International Journal of Clinical Research

Original Research

Assessing the Effects of the 2023 Turkish Earthquakes on Mental Health in Lebanon: A Cross-sectional Study

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DOI : https://doi.org/10.38179/ijcr.v4i1.319

Received: 2024.02.20
Accepted: 2024.03.19
Published: 2024.06.15

Financial support: None
Conflict of interest: None
Patient consent: The study protocol was approved by the Institutional Review Board (IRB) in accordance with ethical standards. The study respected participants' anonymity and confidentiality.

Abstract

Background: On the 6 of February 2023, an earthquake registering 7.8 on the Richter Scale hit the South and center of Turkey, as well as the North and West Syria. Subsequently, another seismic event with a magnitude of 7.5 ensued a few hours later. Two weeks later, a new earthquake of 6.4 magnitude shook both countries again. These two events left behind more than 50000 deaths and a lot of damage, both economically and psychologically, which affected the Lebanese population.

Aim: This study evaluates the adverse effects of these earthquakes on the mental health of people in Lebanon.

Methods: This is a cross-sectional study conducted between 6 March, and 23 March 2023, using an online survey. The questionnaire was divided into 4 sections: demographics, the mental health of participants, anxiety before the earthquakes, and anxiety after the earthquakes using the Lebanese Anxiety Scale- to differentiate between healthy and anxious participants.

Results: The study involves 670 Lebanese participants aged 18 or above. Anxiety proportion rose post-earthquakes. Pre-earthquakes, anxiety risk factors included female gender, younger age, Beirut residency, mental health issues, and medication use; these factors also significantly raised anxiety after earthquakes.

Conclusion: This study demonstrates a remarkable escalation in anxiety proportion following the earthquakes. Pre-existing risk factors such as female gender, younger age, Beirut residency, mental health issues, and medication use for symptom relief exhibited a heightened association with anxiety after the tectonic events. These findings deepen the importance of targeted interventions to address the psychological impact of earthquakes on vulnerable populations.

Keywords: Earthquake, Mental health, Anxiety, Lebanon, Correlates

Introduction

Natural disasters have been among the most frightening and devastating phenomena throughout history. On February 6, a 7.8 magnitude earthquake struck southern and central Turkey, and northern and western Syria at 4:17 am local time which was followed by another one of magnitude 7.5 at 1:24 pm, the epicenter was located 23 kilometers east of Nurdagi, in Turkey's Gaziantep province [1]. The region had not witnessed a quake of this strength for a long time. While still recovering from the first two earthquakes, a new quake of 6.4 magnitude hit both countries on February 20, the epicenter was located in the town of Defne, in Hatay province [2]. As a result, 45,968 and 7,259 confirmed deaths, respectively in Turkey and Syria, have been reported, exceeding 50,000 victims [3]. Being in the same geographical region, the nearby countries took their share of earthquakes and aftershocks including Lebanon, Iraq, Cyprus, and others [4]. However, no physical or economic losses were noted.

Destructive natural disasters are not only confined to the number of death tolls, injuries, and financial losses but also result in critical mental health issues. According to World Health Organization (WHO), the initial psychological assessment after the earthquake in TURKEY revealed states ranging from psychological distress to shock [5]. This was demonstrated in the nearby countries including Lebanon where people started leaving their homes to find a safer place away from crowded buildings fearing a similar earthquake would hit the region. Many studies have evoked the effect of earthquakes on the mental health of survivors [6–10]. It is evidenced that risk factors for mental health include age [11], female sex [7,12,13], and previous psychiatric problems [14]. Nonetheless, no previous studies have been conducted to evaluate the effect of the recent Turkish and Syrian earthquakes on the mental health of the region. This study will allow us to assess the mental status of the people residing in Lebanon and clarify the associated risk factors.

Recognizing the mental health outcome of the population in Lebanon and the associated risk factors is fundamental to identifying vulnerable populations and providing the necessary psychological and emotional support.

