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Title: Resilience and Spiritual Well-being as Predictors of Post-Traumatic Stress Disorder among Earthquake Survivors in Khoy, Iran, 2023

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Abstract

Background: Post-traumatic stress disorder is frequently observed in individuals who have experienced earthquakes and may result in prolonged psychological challenges. Personal capacities, including psychological resilience and spiritual health, could serve as mitigating elements; however, their role in forecasting PTSD severity has not been sufficiently investigated within disaster-affected communities in Iran. The present research sought to determine whether resilience and spiritual well-being can predict the intensity of PTSD symptoms in survivors of the 2023 Khoy earthquake, after accounting for demographic and trauma-related factors

Methods: This investigation utilized a cross-sectional methodology to examine associations among variables. The study cohort consisted of 164 adult survivors, selected through a two-stage cluster sampling approach from public health clinics in the city of Khoy, Iran. Over a three-month data collection period, participants provided responses to standardized assessment tools, which included the 10-item Connor-Davidson Resilience Scale, the Spiritual Well-Being Questionnaire, and the PTSD Checklist aligned with DSM-5 criteria. The gathered data were processed using statistical software, employing bivariate correlation analysis and sequential regression modeling to evaluate the relationships.

Results: Resilience (M = 23.14, SD = 6.39) and spiritual well-being (M = 36.50, SD = 3.40) were significantly negatively associated with PTSD symptoms. In regression analysis, resilience alone explained 33% of the variance (R^2 = 0.33, $p < 0.001$); adding spiritual well-being increased explained variance to 39% (ΔR^2 = 0.06, p = 0.027). Both remained significant unique predictors (β = –0.61 and β = –0.26), respectively.

Conclusion: Resilience and spiritual well-being are key protective factors against PTSD among earthquake survivors in Khoy, Iran, 2023, highlighting their potential utility in culturally informed post-disaster mental health interventions.

Keywords: earthquake; post-traumatic stress disorder; resilience; spiritual well-being; Iran

Introduction

Earthquakes are among the most destructive natural disasters, causing not only widespread loss of life and economic damage (1, 2) but also profound social and psychological disruption, including the erosion of social norms and values (3). Post-traumatic stress disorder (PTSD) is a prevalent psychological condition following earthquakes, characterized by intrusive memories, avoidance, and negative alterations in cognition and mood (4). A meta-analysis of 46 studies (N = 76,101) reported a pooled post-earthquake PTSD prevalence of 23.66% (5), and long-term PTSD has been linked to substance use disorders (6), social isolation (7), and increased suicide risk (8)Therefore, paying attention to factors that influence post-earthquake post-traumatic stress disorder is crucial to maintaining and even improving mental and physical health. Undoubtedly, disaster experience is one of the main factors that influence post-disaster response. Research has consistently demonstrated a dose-response relationship between trauma severity and the likelihood of developing PTSD (4-6). This means that greater exposure to traumatic events is associated with an increased risk of PTSD. Objective factors, such as the death or injury of family members, property destruction, and loss of personal belongings, have been identified as significant predictors of PTSD severity (7, 8). Additionally, subjective experiences, including perceived life threat and worry for others also contribute substantially to PTSD development(4, 9). While traumatic exposure is a key factor in PTSD, psychological and sociodemographic variables beyond trauma severity may further influence its onset and severity. In a study of Turkish earthquake survivors, PTSD symptoms were significantly associated with multiple factors, including: female gender, older age, history of prior psychological distress, acute psychological reactions during the earthquake, proximity to the epicenter, repeated exposure to trauma-related reminders, ethnicity, resilience, spirituality and religious involvement, and negative subjective appraisals of the disaster (10).

