Kahramanmaraş 2023 earthquake. A model of the mediating effect of earthquake preparedness between fear of earthquake and anxiety emotions was prepared. This model has shown that personal earthquake preparedness did not mediate the relationship between fear of earthquake and anxiety symptoms. An important implication of this result is that in the long run personal earthquake preparedness would not moderate the effect of fear of earthquake on anxiety emotions.

Another important result of this study is that for personal earthquake preparedness to gain importance, earthquake victims must first believe that preparation reduces the destructive effects of earthquakes. Otherwise, earthquake victims would not take action to prepare for earthquakes. Another important result is that high-magnitude earthquakes eliminate personal earthquake preparedness and push earthquake victims' preparedness interventions beyond their capacity. Therefore, a shift from personal earthquake preparedness to government preparedness interventions is necessary to reduce mental health consequences. Government authorities should focus on building preparedness to prevent traumatic losses. Performance-based analysis should be made mandatory in earthquake-resistant building design projects. Problems should be solved before the legislation comes into force in the implementation stages. The reactions of building structures (base shear forces, ground slides, etc.) should be measured in terms of resistance to destructive loads.

It is further suggested that government authorities increase the financial support to families of earthquake victims for housing transformation and should not delay ongoing earthquake resilient housing projects for earthquake victims. The Turkish Government should provide the financial support as promised to cover about half the cost of housings for earthquake victims.

As for earthquake survivors' coping strategies under present circumstances, it is suggested that displaced earthquake survivors return home, stay away from poor building stocks and build a new life with the surviving relatives. With large number of fault lines being active in Turkey, it is impossible to escape earthquakes. Therefore, earthquake survivors should take advantage of financial support for government housings or convert their damaged houses into earthquake-resistant houses. It no longer makes sense to recommend intervention strategies to public on the basis that houses would collapse, considering the loss of half the houses in Hatay province only.

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Ethical Statement:

The author declares that ethical rules have been followed in all preparation processes of this study. In case of detection of a contrary situation, Journal of Management and Economics Research has no responsibility, and all responsibility belongs to the author of the study.

The study was approved by the Cukurova Universityversity ethics committee with decision date 09 Oct 2024 and number E.1121020.

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