

The Psychological Consequences of 6 February 2023 Kahramanmaraş Earthquakes

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Research Article

Keywords: Kahramanmaraş Earthquakes, Psychological Resilience, PTSD, Anxiety, Depression.

Posted Date: April 29th, 2024

DOI: <https://doi.org/10.21203/rs.3.rs-4289712/v1>

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Version of Record: A version of this preprint was published at Natural Hazards on September 19th, 2024. See the published version at <https://doi.org/10.1007/s11069-024-06902-9>.

Abstract

The Kahramanmaraş Earthquakes (2023) are the largest and most destructive earthquakes witnessed in the era of the Republic of Turkey. Earthquakes lead to serious mental health problems such as PTSD in individuals. Earthquakes that cause significant death and injury on a large scale, such as the Kahramanmaraş Earthquakes, can result in various mental health problems. Therefore, the aim of the study was to examine the effects of variables such as Post-Traumatic Stress Disorder (PTSD), event impact, psychological resilience, depression, and anxiety levels on adult earthquake survivors affected by the Kahramanmaraş Earthquakes, using a quantitative research approach with survey techniques. A total of 662 earthquake survivors were reached. The effect of variables on each other was analyzed using Structural Equation Modeling (SEM). According to the findings of the study, event impact had a significant and positive effect on PTSD ($\beta = 0.780$, $p = 0.000$). Unexpectedly, resilience did not have a significant effect on PTSD ($\beta = -0.04$, $p > 0.05$). PTSD had a significant and positive effect on anxiety ($\beta = 0.936$, $p = 0.000$) and depression ($\beta = 0.643$, $p = 0.000$). Consequently, event impact's severity increased PTSD, which in turn led to anxiety and depression. Surprisingly, psychological resilience did not serve as a protective factor against PTSD. For future research, it is recommended to examine psychological resilience with different event types, on different sample groups, and using more comprehensive and varied methods.

1. INTRODUCTION

Natural disasters are devastating events that have serious impacts on societies and economies, with consequences that can last for years (The World Bank, 2022). Earthquakes, the most destructive natural disasters (EM-DAT, 2022), stand out for causing loss of life and property, as well as significant damage and losses (Bartels & Vanrooyen, 2012; Paudel & Ryu, 2018). In the past 20 years, over 11,300 earthquakes worldwide have resulted in the loss of more than 1.5 million lives and caused material losses for around 2.5 billion people (EM-DAT, 2021).

On February 6, 2023, two earthquakes occurred in the Pazarcık and Elbistan districts of Kahramanmaraş province (Turkey) at 04:17 with a magnitude of 7.7 Mw and at 13:24 with a magnitude of 7.6 Mw, affecting an area of 108,000 km² (DEMA, 2023). The Kahramanmaraş Earthquakes (2023) severely affected 11 provinces where approximately 14 million people, constituting about 16.5% of Turkey's population, reside (Adana, Adıyaman, Diyarbakır, Elâzığ, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa) (DEMA, 2023; PSB, 2023). In the Kahramanmaraş earthquakes (2023), there were 50,096 deaths, 108,068 injuries, and over 1.2 million people displaced (CRED, 2023; The World Bank, 2023). The earthquakes of 2023 in Kahramanmaraş left a staggering toll on infrastructure: 35,355 buildings collapsed, with an additional 17,491 requiring immediate demolition. Moreover, 179,786 structures suffered severe damage, while 40,228 were moderately affected, and a further 431,000 showed signs of slight damage (PSB, 2023). The Kahramanmaraş earthquakes (2023) have been recorded as the largest earthquakes experienced during the Republic era in Turkey (CRED, 2023; PSB, 2023).

It is known that earthquakes lead to many mental health problems (MHP) in individuals (Kar et al., 2021; Park & Bae, 2022; Norwood, Ursano, & Fullerton, 2000; Stephen Joseph, 2000). This situation causes changes in psychological and behavioral responses (Van der Kolk, 2012). Both trauma experienced by earthquake survivors and the loss of their loved ones and homes result in various MHPs (Shrestha & Gopal, 2021). If these problems persist over time, Post-Traumatic Stress Disorder (PTSD) (the most common psychiatric diagnosis) (Pietrzak et al., 2012), depression (Fuchs et al., 2021), anxiety (Xi et al., 2020), sleep disorders (Krakow et al., 2004), panic disorder (Grimm et al., 2012), and other mental health problems (Norris et al., 2002) also emerge (Bromet & Havenaar, 2007; North et al., 2004).

Earthquake survivors experience long-term stress when exposed to trauma (Arnberg et al., 2013; Liu et al., 2011). Resilient earthquake survivors cope more easily with this stress (Prayag et al., 2020). This is because psychological resilience is known to be a protective defense system against the effects of stress and trauma (Bonanno et al., 2007).

The concept of Post-Traumatic Stress Disorder (PTSD) has been addressed in the literature in traumatic events such as exposure to war (Hoge et al., 2004), sexual assault (Dworkin et al., 2023), motor vehicle accidents (Ning et al., 2017), and child abuse (Bohus et al., 2019). In addition to these, studies have also been conducted on PTSD following natural disasters such as floods (Golitaleb et al., 2022), hurricanes (Naudé et al., 2022), landslides (Golitaleb et al., 2022), volcanic eruptions (Rahmawati et al., 2023), fires (Judith C. Kulig, 2019), tsunamis (Suriastini et al., 2022), and earthquakes (Alipour & Ahmadi, 2020). Studies examining the relationship between PTSD and anxiety (Facer-Irwin et al., 2019), depression (Gulliver et al., 2021), severity of event impact (Joseph, 2000), and psychological resilience (Berger et al., 2007; Hoge et al., 2004) are known in the literature. In a study conducted in the UK, it was observed that PTSD symptoms lasted for a long time (5–8 years) (Yule et al., 2000). In a study conducted six years after the 2004 Indian Ocean Tsunami on those who were on vacation in Southeast Asia during the 2004 Indian Ocean Tsunami, it was found that suicidal ideation and comorbidity were common in cases with high levels of PTSD (Arnberg et al., 2013).