Resilience, the capacity of a person to not just endure but prosper when confronted with significant challenges, is a critical element in managing severe life disruptions (11). This capacity can also alter the connection experienced among exposure to catastrophic events, financial damages, and the subsequent development of Post-Traumatic Stress Disorder (12). The influence of various determinants can vary greatly across individuals from diverse cultural backgrounds, social environments, and physical locations (11).Furthermore, it has been demonstrated that resilience, in conjunction with support from one's social network, exerts both a direct influence on PTSD symptoms and an indirect effect, which is mediated through symptoms of anxiety and depressive disorders (4). In recent studies, religious faith has been identified as a significant asset for psychological and social support in managing stress, especially following events that cause trauma to a community. When examining the complex structure of faith-based worldviews, both personal spirituality and organized religious practice function as mechanisms that aid in positive psychological adaptation to difficult circumstances (3). Religious beliefs as a whole are a double-edged sword with various positive or negative aspects in adaptation to traumatic stress and may be effective. Variations in religious teachings, ceremonial practices, community reinforcement, cultural influences, personal traits, and spiritual experiences can significantly influence how faith shapes reactions to traumatic stress and suicidal behavior(13). Studies following the Haiti earthquake indicated that, in the

aftermath of the trauma, many individuals reported increased faith in a higher power and a renewed commitment to religious rituals. However, some reports also documented inter-religious tensions including conflicts between adherents of different Christian sects and violent confrontations with practitioners of Voodoo, whose beliefs and practices were perceived by some groups as representing divine retribution(14). Thus, spirituality plays a dual role in the context of PTSD: while it often serves as a protective resource, it may under certain conditions contribute to symptom exacerbation (15). There are mixed reports on the relationship between resilience and spirituality. Some report no significant relationship between resilience and spirituality(14, 16). Considering that some studies have reported the role of resilience and spirituality in the occurrence of various problems, and taking into account earthquake-prone areas, it has also been reported that there is a positive association between spirituality and people's resilience to trauma after earthquakes (17).In the specific context of Khoy (a city with a long history of seismic activity, including seven major earthquakes since 1843 and hundreds of aftershocks) the psychological aftermath of the January 2023 earthquake was further intensified by the proximity of the catastrophic Turkey earthquake just ten days later, as well as by the spread of distressing misinformation on social media. These compounding stressors created a unique psychosocial context in which resilience and spiritual well-being may serve particularly salient protective functions. Given the region's strong cultural and religious foundations and the absence of localized research on these factors among Khoy's earthquake survivors this study aims to address a critical gap in the trauma and mental health literature. Based on prior evidence, this study aims to examine whether resilience and spiritual well-being predict PTSD symptom severity among adult survivors of the 2023 earthquake in Khoy, Iran.

Methods:

This investigation utilized a cross-sectional and correlational methodological approach. The study population included all adult inhabitants of Khoy City who were exposed to the seismic events occurring on October 6, 2020, and/or January 28, 2023.

A cohort of 164 potential subjects was initially recruited for participation. Recruitment took place via outpatient facilities at eight different urban health service centers located throughout Khoy. The selection of these centers was conducted using a two-phase cluster sampling technique. During the initial phase, eight primary health service hubs were deliberately chosen to provide comprehensive geographical coverage of the various areas within the city. In the subsequent phase, a single auxiliary center was randomly picked from each primary hub. From each of these auxiliary centers, approximately 23 to 25 individuals were selected for invitation using a convenience sampling approach.

Verbal screening was performed at the point of invitation to confirm eligibility. Individuals who failed to satisfy the inclusion prerequisites or who met any of the predefined exclusion conditions were not included in the research project. From the original group of 164 invited participants, 36 were subsequently omitted. Twenty exclusions were due to partially completed responses on essential study measures, which included assessments for psychological resilience, spiritual well-being, or post-traumatic stress disorder. A further 16 exclusions were based on self-reported information, citing either a pre-existing diagnosis of a psychological

disorder, the use of psychotropic medication prior to the earthquakes, or experiencing another significant traumatic incident within the six months preceding the study. Examples of such incidents were severe accidents, physical or sexual assault, a critical medical diagnosis, or the loss of an immediate family member. Consequently, the definitive sample for data analysis included 164 adult survivors of the earthquakes.

Data collection was conducted between December 2023 and February 2024, following approval by the Institutional Research Ethics Committee of Khoy University of Medical Sciences. Written informed consent was obtained from all participants after a clear explanation of the study's purpose, voluntary nature of participation, the right to withdraw at any time without penalty, and the confidentiality of their responses. All data were anonymized at the point of collection using participant ID codes instead of names, stored on a password-protected computer accessible only to the research team, and retained in accordance with national data protection guidelines. No identifying information appears in any published material.