Materials & Methods

Setting, study design

This is a cross-sectional study conducted on people residing in Lebanon. An anonymous online questionnaire was created using Google Forms and was spread via several social media platforms between 6 March 2023 and 23 March 2023. To reach a larger sample of the population with a wide geographical distribution in the Lebanese regions, the snowball method was applied.

A pilot study was conducted to ensure the questionnaire was clear by asking a small group of participants if they encountered any issues while filling out the form. Afterward, the final version of the questionnaire was diffused.

Survey and participants

The survey was self-administered. The participation was completely voluntary, and no financial reward was offered. Before filling out the survey, the participants were informed that the questionnaire was anonymous and that the data would be used only for research purposes. Similarly, to make all questions clear, examples of mental health disorders were provided for the options that include multiple types and may be confusing. Out of the 707 responses that were collected, 37 participants were excluded due to their age being less than 18 years old or their non-residence in Lebanon. Consequently, the total acceptance rate of the filled questionnaires was 94.7%: 670 participants were therefore included in the current study based on the inclusion criteria: aged 18 or more and residing in Lebanon.

Data collection tool

Since different sociodemographic backgrounds were reached, the questionnaire was available in both Arabic

and English, using forward and back translation methods, to provide both languages in the questionnaire. The questionnaire was divided into 4 sections consisting of 29 questions in total. The average time to fill out the form was 10 minutes.

First, the demographic data were collected: gender, age, governorate of residence, level of education, working status, and marital status. Second, the participant was asked to declare if he was diagnosed with a mental health disorder by a specialist and choose which type, he suffers from accordingly. The third and fourth sections investigated the mental health of the participants before and after the earthquakes respectively.

In each of the last two sections, the participant's anxiety level was evaluated by answering 10 questions from the Lebanese Anxiety Scale (LAS-10). In addition to the questions of the LAS-10, in the third section, the participant was asked to mention if he was using a medication to relieve his symptoms, if were present, before the earthquake. Therefore, the answers in the fourth section (after the earthquake) were compared to the answers in the third section (before the earthquake) to determine the effect of the earthquake on the mental health of the people in Lebanon.

The Lebanese Anxiety Scale (LAS-10) is a 10-item scale used to screen for anxiety in adult patients and can be used in clinical practice. A score of 13.5 is a cut-off between healthy and anxious participants. The positive predictive value of the LAS-10 score is 26.9% whereas its negative predictive value is 95.2% [15].

Statistical analysis

The collected data was converted from Google Forms into Microsoft Excel. The analysis was conducted using the Statistical Package of the Social Sciences (SPSS) version 22.0 for Windows. For descriptive analysis, frequency and percentage were used for categorical variables, and mean and standard deviation for quantitative variables. The distribution of these variables was considered normal using visual inspection of the histogram, while the skewness and kurtosis were lower than 1. These conditions are considered compatible with normality with a sample size higher than 300.

For the bivariate analysis of continuous variables, the Student's T-test was used to compare the means between 2 groups and ANOVA to compare between three groups or more, after checking for homogeneity of variances using Levene's test. In case the variances are not homogenous, the corrected T-test and the Kruskal-Wallis test are used, respectively. After ANOVA and Kruskal-Wallis significant testing, post hoc analyses were conducted using Bonferroni adjustment. A Spearman correlation coefficient was used between continuous variables, and a gamma coefficient to assess the association between ordinal variables. To compare the dependent variable before and after the earthquake, a paired sample T-Test was used.

As for the multivariable analysis, multiple linear regressions were conducted to assess the correlates of dependent variables in the whole sample, after checking the residues' normality, the linearity of the relationship, the absence of multicollinearity, and the homoscedasticity assumptions; a stepwise method was used to reach the most parsimonious model. The beta coefficient, its 95% Confidence Interval, and the p-value were reported. In addition, repeated measures ANOVA was used to calculate the marginal means after adjustment over potential confounders. A p-value <0.05 was chosen to designate statistical significance.