The data collected from the fieldwork conducted after the Kahramanmaraş Earthquakes (2023), which are considered the most devastating earthquakes in the history of the Republic of Turkey, will contribute to making social-level inferences. Strengthening the scales used to comprehensively evaluate the psychological effects of these earthquakes, declared as a level 4 disaster, and testing the results will provide a significant contribution to the literature. Furthermore, it is envisaged that the integrated use of scales assessing a wide range of psychological effects such as anxiety, depression, PTSD, and psychological resilience will strengthen theories. Consequently, this study presents a comprehensive approach to evaluating the psychological consequences of the affected community. In this study, firstly, PTSD, anxiety, depression, event impact, and psychological resilience will be measured in adult individuals affected by the Kahramanmaraş Earthquakes (2023). Subsequently, the impact of these variables on each other will be measured, and the model we constructed will be tested.

2. THEORETICAL BACKGROUND, HYPOTHESES, AND RESEARCH MODEL

This study aims to test a specific hypothesis using independent variables created based on the existing research findings obtained from the literature review. In this study, four hypotheses are formulated to test the relationship between event impact, psychological resilience, anxiety, and depression with PTSD. The

variables in the tested model are shown in Fig. 1.

People are expected to experience an increase in PTSD symptoms proportional to the level of their exposure to traumatic events. In other words, the severity of exposure to trauma is directly proportional to PTSD. It is known that the severity of direct exposure to trauma and traumatic event intensity have a significant impact on PTSD and other mental health issues (Jakob et al., 2017). A study conducted on a group of middle school children who survived the 2008 Wenchuan earthquake concluded that the severity of exposure to the earthquake was directly associated with PTSD (Liu et al., 2011; Ying et al., 2014). In a study conducted on high school students after the Great East Japan Earthquake, a significant and positive correlation was found between the severity of event impact and PTSD (Okuyama et al., 2018). A study conducted on individuals affected by the Prestige oil spill in Spain found that those living in areas close to the leak showed more PTSD symptoms compared to those living farther away (Sabucedo et al., 2010). It was observed that there was a positive relationship between PTSD symptoms and exposure severity among civilians exposed to the 2014 Israel-Gaza conflict (Besser et al., 2015). The severity of event impact can have a precursor effect on PTSD. Based on these findings, it can be stated that as individuals are more affected by a traumatic event, PTSD symptoms also increase in the same direction. Recent studies in the literature suggests that there is a positive relationship between the severity of event impact and PTSD. In this study, based on the current literature, the H1 hypothesis is proposed to test whether event impact is associated with PTSD.

Hypothesis 1

(H1): In individuals affected by the Kahramanmaraş Earthquakes (2023), event impact will have a significant and positive effect on PTSD.

The stress and traumas experienced after an earthquake have negative effects on individuals' psychological health. However, it is expected that some individuals will cope better after the earthquake and exhibit fewer PTSD symptoms. A study conducted following the 2005 earthquake in Pakistan concluded that individuals with high psychological resilience had lower PTSD symptoms (Ahmad et al., 2010). It was inferred that psychological resilience was a protective factor for both physical and mental health in individuals who survived the Fukushima nuclear explosion (Kukihara et al., 2014). In a study conducted with college students in Israel who were experiencing psychological distress, it was observed that individuals with high psychological resilience had fewer PTSD symptoms, while individuals with low psychological resilience had higher PTSD symptoms (Bensimon, 2012). In a study conducted on police officers affected by Hurricane Katrina, it was found that individuals with high psychological resilience and a positive outlook on life reduced their PTSD symptoms (Mccanlies et al., 2014). In this context, psychological resilience can be an important factor in the recovery process after an earthquake. Additionally, the psychological resilience of individuals experiencing traumatic events has been shown to be effective in reducing PTSD symptoms. Moreover, psychological resilience is a protective factor against mental health issues. In this study, based on the current literature, the H2 hypothesis is proposed to test whether psychological resilience is associated with PTSD.

Hypothesis 2

(H2): In individuals affected by the Kahramanmaraş Earthquakes (2023), psychological resilience will have a significant and negative effect on PTSD.

An earthquake can induce intense stress responses in individuals, which can lead to symptoms of anxiety and depression. The presence of PTSD after an earthquake can lead to symptoms such as constant alertness and recurring nightmares. These symptoms can contribute to mental health problems in individuals, such as anxiety disorders and depression. Earthquakes can leave traumatic effects on individuals, leading to long-term consequences affecting mental health (Chan et al., 2012; Liu et al., 2011). A study conducted after Hurricane Katrina observed depression and anxiety issues among those exposed to trauma (Osofsky et al., 2009). It is known that traumatic events, such as earthquakes, increase the risk of mental health problems such as PTSD, anxiety, and depression in individuals (Jakob et al., 2017). After the Exxon Valdez oil spill, individuals displaying PTSD symptoms were also observed to exhibit symptoms of anxiety (Palmkas et al., 1993). In a study conducted after the Haiti earthquake, a significant and positive relationship between PTSD and depression was observed (Cénat & Derivois, 2014). A study conducted on children after the Lushan earthquake concluded that PTSD symptoms mostly occurred before depressive symptoms (Cheng et al., 2020). Current research indicates that the intense emotional stress factors resulting from PTSD and the trauma experienced by earthquake survivors lead to various mental health problems. Therefore, the emergence of PTSD symptoms has been observed to contribute to factors such as anxiety and depression. In this study, hypotheses H3 and H4 are proposed to test the relationship between PTSD and anxiety, as well as PTSD and depression.

Hypothesis 3

(H3): In individuals affected by the Kahramanmaraş Earthquakes (2023), anxiety will have a significant and positive effect on PTSD.

Hypothesis 4

(H4): In individuals affected by the Kahramanmaraş Earthquakes (2023), depression will have a significant and positive effect on PTSD.

3. METHODS

3.1. Research Design

In this study, descriptive research methods were employed. The data were collected using Likert-type scales to understand the relationships between event impact, anxiety, depression, psychological resilience, and post-traumatic stress disorder (PTSD), hence adopting a quantitative research approach. The structure of the study involves a combination of correlational survey design and causal comparative survey design. Additionally, structural equation modeling (SEM) was used to systematically analyze the relationships between various variables. Correlational survey design refers to a research approach evaluated using statistical measures, such as correlation coefficients, to determine the presence of potential relationships between at least two variables (Apuke,

2017). Causal-comparative survey design is a type of research that attempts to find the cause or effect of existing differences between at least two groups of individuals (Fraenkel et al., 1993). Structural equation modeling is a theory-based and statistical data analysis approach used to evaluate causal and correlational relationships between observed and latent variables and to test predetermined hypotheses (Natasha K. Bowen, 2011).