Participants completed three validated Persian instruments. Psychological resilience was assessed using the 10-item Connor-Davidson Resilience Scale (CD-RISC-10), a brief version of the original scale validated by Campbell-Sills and Stein[18]. Each item is rated on a 5-point Likert scale ranging from 0 (*not true at all*) to 4 (*true nearly all the time*), yielding a total score between 0 and 40, with higher scores indicating greater resilience. The Persian version has demonstrated strong internal consistency (Cronbach's $\alpha = 0.85$) and content validity in Iranian nursing populations[19]. In the current sample, Cronbach's $\alpha = 0.84$.

The assessment of spiritual well-being was conducted utilizing the 20-question Spiritual Well-Being Scale (SWBS). This instrument is divided into two domains: Religious Well-Being and Existential Well-Being. Participants indicated their level of agreement with each statement on a 6-point Likert scale, ranging from 1 (representing strong disagreement) to 6 (representing strong agreement). The cumulative scores can vary from 20 to 120, where elevated scores are indicative of a more pronounced sense of spiritual well-being. The Persian version of this scale has been established to possess satisfactory reliability and construct validity for use with adult populations in Iran [20]. For the present research, the calculated Cronbach's alpha coefficient was 0.78.

PTSD symptom severity was assessed using the PTSD Checklist for DSM-5 (PCL-5), a 20-item self-report measure developed to align with DSM-5 diagnostic criteria [20]. Items are rated on a 5-point scale from 0 (not at all) to 4 (extremely), producing a total score between **0 and 80**. The Persian version has demonstrated a five-factor structure, high internal consistency ($\alpha = 0.92$), and strong convergent validity in trauma-exposed Iranian samples [21]. In our sample, Cronbach's $\alpha = 0.91$.

Trauma exposure was assessed using a researcher-developed checklist. Property damage was coded as: 1 = minor, 2 = moderate, 3 = severe, 4 = total destruction. Displacement was categorized as: 1 = living in a tent, 2 = residing in own home, 3 = displaced outside the city. Physical injury was recorded dichotomously (0 = no, 1 = yes).

Data were analyzed using SPSS version 22. Descriptive statistics (frequencies, means, and standard deviations) and Pearson correlation coefficients were computed. A stepwise regression analysis was conducted to predict PTSD symptom severity (PCL-5 total score). In Step 1, resilience (CD-RISC-10 score), was entered into the model; in Step 2, spiritual well-being (SWBS) was added to evaluate its incremental predictive contribution. Demographic variables (age, gender, education, marital status) and trauma-related factors (property damage, displacement, injury) were examined in preliminary analyses but were not significantly associated with PTSD and therefore excluded from the final regression model to maintain parsimony and avoid over-fitting.

Results

Of the 184 participants initially recruited, 20 were excluded due to incomplete questionnaires and 16 more due to missing data on key variables (resilience, spiritual well-being, or PTSD scales), yielding a final analytical sample of 164 participants. The mean age was 37.69 years (SD = 10.73); the majority were female (55.5%), married (68.3%), held at least a bachelor's degree (84.1%), and reported medium to good economic status (87.2%). Most participants (95.1%) had no history of drug use, and 63.4% were currently living in their own homes. Full demographic characteristics are presented in Table 1.

Table 1. Descriptive Statistics of Demographic Variables (N = 164)

Variable	Category	N	Percentages*
Gender	Male	73	**44.51**
	female	91	**55.49**
Marital status	Single	50	**30.49**
	married	112	**68.29**
	Other (divorced/widowed)	2	**1.22**
Educational status	Less than a diploma	2	**1.22**
	diploma	25	**15.24**
	Bachelor's degree	87	**52.99**
	Above bachelor's degree	50	**30.49**
Economic Status	weak	12	**7.32**
	medium(neither very good nor very bad)	105	**63.90**
	Good	46	
	very good	11	**28.05**
			6.71
History of drug use	Yes	8	**4.88**
	No	156	**95.12**
Current Housing	Living in tent	46	**28.05**
	In own home	64	**39.02**
	Displaced (left the city)	54	**32.93**
Property Damage	Minor	75	**45.73**
	Moderate	61	**37.20**
	Severe	24	**14.63**
	Destruction	4	**2.44**
Physical Injury	Yes	19	**11.59**
	No	145	**88.41**