Results

Sample description

This study includes 670 participants aged 18 or older and residing in Lebanon. To submit the survey, the participants were required to fill out all the sections of the questionnaire. Out of 670 participants, 494 were females (73.7%). The majority were not married including single, widowed, and divorced (86.1%) and the average age of the participants was 24.09 ± 8.03 (ranging from

18 to 65 years). As for the level of education, most were university students (87.6%). Among these participants 347 were students (51.8%), 137 were students and employed (20.4%), 115 were employed (17.2%), and 71 were unemployed (10.6%).

The participants were widely distributed. They were from Akkar (n=17, 2.5%), Baalbeck-Hermel (n=32, 4.8%), Beirut (n=187, 27.9%), Beqaa (n=39, 5.8%), Keserwan-Jbeil (n=8, 1.2%), Mount-Lebanon (n=193, 28.8%), Nabatieh (n=43, 6.4%), North Lebanon (n=34, 5.1%), and South Lebanon (n=117, 17.5%).

Participants mental health

Anxiety before and after the earthquake

The Mean LAS-10 was 13.05±6.62 SD and 13.83±7.86 SD, before and after the earthquake respectively (p<0.001). Before the earthquake, 296 participants (44.2%) scored more than 13.5 which is the cut-off for LAS-10. After the earthquake, this number increased to 321 participants (47.9%) (Table 1).

When we divided the participants according to their gender, a higher percentage of females compared to males showed a LAS-10 score above 13.5 before (48.4% vs 32.4%) and after (53.6% vs 31.8%) the earthquakes (p<0.001) (Table 2).

According to Table 3, the LAS-10 score has significantly (p-value<0.001) increased in both genders before and after the earthquakes while maintaining a score below the cut-off for males and a score above the cut-off for females. As for those who were previously diagnosed with a mental health disorder, they reflected a higher significant LAS-10 score (17.85±6.66 SD) which is above the cut-off before the earthquakes compared to those who were not diagnosed with a mental health disorder (12.23±6.26 SD), (p-value 0.01). Again, their score remained above the cut-off after the earthquakes, with a higher value (19.48±8.29 SD) compared to those not diagnosed by a mental health disorder (12.86±7.37 SD), (p-value<0.001). An inverse significant correlation was found between the age and the LAS-10 score before (p-value=0.03) and after (p-value=0.02) earthquakes. Furthermore, the LAS-10 before the earthquakes was found to be significantly correlated with the LAS-10 after the earthquakes (p-value<0.001). Meanwhile, being single/widowed/divorced, university level, or unemployed showed a higher LAS-10 before and after the earthquakes compared to being married, at the school level, or employed. However, these results were not significant (Table 1 in supplementary material).

Multivariable analysis

When taking the LAS-10 before the earthquake as the dependent variable, the Beta regression model analysis revealed that females (β= 2.644, 95% CI=1.580_3,709), age (β=-0.123, 95% CI=-0.202_-0.045), usage of medication to relieve symptoms before the earthquakes (β=4.229, 95% CI=2.369_6.089), residence in South vs Beirut (β=-1.928, 95% CI=-3.217_-0.639) and previous diagnosis with a mental disorder (β=4.495, 95% CI=3.063_5.928) were significant predictors of a higher score of LAS-10 (Table 2 in supplementary material).

When taking the LAS-10 after the earthquake as the dependent variable, the Beta regression model analysis revealed that females (β=3.603, 95% CI=2.341_4.865), age (β=-0.147, 95% CI=-0.240_-0.053), usage of medication to relieve symptoms before the earthquakes (β=3.515, 95% CI=1.309_5720), residence in South vs Beirut (β=-2.238, 95% CI=-3.766_-0.710) and previous diagnosis with a mental disorder (β=5.840, 95% CI=4.142_7.539) were significant predictors of a higher score of LAS-10 (Table 2 in supplementary document) .