3.2. Study Area

Turkey is geographically prone to earthquake risks due to its location at the intersection of the African, Eurasian, and Arabian tectonic plates. Particularly, significant active fault lines such as the North Anatolian Fault, East Anatolian Fault, and West Anatolian Fault are located within the country's borders. This indicates that Turkey is a region where earthquakes frequently occur (Bayrak et al., 2015).

On February 6, 2023, at 04:17, an earthquake with a magnitude of 7.7 Mw centered in Pazarcık, Kahramanmaraş, occurred on the East Anatolian Fault Zone (EAFZ). Approximately 10 hours later, an independent earthquake with a magnitude of 7.6 Mw centered in Elbistan, Kahramanmaraş, occurred (Hacettepe University, 2023). As a result of the Kahramanmaraş earthquakes, the provinces of Kahramanmaraş, Hatay, Malatya, Adıyaman, Kilis, Elâzığ, Adana, Diyarbakır, Osmaniye, Gaziantep, and Şanlıurfa suffered significant damages and were affected (Bursa Technical University, 2023). The overview of the affected 11 provinces on the map of Turkey is shown in Fig. 2. The total population in the affected 11 provinces is 14,013,196, with 9,207,259 adults (PSB, 2023). The Kahramanmaraş earthquakes (2023) resulted in the loss of 50,096 lives, 108,068 injuries, and displacement of more than 1.2 million people (CRED, 2023; The World Bank, 2023). Damage assessment studies conducted after the earthquake revealed that 35,355 buildings were collapsed, that 17,491 were urgently to be demolished, that 179,786 were severely damaged, that 40,228 were moderately damaged, and that 431,000 were slightly damaged (PSB, 2023).

3.3. Participants

The population of the study consists of adult individuals in the 11 provinces affected by the Kahramanmaraş earthquakes (2023), excluding individuals under the age of 18. The sample size of the study comprises at least 384 adult individuals with a 95% confidence level and a 5% margin of error (Earl Babbie, 2007). In the research, a random sampling method was employed (West, 2016). The disadvantage of this sampling method is time and cost limitations. A total of 662 earthquake survivors were reached in the study. The sample size of the research is sufficient for the population of the study. The demographic information of those adults affected by the Kahramanmaraş earthquakes (2023) is presented in Table 1. Data collection for the research was conducted both face-to-face and online. Face-to-face surveys were conducted in various locations such as tent camps, container camps, bus stations, airports, parks, cafes, shopping malls, and markets in the earthquake-affected areas. The extensive area affected by the earthquake led to time and activity constraints in survey work, resulting in online surveys being conducted in some provinces.

3.4. Data collection tool

In the research, a survey was used as the data collection tool, consisting of 7 sections. The first section includes participants' demographic characteristics. Among the demographic characteristics are questions regarding gender, age, marital status, educational level, economic status, having children, experience with disasters (have you experienced a disaster before?), and in which province the participant experienced the earthquake. These variables are the independent variables of the study.

The Clinician-Administered PTSD Scale (CAPS-5) Turkish Version

The CAPS-5-TR, developed by Boysan et al. (2017), (Boysan et al., 2017) was used in accordance with DSM-5 standards. The scale consists of 20 questions and 4 subscales: Re-experiencing (RE), Avoidance (AV), Negative Alterations (NA), and Hyper-arousal (HA). It is rated on a 5-point Likert scale ranging from 0 (Not at all) to 4 (Extremely). The Cronbach's Alpha coefficient for the CAPS-5-TR version was found to be greater than 0.87. Sample items from the scale include "How overwhelmed have you been by suddenly feeling or acting as if you were actually reliving the stressful event (as if you were actually back in the moment and reliving it)?" and "How overwhelmed were you by having strong physical reactions (e.g., heart palpitations, difficulty breathing, sweating) when things reminded you of the stressful event?".

The Impact of Event Scale- Revised (IES-R)

The IES-R, a revised version of the Impact of Event Scale (IES) developed by Horowitz et al. (1979) according to DSM-5 standards (Horowitz et al., 1979), was used (Weiss, 2007). The scale was adapted into Turkish by Aytül Çorapçıoğlu, 2006). It consists of 22 items, with 3 subscales: Intrusion and Avoidance (each with 8 items), and Hyperarousal (6 items). It is an appropriate tool for measuring subjective responses to a specific traumatic event in an adult or elderly population. The scale is rated on a 5-point Likert scale, ranging from 0 (Not at all) to 4 (Extremely). The Cronbach's Alpha coefficient for the scale is 0.937 for the entire group. The test-retest reliability of the developed scale collected over a 6-month interval ranges between 0.89 and 0.94. The participants were asked to describe a recent stressful event and explain how much any difficulties or distress they experienced in the past seven days affected them. Sample items from the scale include "Did any reminders bring back feelings about this?".

Resilience Scale for Adults (RSA)

The Turkish version of the Resilience Scale for Adults (RSA), adapted by Basım and Çetin (2011) (H. Nejat BASIM & Fatih ÇETİN, 2011), was used (Friborg et al., 1996). The scale consists of 33 items and comprises six subscales: Perception of Self (POS), Perception of Future (POF), Structured Style (STS), Social Competence (SOC), Family Cohesion (FAC), and Social Resources (SOR). The scale is rated on a 5-point Likert scale (1 to 5). Items numbered 1, 3, 4, 8, 11, 12, 13, 14, 15, 16, 23, 24, 25, 27, 31, and 33 are reverse-coded. During the development of the scale, it was tested on two different sample groups: university students and bank employees. The Cronbach's Alpha coefficient for the scale was found to be 0.86.

Adult Anxiety Short Form (AA)

The DSM-5 Adult Anxiety Short Form (AASF) was used in the study (APA, 2013). It was designed to assess the presence and severity of generalized anxiety disorder symptoms in adults (aged 18 and older) over the past 7 days, following DSM-5 standards. Items such as "Felt like something awful might happen" and "Felt worried" are included. The short form consists of 7 items and is rated on a 5-point Likert scale ranging from 1 (Never) to 5 (Almost Always). It is scored within a range of 7 to 35, with higher scores indicating increased anxiety severity as it approaches 35.