*Note. Percentages are reported to two decimal places. Total N = 164 for all variables

Pearson correlation analyses revealed that resilience was significantly negatively correlated with all PTSD symptom clusters except avoidance (all $p < 0.01$), while spiritual well-being showed weaker, though statistically significant, negative associations with intrusion and emotional numbing ($p < 0.05$). All study variables met assumptions of normality (skewness and kurtosis within ±2), independence of errors (Durbin-Watson = 1.96), and absence of multicollinearity (VIF < 1.03). Correlation coefficients and descriptive statistics are summarized in Table 2.

Table2. Pearson Correlations of Study Variables (N = 164)

	VARIABLES	1	2	3	4	5	6	7	8	M	SD	SKEW	KURT
١	Resilience	—								23.14	6.39	0.45	-0.20
٢	Spiritual well-being	0.16*	—							36.50	3.40	0.75	1.23
٣	Existential health	0.19*	0.36	—						39.94	5.33	0.51	1.14
٤	Intrusion	-0.57	-0.14*	0.02	—					11.48	5.22	0.85	0.17
٥	Avoidance	0.01	0.06	0.05	-0.05	—				5.16	1.92	0.52	0.26
٦	Negative mood	-0.51	-0.10	0.25	-0.77	-0.04	—			7.44	3.03	1.12	1.03
٧	Hyper arousal	-0.45	-0.07	-0.10	-0.60	-0.05	-0.57	—		7.80	3.19	0.56	-0.71
٨	Emotional numbing	-0.45	-0.18*	-0.11	-0.71	-0.03	-0.67	-0.53	—	9.70	4.71	1.16	0.87

Note. *p < 0.05, p < 0.01. M = Mean, SD = Standard Deviation. All values are reported to two decimal places.

Table3. Stepwise Regression Analysis Predicting PTSD Symptoms from Resilience and Spiritual Well-Being

STEP	PREDICTOR	B	β	T	p-value	R²	ΔR²	F	DF
1	Resilience	-1.27	-0.57	-4.82	< 0.001	0.33	—	23.19	(1, 163)
2	Resilience	-1.36	-0.61	-5.30	< 0.001	0.39	0.06	15.06	(2, 162)
	Spiritual well-being	-1.08	-0.26	-2.24	0.027				

*Note. **B** = unstandardized coefficient, **β** = standardized coefficient. All coefficients are reported to **two decimal places**. p < 0.01*

A stepwise regression analysis indicated that resilience alone accounted for 33% of the variance in total PTSD symptoms ($R^2 = 0.33$, $F(1, 163) = 23.19$, $p < 0.001$). Adding spiritual well-being in the second step significantly improved the model, explaining an additional 6% of variance ($\Delta R^2 = 0.06$, $p = 0.027$), for a total of 39% explained variance ($R^2 = 0.39$, $F(2, 162) = 15.06$, $p < 0.001$). In the final model, both resilience ($\beta = -0.61$, $p < 0.001$) and spiritual well-being ($\beta = -0.26$, $p = 0.027$) emerged as significant unique negative predictors of PTSD symptom severity. Existential well-being did not contribute significantly and was excluded from the model. Regression results are detailed in Table 3.

Discussion

This study examined the role of resilience and spiritual well-being in relation to PTSD symptoms among survivors of the 2023 Khoy earthquake. Findings indicate that individuals with greater resilience and higher levels of spiritual well-being tend to experience less severe PTSD symptoms, suggesting that these internal resources may buffer the psychological impact of traumatic disaster exposure.

These results are consistent with prior research on disasters such as floods, hurricanes, and wildfires, which have shown that spirituality encompassing both religious and existential dimensions, can serve as a critical component of resilience by fostering adaptive coping, strengthening social bonds, enhancing self-efficacy, and providing meaning in the face of loss(22, 23). In a study of survivors of the 2023 Turkey earthquake, Kirks and Shanley (24)found that spirituality exerted a strong positive influence on resilience, particularly by mitigating symptoms of depression, anxiety, and stress in the aftermath of disaster. Similarly, research among African American survivors of Hurricane Katrina revealed that spiritual and religious practices served as key resources for enhancing resilience, primarily through improving social support, reducing PTSD symptoms, and facilitating post-disaster reconstruction(25). Following the Alberta wildfires, strengths-based, spiritually mindful interventions were identified as protective factors and therapeutic tools, helping children, youth, and families cope with trauma and build long-term resilience(26).

