

# ASSESSING THE IMPACT OF THE 2023 TÜRKİYE–SYRIA EARTHQUAKE ON SLEEP DISTURBANCES AMONG CHILDREN AND ADOLESCENTS

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## ABSTRACT

Despite growing evidence that disasters adversely affect children's sleep, data on displaced Syrian children following the 6 February 2023 Türkiye–Syria earthquake remain scarce. This study investigated the prevalence and determinants of sleep disturbances among displaced Syrian children and adolescents one month after the earthquake. A cross-sectional study was conducted from March to April 2023 among 150 participants aged 7–17 years residing in five government shelters in Syria. Sleep disturbances were assessed using the Child and Adolescent Sleep Checklist (CASC), and data were analyzed using independent-samples t-tests, one-way analysis of variance, and Pearson correlation. Clinically significant sleep disturbance (CASC  $\geq 18$ ) was identified in 95.3% of participants. Irregular nocturnal sleep affected nearly all participants, while 44.7% experienced insufficient sleep. Children aged 7–12 years had significantly higher scores for sleep breathing/unstable sleep and parasomnia/sleep movement than adolescents (both  $p \leq 0.001$ ). Educational grade was associated with multiple sleep domains, whereas longer nocturnal sleep duration was associated with lower sleep disturbance scores (both  $p < 0.05$ ). These findings reveal a substantial burden of sleep disturbance among displaced children following a major disaster and support integrating age-specific sleep assessment and targeted interventions into post-disaster pediatric care.

Keywords: *Türkiye–Syria earthquake; sleep disturbances; children; adolescents; Syria; displacement*



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## BACKGROUND

Sleep serves as essential nourishment for the brain and plays a vital role in the functioning of various organs. The duration and quality of sleep differ among individuals and age groups. Similar to other age groups, children and adolescents require more sleep than adults. According to the most recent sleep guidelines from the American Academy of Sleep Medicine, children aged 6 to 12 should obtain 9 to 12 hours of sleep per night, whereas adolescents aged 13 to 18 should aim for 8 to 10 hours. Sleep is crucial for removing metabolic waste products from the brain and regulating brain activity,

particularly during memory consolidation (Paruthi et al., 2016). However, several factors, such as earthquakes, can disturb sleep patterns.

The earthquake, measuring 7.5 MW, was one of the most powerful to strike northwest Syria in over eighty years, occurring on February 6, 2023 (Över et al., 2023). Subsequently, hundreds of aftershocks followed (Ahmed et al., 2023). According to the United Nations, Syria's population is approximately 23 million, and approximately 11 million individuals have been affected by the earthquake

(Balikuddembe et al., 2024; World Health Organization, 2023).

Earthquakes are recognized as the most frequent natural disasters (B. Tang et al., 2017). They are unavoidable and cause human casualties and property damage, along with significant long-term effects on the psychological well-being of affected individuals, particularly children and adolescents. Another consequence is sleeping disruption, which is commonly observed in children and adolescents who are victims of disasters. Several reviews have indicated that individuals in these age groups have experienced sleep changes, which indicate that individuals impacted by natural disasters often suffer from sleep disturbances (Giannakopoulos & Kolaitis, 2021).

A meta-analysis of sleep disturbances in traumatized children indicates a prevalence ranging from 3% to 77.1% (Rolling et al., 2025). According to Tang et al. (2018), general sleep disturbances among children and adolescents living in families displaced by Hurricane Katrina were 46% at 24 months and 50% at 30 months after the incident. Additionally, 46% of young evacuees from Hurricane Katrina experienced sleep problems. Another study involving 1,919 junior high students found that they slept fewer hours than before the 2011 earthquake and tsunami disaster in Japan.

Key aspects of sleep disturbance include insomnia, which is the inability to fall asleep or achieve restful sleep; short sleep duration, referring to the limited amount of sleep an individual obtains; difficulty initiating sleep, characterized by the challenges in falling asleep; and multiple awakenings, defined as the number of times an individual wakes during the night (McCarthy, 2021). Additionally, daytime sleepiness can be a result of PTSD, with affected individuals often exhibiting increased sleep fragmentation or arousals, primarily occurring at night. This disruption is considered to be a significant factor contributing to both PTSD and associated sleep disorders (Rezayat et al., 2020).