Adult Depression Short Form (AD)

The DSM-5 Depression Short Form (ADSF) was used in the study (APA, 2013). It was designed to assess the presence and severity of depression symptoms in adults (aged 18 and older) over the past 7 days, following DSM-5 standards. Items such as "Felt like he/she couldn't do anything right" and "Wanted to be by himself/herself" are included. The scale consists of 8 items and is rated on a 5-point Likert scale ranging from 1 (Never) to 5 (Almost Always). It is scored within a range of 8 to 40, with higher scores indicating increased severity as it approaches 40.

3.5. Data Analysis

The data analysis was conducted using IBM Statistical Package for Social Sciences (SPSS) 25 and Analysis of Moment Structure (AMOS) 24 software packages. Descriptive statistics were used to determine the demographic characteristics of the earthquake survivors, as well as the mean (M), standard deviations (SD), number (n), and percentages (%) of the scales and factors used in the study. Covariance-Based Structural Equation Modeling (CB SEM) approach was employed to create a hypothetical model for the mental disorders of those HCWs involved in the Kahramanmaraş Earthquakes (2023) (J. F. Hair Jr. et al., 2010; Jackson et al., 2009). The preference for CB SEM lies in its use as a method for quantitatively validating theoretical models (Finkelstein, 2005). Meanwhile, maximum likelihood estimation was used in CB SEM to estimate the parameters of the model in SEM.

The suitability of the data for factor analysis was tested using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The reliability of the scales and factors was assessed using Cronbach's alpha (CA). Confirmatory Factor Analysis (CFA) was conducted to test the model fit indices of the scales used in the study. To assess the validity of the measurement model, parameters such as $\chi^2/\text{Degree of Freedom}$ (χ^2/df), Root-Mean-Square Error Approximation (RMSEA), Goodness-of-fit Index (GFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), and Adjusted Goodness of Fit Index (AGFI) were evaluated. Additionally, Average Variance Extracted (AVE) and Composite Reliability (CR) were applied to test the convergent and discriminant validity of the structures (Claes Fornell and David F. Larcker, 1981; J. F. H. G. T. M. R. C. M. S. M. D. N. P. R. S. Hair Jr., 2021).

4. RESULTS

In the scope of the research, 662 earthquake survivors were reached. Table 1 shows the demographic data of the earthquake survivors. 52.3% of the earthquake survivors are female, while 47.7% are male. 31.1% of the earthquake survivors are married, while 68.9% are single. 67.8% of the earthquake survivors have a moderate income, 61.2% are university graduates, and 30.8% have children. 25.8% of the earthquake survivors lost a relative in the disasters they experienced. Regarding the Kahramanmaraş Earthquakes (2023), 8.8% of the earthquake survivors lived in Adana province, 4.1% in Adiyaman province, 3.2% in Diyarbakır province, 18.6% in Elazığ province, 6.2% in Gaziantep province, 21.8% in Hatay province, 7.7% in Kahramanmaraş province, 8.5% in Kilis province, 11% in Malatya province, 5.9% in Osmaniye province, and 4.4% in Şanlıurfa province. The youngest earthquake survivor is 18, and the oldest is 60 years old. The average age of the earthquake survivors reached in the research is 28.27.

Table 1
Individual Characteristics of Participants

Individual Characteristics of Participants					
Variable		Groups		Frequency	Percent
Gender		Female		346	52.3
		Male		316	47.7
marital status		Married		206	31.1
		Single		456	68.9
Educational background		secondary education		257	38.8
		associate degree		88	13.3
		Undergraduate		284	42.9
		Graduate		33	5.0
Income status		Low		131	19.8
		Middle		449	67.8
		High		82	12.4
Child status		Yes		204	30.8
		No		458	69.2
Loss status		Yes		171	25.8
		No		491	74.2
Employer / Institution		Adana		58	8.8
		Adıyaman		27	4.1
		Diyarbakır		21	3.2
		Elâzığ		123	18.6
		Gaziantep		41	6.2
		Hatay		144	21.8
		Kahramanmaraş		51	7.7
		Kilis		56	8.5
		Malatya		73	11.0
		Osmaniye		39	5.9
		Şanlıurfa		29	4.4
Variable	Minimum	Maximum	Mean	SD	
Age	18	60	28.27	9.296	

Table 2
Validity and Reliability Results of Variable Scales

Measuring Instruments	M	SD	KMO	Bartlett's test	CA	CR	AVE
PTSD	3.18	0.890	0.963	0.000	0.957		
<i>Re-experiencing (RE)</i>	3.10	0.960			0.891	0.886	0.609
<i>Avoidance (AV)</i>	3.22	1.092			0.795	0.792	0.657
<i>Negative Alterations (NA)</i>	3.09	0.892			0.882	0.879	0.512
<i>Hyper-arousal (HA)</i>	3.29	0.960			0.888	0.887	0.570
IES-R	3.04	0.867	0.961	0.000	0.953		
<i>Intrusion (IN)</i>	3.12	1.004			0.926	0.921	0.597
<i>Avoidance (AV)</i>	2.89	0.823			0.852	0.853	0.524
<i>Hyperarousal (HA)</i>	3.12	0.991			0.894	0.896	0.591
Resilience	3.44	0.662	0.835	0.000	0.895		
<i>Social Resources (SOR)</i>	3.45	0.989			0.865	0.879	0.516
<i>Perception of Self (POS)</i>	3.39	1.076			0.756	0.774	0.520
<i>Structured Style (STS)</i>	3.58	1.054			0.736	0.852	0.591
<i>Perception of Future (POF)</i>	3.27	1.112			0.710	0.737	0.502
<i>Social Competence (SOC)</i>	3.52	1.212			0.725	0.775	0.624
Anxiety	3.21	1.071	0.907	0.000	0.929	0.924	0.637
Depression	2.92	0.972	0.925	0.000	0.917	0.918	0.586

M = Mean, SD = Standard Deviation, KMO = Kaiser-Meyer-Olkin, CA = Cronbach's Alpha, CR = Composite Reliability, AVE = Average Variance Extracted.