Estimated Marginal Means

The adjusted mean of the LAS-10 was significantly higher after the earthquake with a score of 15.90 compared to a score of 14.64 before the earthquake (Figure 1, p-value <0.05). Taking into consideration the adjusted mean of the LAS-10, those who

Table 1: Description Summary of the used scales

	Mean (SD)	Median	Minimum score	Maximum score	LAS categories	
					Lowest than 13.5	More than 13.5
LAS-10 before the earthquake	13.05 ±6.62	13.00	3.00	40.00	374 (55.8%)	296 (44.2%)
LAS-10 after the earthquake	13.83 ±7.86	13.00	3.00	40.00	349 (52.1%)	321 (47.9%)

Table 2: LAS-10 categories before and after the earthquake, according to gender

	LAS-10 before			LAS-10 after		
	Lowest than 13.5	More than 13.5	p-value	Lowest than 13.5	More than 13.5	p-value
Gender						
Male	119 (67.6%)	57 (32.4%)	<0.001	120 (68.2%)	56 (31.8%)	<0.001
Female	255 (51.6%)	239 (48.4%)		229 (46.4%)	265 (53.6%)	

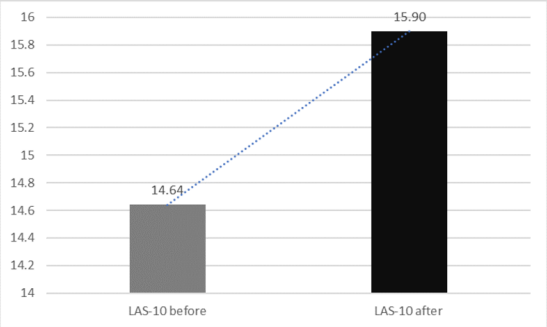

Figure 1: The adjusted mean of the LAS-10 scales before and after the earthquake (covariates: gender, age, marital status, level of education, working status, using medication and governorate) (p-value <0.05)

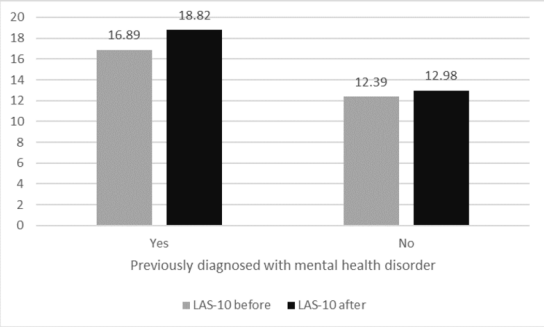

Figure 2: The adjusted mean of the LAS-10 before and after the earthquake between those diagnosed previously with a mental disorder (covariates: gender, age, marital status, level of education, working status, using medication and governorate) (p-value <0.05)

were previously diagnosed with mental health disorders had a significant increase in their mean score from 16.89 before the earthquakes to 18.82 after the earthquakes. Similarly, those who were not diagnosed with a mental health disorder displayed an increased score after the earthquake (from 12.39 to 12.98), which is still significant (Figure 2, p-value <0.05).

Discussion

The present study revealed a significant level of anxiety after the earthquakes that struck Turkey and the nearby regions in Lebanon. We identified that female sex, younger age, residence in Beirut, previous diagnosis of mental health disorder, and usage of medications to relieve anxiety symptoms were significantly correlated with higher anxiety levels before the earthquake and most importantly, a rise in their level after the earthquakes. Residency in Beirut was correlated with higher LAS-10 scores before and after the earthquakes; this could be the reflection of Lebanese susceptibility to more emotional damage due to the ongoing economic crisis and the recent Beirut Blast.