The protective effect of resilience may be explained by its association with adaptive cognitive emotion regulation strategies, which help individuals, reframe negative experiences and reduce emotional reactivity(27). In line with Wang et al.(28, 29), our findings support the notion that resilience buffers the impact of trauma exposure on PTSD, particularly by mitigating the effects of sleep disturbance and negative mood. Specifically, their moderated mediation analyses indicated that the association between earthquake exposure and PTSD was significant only among individuals with low resilience, underscoring resilience as a key moderator in post-trauma adaptation.

Spiritual well-being, on the other hand, may operate through meaning-making and existential coherence. Spirituality constitutes an essential part of the semantic system for many individuals and shapes their coping reactions. While positive spiritual appraisals can foster hope and connection, spiritual struggle such as attributing trauma to divine punishment or perceiving a weakening of God's power can lead to spiritual dissatisfaction and, in higher concentrations, has been associated with symptoms of depression, suicide, and PTSD in various trauma samples(30).

It is also worth noting that experiential avoidance a behavioral tendency to avoid painful internal experiences such as thoughts, emotions, or memories may influence PTSD trajectories(31). Although avoidance did not emerge as significantly linked to resilience in our sample, this may reflect the specific context of the Khoy earthquake, which involved limited structural collapse and mass casualties, potentially reducing the reliance on avoidance as a dominant coping strategy.

Further supporting the role of psychological resources, a study on military veterans found significant associations between all three PTSD subscales (re-experiencing, avoidance, and hyper arousal) and both resilience and quality of life(32). Although that population differs from our civilian earthquake survivors, the consistent inverse relationship between resilience and PTSD across diverse trauma contexts reinforces the robustness of this protective factor.

Notably, in our study, resilience was significantly associated with all PTSD subscales except avoidance, which aligns with the contextual explanation above and suggests that the expression of PTSD symptoms may vary based on disaster characteristics and cultural coping norms.

The study has several limitations. First, the cross-sectional design precludes causal inferences. Second, data were collected via self-report measures, which may be subject to recall or social desirability bias. Third, the sample was limited to survivors in Khoy, reducing generalizability to other cultural or geographic contexts. Finally, individuals with severe psychiatric symptoms may have been underrepresented due to non-participation or inability to complete questionnaires.

These findings support integrating resilience-enhancing and spiritually sensitive approaches into post-disaster mental health programs. Specifically, interventions that cultivate adaptive coping, foster meaning-making, and draw on culturally relevant spiritual resources may help mitigate PTSD symptoms and promote psychological recovery among survivors. Future research should employ longitudinal or experimental designs to determine whether actively strengthening these internal resources can lead to sustained reductions in PTSD risk over time.

Conclusion

This study highlights resilience and spiritual well-being as significant protective factors against PTSD symptoms among earthquake survivors in Khoy. While these associations do not imply causation, they suggest that culturally sensitive interventions targeting these resources may help mitigate post-disaster psychological distress. Future longitudinal studies are needed to confirm causal pathways and evaluate intervention efficacy.

Acknowledgments

Conflict of interest

The authors state that there are no competing interests related to this research, its writing, or its publication.

Ethical considerations

The research was carried out following the ethical standards of the Declaration of Helsinki and received approval from the Ethics Committee at Khoy University of Medical Sciences (Approval Code: IR.KHOY.REC.1402.036). Before any data were gathered, informed consent

was acquired from every participant. Each author played a role in designing the study, analyzing the data, and preparing the manuscript.

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Highlights

This study found that resilience and spiritual well-being significantly predict lower PTSD symptoms in Khoy earthquake survivors, explaining 57% and an additional 4% of symptom variance, respectively. As the first local study in this high-risk seismic region, it underscores the value of culturally grounded, resilience- and spirituality-based mental health support after disasters.

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