Table 2 shows the validity and reliability results of the variable scales. The mean scores of PTSD, IES-R, resilience, anxiety, and depression among the earthquake survivors were found to be 3.18 (SD = 0.890), 3.04 (SD = 0.867), 3.44 (SD = 0.662), 3.21 (SD = 1.071), and 2.92 (SD = 0.972), respectively. The KMO values were determined to be 0.963 for the PTSD scale, 0.961 for the IES-R scale, 0.835 for the resilience scale, 0.907 for the anxiety scale, and 0.925 for the depression scale. The Bartlett's test values were significant for all scales ($p = 0.000$). These values indicate the suitability and adequacy of the respective scales (Field, 2009; Kaiser, 1974). To test the reliability and validity of the scales and factors, CA, AVE, and CR were applied. The reliability analysis resulted in CA values of 0.957 for the PTSD scale, 0.953 for the IES-R scale, 0.895 for the resilience scale, 0.929 for the anxiety scale, and 0.917 for the depression scale. Additionally, all factors of the scales had CA values above 0.7, indicating acceptable reliability of the survey (Garson, 2013; Nunally, 1978). Furthermore, the AVE and CR values for all latent variables were greater than 0.5 and 0.7, respectively (Claes Fornell and David F. Larcker, 1981; J. F. H. G. T. M. R. C. M. S. M. D. N. P. R. S. Hair Jr., 2021), indicating convergent validity for each variable. Consequently, the structural model established to test the relevant research theory exhibited excellent internal consistency.

Table 3
Model Fit Indices of Scales

Scales	χ^2/df	IFI	TLI	CFI	GFI	AGFI	RMSEA
PTSD	4.365	0.942	0.929	0.942	0.908	0.878	0.064
IES-R	4.364	0.912	0.897	0.912	0.867	0.830	0.061
Resilience	4.117	0.827	0.873	0.824	0.934	0.903	0.069
Anxiety	3.468	0.995	0.986	0.995	0.990	0.958	0.061
Depression	4.512	0.979	0.960	0.979	0.970	0.929	0.063

Table 3 presents the model fit indices of the variable scales. Confirmatory factor analysis was conducted to test the model fit indices of the scales. The model fit indices, including χ^2/df , IFI, TLI, CFI, GFI, AGFI, and RMSEA parameters, were evaluated. It is required that IFI, TLI, CFI, and AGFI values be greater than 0.80 (Gefen et al., 2000), χ^2/df value be less than 5 (J. F. Hair Jr. et al., 2010), and RMSEA value be less than 0.700 (James H. Steiger, 2007). The results of the confirmatory factor analysis showed that the PTSD scale ($\chi^2/df = 4.365$, IFI = 0.942, TLI = 0.929, CFI = 0.942, GFI = 0.908, AGFI = 0.878, RMSEA = 0.064), the IES-R scale ($\chi^2/df = 4.364$, IFI = 0.912, TLI = 0.897, CFI = 0.912, GFI = 0.867, AGFI = 0.830, RMSEA = 0.061), the resilience scale ($\chi^2/df = 4.117$, IFI = 0.827, TLI = 0.873, CFI = 0.824, GFI = 0.934, AGFI = 0.903, RMSEA = 0.069), the anxiety scale ($\chi^2/df = 3.468$, IFI = 0.995, TLI = 0.986, CFI = 0.995, GFI = 0.990, AGFI = 0.958, RMSEA = 0.061), and the depression scale ($\chi^2/df = 4.512$, IFI = 0.979, TLI = 0.960, CFI = 0.979, GFI = 0.970, AGFI = 0.929, RMSEA = 0.063) demonstrated a good fit. It can be stated that the used scales generally have acceptable and good fit.

A structural model evaluation was conducted to test the relevant research theory. A 95% confidence interval with a significance level of $p < 0.05$ was used to test the direct effects of the latent variables (see Fig. 3 and Table 4). The structural model established for the mental disorders of the earthquake survivors in the Kahramanmaraş Earthquakes (2023) is significant ($p = 0.000$) and indicates good fit indices ($\chi^2/df = 4.302$, IFI = 0.904, TLI = 0.889, CFI = 0.904, GFI = 0.829, AGFI = 0.888, RMSEA = 0.081).

Table 4
Path Coefficient and Hypothesis Test Results

	β	SE	c.r.	p	Decision
H1: IES-R $\rightarrow$ PTSD	0.780	0.030	25.612	0.000	Supported
H2: Resilience $\rightarrow$ PTSD	-0.004	0.063	-0.062	0.950	Not supported
H3: PTSD $\rightarrow$ Anxiety	0.936	0.053	19.496	0.000	Supported
H4: PTSD $\rightarrow$ Depression	0.643	0.044	14.522	0.000	Supported

The IES-R has a significant and positive effect on PTSD among the earthquake survivors ($\beta = 0.780$, $p = 0.000$). Therefore, H1 is valid. However, the resilience of the earthquake survivors does not have a significant effect on PTSD ($\beta = -0.004$, $p = 0.950$), indicating that H2 is invalid. Additionally, PTSD has a significant and positive effect on anxiety ($\beta = 0.936$, $p = 0.000$), supporting the validity of H3. Lastly, PTSD also has a significant and positive effect on depression among the earthquake survivors ($\beta = 0.643$, $p = 0.000$), confirming the validity of H4.

5. DISCUSSION

In the preceding sections of our study, a detailed examination of the psychological implications of earthquakes was conducted. By bringing together the data and literature discussed, it was elucidated that earthquakes led to various mental health issues among survivors. Our current research provides a comprehensive investigation into the effects of earthquakes on the psychological well-being of survivors. The findings highlight the presence of prominent factors such as PTSD at the core of psychological problems commonly observed among earthquake survivors. In this context, this study underscores the pivotal role of PTSD, which is the focal point of our investigation, in understanding the impact of the Kahramanmaraş earthquakes on survivors. Furthermore, this section delves into how event impact and psychological resilience affect PTSD and how PTSD influences anxiety and depression. It becomes evident in this section that more effective preventive and supportive strategies need to be developed to address the challenges faced by earthquake survivors. Additionally, it is recommended that further research be conducted to support this, with more comprehensive studies utilizing qualitative interviews, case studies, and case analyses.