Additionally, a high LAS-10 score before the earthquakes was associated with a higher score after the earthquakes. As a previous study stated, the earthquakes affected the psychological status of the survivors in Turkey raising their levels of anxiety and stress [16]. Similarly, even though Lebanon was a victim of only aftershocks, and no

physical injuries were noted, the Lebanese population witnessed the effect of this disaster on its targets through the news on social media experiencing increased levels of anxiety. Before the earthquakes, 44.2% of the people residing in Lebanon had a LAS score above 13.5 which indicates higher anxiety states in the population living in Lebanon. These high levels of anxiety could be attributed to previous wars Lebanon had experienced and the recent Beirut Blast [17–20]. Subsequently, after the earthquakes, this number significantly increased to 47.9%. Not only has the percentage of the participants having a score above 13.5 increased but also the LAS-10 reflected a higher mean after the earthquakes. While taking the adjusted mean into account, the scale has risen from 14.64 to 15.90. This finding was consistent with other studies that also revealed a negative impact of earthquakes on mental health [7,21–23].

Going further into detail, females were associated with higher LAS-10 scores than men before the earthquakes. Indeed, 48.4% of females were above the cut-off while 32.4% of men were so. This finding was demonstrated by other studies, reflecting higher mental health problem levels among females 24,25. Furthermore, more females were having anxiety symptoms after the earthquakes. The percentage has increased from 48.4% to 53.6% of females. At the same time, their mean LAS-10 score has increased from 13.82 to 14.87. This study is comparable with other studies proving that females are more affected than males by natural disasters [12,13].

We found that age was inversely correlated with LAS-10 score meaning that younger age participants suffered from higher anxiety levels before and after the earthquakes. This finding is consistent with an American study that showed a higher prevalence of mental health problems among younger adults 26. Additionally, a study conducted in Japan found that younger age was associated with more negative psychological effects after the earthquake [11].

In our study, 14.6% of the participants were previously diagnosed with a mental health disorder by a specialist which explained their higher scores before the earthquakes. They presented an adjusted mean of 16.89 while those who did not mention a previous diagnosis had a mean of 12.39. Moreover, those participants were highly affected by the earthquakes manifesting an adjusted mean of 18.82 post-earthquakes. Therefore, the presence of mental illness renders them more susceptible to adverse emotions and worsening of their mental status evidenced by their higher LAS-10 scores. This finding is consistent with another study that revealed previous psychiatric problems as a risk factor for negative outcomes after earthquakes [14]. In parallel, participants (8.2%) who were using medication to relieve their anxiety symptoms mentioned in the LAS-10 before the earthquakes were found to be positively correlated with higher scores on the LAS-10 before and after the earthquakes.

A strength of this study was the distribution of the questionnaire soon after the second earthquake making it possible to assess its direct effect on the mental health of people residing in Lebanon. This study was however limited by its cross-sectional design, hampering a causal relationships demonstration. The collection of data made through an online survey and spread via the snowball method also had its strengths and limitations: one strength of this study was the ability to reach a large sample of the population from different regions of Lebanon, although a selection bias is still possible due to the non-random sampling method. Another limitation is that the sample mostly consisted of university students rendering the mean age 24.09 ± 8.03 SD, which prevented us from evaluating the levels of anxiety in older adults. Furthermore, evaluating anxiety, especially before the earthquake, might have subjected the study to a recall bias. The online method was necessary due to the economic crisis happening in Lebanon that prevented us from doing a live questionnaire but enabled us to recruit a widespread sample across the country at a low cost. Using the

standardized and validated in the Lebanese population LAS-10 is a strength, but we only managed to measure anxiety in adults, with no assessment of other mental health problems, like depression or stress. One reason for that was the willingness not to lengthen the questionnaire to prevent boring people and having biased answers. Lastly, the self-reported answers may be considered a limitation since they could have caused objectivity bias, leading to non-differential information bias. Further studies that would consider these limitations would be recommended, while the long-term effect of earthquakes on mental health should also be studied.

Conclusion

Despite its limitations, to our knowledge, this study was the first to be conducted in Lebanon to investigate the effect of earthquakes on the mental health of the population. Furthermore, it provided significant evidence that females, younger ages, Beirut residents, mental health patients, and those using medications are more susceptible to the harmful emotional effects of natural disasters. Thus, special attention should be delivered to the high-risk population to limit the deleterious impact of recent events on their mental health.

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