Consistent with H1, it is observed that the impact of the event has a significant and positive effect on PTSD. Similar findings are evident in the literature. In a study involving individuals who had overcome serious illnesses such as acute lung injury (Bienvenu et al., 2013), the Impact of Event Scale–Revised (IES-R) was utilized to assess PTSD symptoms, while the Clinician-Administered PTSD Scale (CAPS) was used to diagnose PTSD. A significant and positive relationship was found between these two variables. In this study, despite the sample group being different from earthquake survivors, consisting of individuals who had overcome acute lung disease, results were obtained that support our hypothesis. Hence, even following any health issue, symptoms of PTSD are observed in individuals, making it inevitable for PTSD symptoms to occur following a large-scale disaster such as the Kahramanmaraş Earthquakes. In a study involving individuals with substance use disorder (Rash et al., 2008), the psychometric properties of the Impact of Event Scale–Revised (IES-R), a screening tool that can be used to identify Posttraumatic Stress Disorder (PTSD) symptoms, were evaluated. These findings supported the reliability of the IES-R in measuring PTSD symptoms and its utility in clinical trials. A significant and positive relationship was found between the IES-R and PTSD. In our own study, we used the IES-R to measure the severity of the event. In a study by Sveen et al. (2016) (Sveen et al., 2016), which investigated the psychometric properties of the Posttraumatic Checklist for DSM-5 (PCL-5) on parents of children with burns, a significant and positive relationship was found between PCL-5 and IES-R. Following the sarin gas attack on the Tokyo subway in 1995, researchers examined the mental and physical symptoms of victims five years after the attack (Iwanami et al., 2004). They investigated the long-term effects of the attack and identified symptoms associated with PTSD. Victims displaying PTSD symptoms also exhibited high levels of anxiety, and a significant and positive correlation was found between the total score of the Impact of Event Scale–Revised (IES-R) and the Clinician-Administered PTSD Scale (CAPS). Similar to our study, the results we obtained also predicted PTSD symptoms using the IES-R as a measure of trauma severity and determinant. When considering the overall evaluation of the H1 hypothesis, the existing literature indicates that the IES-R has a significant and positive effect on PTSD. One of the main reasons for the high impact of the IES-R on PTSD symptoms in the Kahramanmaraş Earthquakes is thought to be the fact that it was a Level 4 disaster, and that individuals had not experienced such an event before. Regardless of the magnitude of the IES-R, it may be possible to mitigate PTSD. For future research, it is recommended to explore whether increasing awareness and consciousness could serve as a significant tool in reducing PTSD. The reasons for the high occurrence of PTSD symptoms need to be thoroughly investigated. It is thought that this disaster affected all provinces across Turkey. This is because Turkey has a cultural, emotional, and public-spirited structure, causing the pain of the events experienced in 11 provinces to be felt nationwide and shared through various media channels. The psychological effects of the Kahramanmaraş earthquakes should be studied not only in the 11 provinces but also nationwide. In conclusion, trauma can affect not only the immediate area but also the entire environment. It is also thought that there will be both direct and indirect effects of trauma, and that these indirect effects should not be overlooked.

Contrary to H2, unexpectedly, it was found that psychological resilience did not affect PTSD symptoms. There are various studies in the literature that contradict this finding. Following the 9/11 terrorist attacks, a group of individuals living in New York exhibited higher resilience, which was more widespread

among individuals exposed to trauma (the most significant determinant of PTSD) (Bonanno et al., 2006). Additionally, the study suggested the need for further investigation into how resilience affects different types of exposure. In our own study, we obtained different data due to the different type of exposure, namely the earthquake. The main factor contributing to the different results in our study is the earthquake being a Level 4 disaster and simultaneously affecting 11 provinces destructively. A literature review conducted on employees working in various workplaces affected by disasters (Brooks et al., 2020) found that psychological resilience had a significant and negative impact on PTSD. The study observed an increase in psychological resilience among those involved in disaster relief efforts, which consequently reduced the likelihood of experiencing PTSD. In provinces affected by the Kahramanmaraş Earthquakes (2023), such as Kahramanmaraş and Hatay, there are a total of 21,172 rubble. In provinces heavily affected like these, it is common for individuals to experience PTSD due to witnessing the losses of earthquake victims, whether they participate in relief efforts during the earthquake or not. Furthermore, there is also a study in the literature that failed to find a significant relationship between psychological resilience and PTSD. Following the earthquake in China in 2012, a study conducted on 350 individuals conscripted in Yiliang county (Wu et al., 2015) found results similar to our own study, where psychological resilience did not have a significant impact on PTSD. This was attributed to the low trauma levels among participants and the weak relationship between these two factors. In our study, the earthquake severely affected a region where approximately 15 million people lived. Therefore, the impact of trauma was found to be at high levels in our study. As a result, the participants experienced high levels of PTSD despite their resilience. These findings indicate that psychological resilience does not always affect PTSD symptoms and question the protective role of psychological resilience on PTSD symptoms. Although previous studies suggested that psychological resilience acted as a protective factor against PTSD, differing results were also observed. The Kahramanmaraş Earthquakes stand as the most devastating seismic events in the history of the Republic of Turkey. Registering magnitudes of 7.7 and 7.6 on the Richter scale, respectively, they persisted for 90 seconds, culminating in a tragic toll of 50,000 casualties. Additionally, the earthquakes had a destructive impact on 11 provinces, particularly in Hatay and Kahramanmaraş. In such a massive disaster, the probability of anyone living in the region not having a friend or loved one affected is very low. This also led individuals to experience PTSD. The survivors tried to cope on their own during the first 72 hours after the earthquake. The tragic events they experienced, along with their efforts to rescue their loved ones, forced them to become resilient. All of these factors led to high levels of stress, and they had to be resilient. However, as a result of this complex situation, the resilience level of survivors did not have any impact on experiencing PTSD. Consequently, it was observed that there was a complex relationship between psychological resilience and PTSD, and that these outcomes may vary depending on the sample group, type of event, and its severity. For future research, it is recommended to conduct detailed studies specifically on the psychological effects of the Kahramanmaraş earthquakes. These studies will contribute to the literature and provide insights for decision-makers and policymakers. Additionally, they will support drawing important lessons from the Kahramanmaraş earthquakes.

Consistent with H3 and H4, PTSD has a significant and positive effect on anxiety and depression. Similar results can be found in the literature. In a study examining the impact of depression and anxiety on health satisfaction among PTSD-afflicted veterans (Rauch et al., 2010), depression and anxiety were found to accompany PTSD-afflicted veterans. In a study conducted on adolescents affected by the 2016 Aceh earthquake (Marthoenis et al., 2019), a significant and positive relationship was observed between PTSD and anxiety and depression. In a study conducted on survivors eight years after the 2008 Wenchuan earthquake (Guo et al., 2017), a significant and positive relationship was found between PTSD and depression. In a study conducted on children and adolescents living in Ana Loisa and Dafni cities affected by the 1999 Athens earthquake (Roussos et al., 2005), a significant and positive relationship was observed between PTSD and depression. This study concluded that the strongest determinant affecting PTSD was depression ($\beta = 0.52$). When compared to Roussos et al., 2005 (Roussos et al., 2005), there are some similarities and differences in our study. In our study, too, PTSD has a significant and positive relationship with anxiety ($\beta = 0.936$) and depression ($\beta = 0.643$). However, in our study, anxiety ($\beta = 0.936$) has a greater impact on PTSD compared to depression. The reason for this is thought to be the questions included in the survey. While the questions related to anxiety include phrases such as "I felt scared" and "I felt uneasy", the questions related to depression include phrases such as "I felt helpless" and "I felt sad". As understood from these questions, factors such as experiencing continuous aftershocks may have led to a constant state of fear, anxiety, and restlessness among the earthquake survivors. Additionally, the earthquake in Athens occurred at 14:56 and had a magnitude of 5.9, resulting in a total of 140 deaths (Lekkas, 2001). The earthquake in Athens occurred during waking hours, especially during working hours when people were not at home. However, the first earthquake in Kahramanmaraş (magnitude 7.7) occurred during sleeping hours, and the second earthquake (magnitude 7.6) occurred during midday, resulting in greater loss. We think that there are more anxiety-related outcomes in our study regarding the magnitude and timing of the earthquakes. In a longitudinal study conducted on sexually assaulted women (Nickerson et al., 2013), it was found that PTSD had a significant and positive effect on depression and anxiety symptoms. Since the research was longitudinal, a 12-month process was followed, and over time, PTSD symptoms did not decrease, indicating that survivors had difficulty recovering from the traumatic experience. It is recommended to examine the long-term effects of the Kahramanmaraş earthquakes. In a study conducted on Turkmen students who had experienced war in Iraq and were studying at universities in Turkey (Magruder et al., 2015), a significant and positive relationship between PTSD and depression was observed. While PTSD symptoms caused by trauma were seen in 11.2% of the sample, post-traumatic growth was also observed. In the United Kingdom, frontline healthcare workers who experienced PTSD during the early stages of the COVID-19 pandemic also experienced psychological problems such as anxiety and depression (Greene et al., 2021). This may be due to the long-term psychological effects of the COVID-19 pandemic, healthcare workers not feeling safe, and constantly fearing infection. Similarly, earthquake survivors experiencing constant fear and a sense of being on edge are prone to developing symptoms of anxiety and depression. Therefore, the Kahramanmaraş earthquakes are likely to have long-term effects. In a longitudinal study conducted on children who experienced the Lushan earthquake (Cheng et al., 2020), a significant and positive relationship was found between PTSD symptoms and depressive symptoms. Similarly, in our study, the earthquake survivors experienced anxiety and depression after PTSD. These results suggest that individuals experiencing PTSD are at risk of developing other mental health symptoms such as anxiety and depression. PTSD, anxiety, and depression are serious mental health issues following highly traumatic events like earthquakes. To prevent them from exacerbating each other, it is crucial to reduce long-term effects and provide support such as preventive social support, resilience, and psychological support. The emotional upheaval endured by survivors of the Kahramanmaraş earthquakes – from the initial shock of the disaster to grappling with the profound devastation in the area, the heart-wrenching loss of loved ones, homes, and workplaces, the disruption of their everyday routines, the relentless aftershocks, and the persistent feelings of fear and despair – may have precipitated these mental health challenges.

5.1. Limitations

This study has certain limitations. Firstly, our research has limited capacity for generalization. This is because, during the first 72 hours after the earthquake, a significant number of individuals were evacuated or voluntarily moved to different cities, including those with medical needs, losses, those needing healthcare services, and those experiencing housing and nutrition problems. As a result, some individuals could not be reached during the field research process. Secondly, due to the significant impact of the earthquake, some survivors found it difficult to answer the questions. Those heavily affected by the earthquakes experienced further trauma upon seeing the survey questions and abandoned them halfway through. During the data collection period, these individuals were informed that they could discontinue the survey at any time if they wished, and efforts were made to avoid further traumatization. Thirdly, self-report scales were used as the measuring instrument. Despite being validated, such measuring instruments may be insufficient in measuring the psychological effects of such a large-scale earthquake. Therefore, it is recommended to assess the psychological consequences of the Kahramanmaraş Earthquakes using qualitative research techniques. The limitations encountered during the data collection process should be considered as they may affect the generalizability of the results. Fourthly, the study is cross-sectional and does not demonstrate long-term effects. This could affect the interpretation of the results. For future research, it is recommended to evaluate the consequences of earthquake survivors' psychological effects through long-term longitudinal studies.

6. CONCLUSION

The psychological insights gained from those earthquake survivors affected by the Kahramanmaraş Earthquakes will make a significant contribution to the growing literature on disaster psychology. Investigating mental health outcomes, particularly the MHPs caused by PTSD resulting from such a large-scale earthquake, along with protective factors, is of great importance. Our findings indicate the need for closer and long-term monitoring of the traumas experienced by earthquake survivors. Additionally, our study reveals that survivors of disasters require more psychological, social, and economic support as a result of the calamities they experience. Furthermore, due to the emotional nature of Turkish culture, its cosmopolitan structure, and its overly public-spirited character, it is observed that the psychological consequences of the earthquake need to be studied not only in the 11 provinces affected but also throughout Turkey as a whole.

Along with the results obtained in the study, it is suggested that efforts should be made by decision-makers and policymakers to increase awareness of trauma exposure among citizens in the aftermath of such large-scale disasters. For future research, conducting one-on-one interviews with earthquake survivors to conduct more long-term quantitative, qualitative, and longitudinal studies is recommended. In conclusion, individuals affected by the Kahramanmaraş Earthquakes experienced PTSD. It is generally known that psychological resilience has mitigating effects on the likelihood of developing post-traumatic stress disorder (PTSD). However, in our study, it was observed that this effect was not evident. Therefore, further research is warranted to delve deeper into why the existing resilience of earthquake survivors does not mitigate the risk of PTSD. This research could help us understand whether resilience affects the risk of PTSD under specific conditions and could provide better insights into the psychological health of earthquake survivors. In this context, in-depth studies on the impact and mechanisms of resilience are necessary.

Declarations

Ethical Aspect

In this study, participation was entirely based on voluntary consent to prevent traumatic effects on the earthquake survivors and to show sensitivity to their social lives. Those earthquake survivors who were not willing to participate were not included in the research, and the participants were informed that they could withdraw from the study at any time if they wished. In the informed consent form provided initially, it was clarified that the collected data would not be used for any other purpose and would be kept confidential. The Scientific Research and Publication Ethics Committee of Gümüşhane University approved this study scientifically and ethically in its meeting dated 14/06/2023 with decision number 2023/3.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Data Availability

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Funding

The authors report no funding.

Authors' Contributions

Both authors read and approved the final manuscript.

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Figures

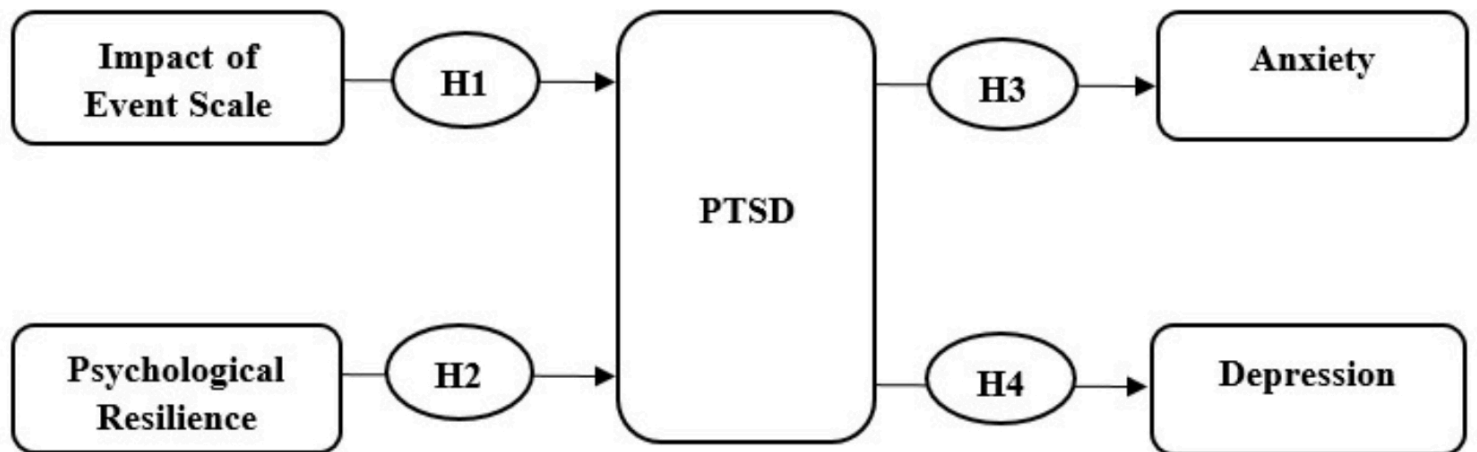


Figure 1

Research Model

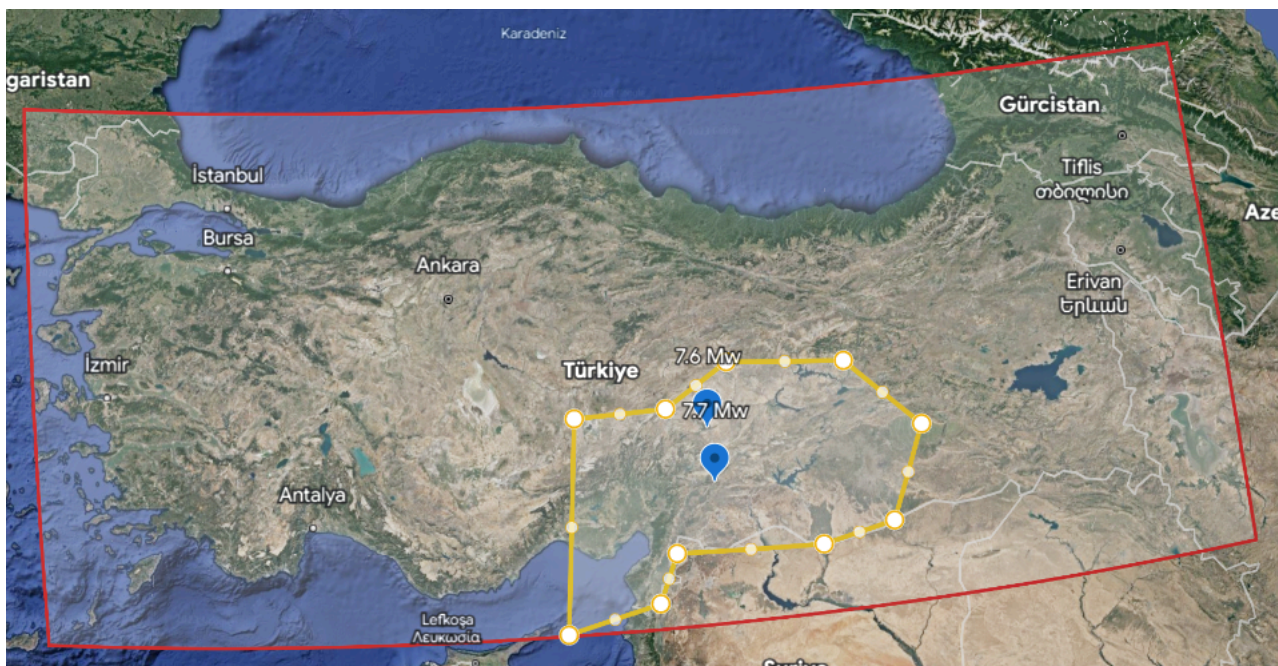


Figure 2

Türkiye Map, Affected Provinces, Epicenters

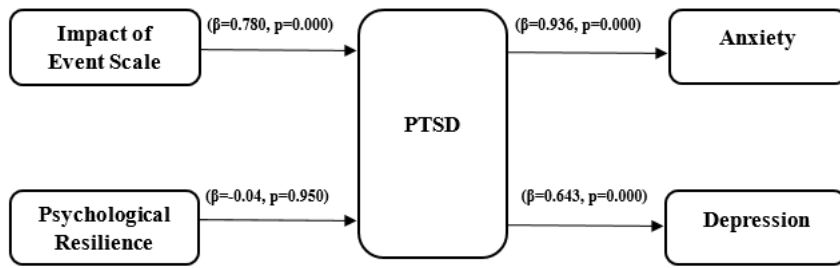


Figure 3

SEM on Mental Disorders of Earthquake Survivors in Kahramanmaraş Earthquakes (2023).