Therefore, children require significantly more sleep than adults to support normal development, which is characterized by a prolonged growth and development period. This research is significant because sleep disturbances caused by major disasters can result in mental health disorders that persist for years. Some negative effects of insufficient sleep include poor concentration, low academic performance among children and adolescents, unacceptable behavior problems, depression, high blood pressure later in life, and decreased daytime alertness.

Grønli et al. (2017) emphasized that sleep disturbances compromise the cognitive and academic outcomes of children who have experienced trauma and acknowledged that disrupted sleep is a defining characteristic of PTSD. This is supported by several publications demonstrating that sleep disturbances following trauma exacerbate both emotional and cognitive difficulties, as well as PTSD symptoms, which, in turn, further impair sleep (Kakaje et al., 2021). For children and adolescents, this cycle is particularly devastating during disasters such as earthquakes, as it threatens to worsen an already fragile mental health condition.

Moreover, Alfuqaha et al. (2023) argue that trauma, including natural disasters, adversely affects psychological functioning (Warsini et al., 2022). These disruptions interfere with sleep quality and exacerbate coping mechanisms, manifesting as hyperarousal, nightmares, and insomnia. Addressing these issues through interventions such as cognitive-behavioral therapy for insomnia (CBT-I) or trauma-sensitive therapy

could help break this cycle and positively impact both sleep and PTSD symptoms. Overall, this study highlighted the need to improve sleep management within the broader context of trauma recovery, particularly in regions like Syria (Alfuqaha et al., 2023; Kakaje et al., 2021). Future services must prioritize sleep, given the long-lasting negative effects of disasters on mental health of vulnerable populations.

## METHOD

### Study design

This cross-sectional descriptive study was conducted in March and April 2023, approximately one month after the 6 February 2023 Türkiye–Syria earthquake. Data were collected in five government-run shelters for displaced families located in the cities of Latakia and Jableh (Latakia Governorate) and Aleppo (Aleppo Governorate), Syria. These three sites were selected because they hosted the largest concentrations of earthquake-displaced households in the study region and because shelter management granted research access.

### Sample

At the time of data collection, 457 children and adolescents aged 7–17 years were registered as residents across the five shelters and constituted the eligible population. Of these, 150 were enrolled through convenience sampling, yielding a participation rate of 32.8%. Participants were approached during daytime hours in shelter common areas over the data collection period; recruitment continued until the target sample was reached. The remaining eligible residents were not enrolled because they were absent during data collection visits, declined participation, did not have a parent or guardian available to provide consent, or did not meet the eligibility criteria below.

Inclusion criteria: (a) aged 7–17 years at the time of interview; (b) displaced from the family home as a direct result of the 6 February 2023 earthquake and residing in one of the five participating shelters for at least two weeks prior to interview; (c) accompanied by a parent or legal guardian able to provide written informed consent and to verify responses; (d) able to communicate in Arabic and to understand and respond to the interview questions; and (e) child assent obtained.

Exclusion criteria: (a) a documented diagnosis of a primary sleep disorder, neurological condition, or intellectual or developmental disability that would preclude reliable self-report; (b) acute physical injury or illness requiring medical care at the time of data collection; (c) current use of sedative, hypnotic, or psychotropic medication known to affect sleep; and (d) parent or child refusal to participate.

### Instrument

Two tools were used in this study; both were written in Arabic to facilitate communication between the researchers and the children.

Tool I socio-demographics, including age, gender, school grade, household size, current shelter (place of residence), and loss of a family member. Trained interviewers recorded responses during structured interviews using predefined response categories.

Tool II: Japanese version of newly developed sleep screening questionnaire: The Child and Adolescent Sleep Checklist (CASC) is a sleep screening instrument originally developed and validated in Japan (Oka et al., 2009) and subsequently translated and validated in other languages, including Chinese (Yang et al., 2020). It consists of 36 items divided

into two parts. The first part includes 12 questions about sleep during the previous week, covering both nighttime and daytime sleep. The second part comprises 24 statements rated on a four-point Likert scale, where 0 = Never, 1 = Occasionally, 2 = Usually, and 3 = Always. Item scores are subdivided into four categories: bedtime issues (Q1-Q6), sleep breathing and unsteady sleep (Q7-Q12), parasomnia and sleep movement (Q13-Q18), and daytime issues (Q19-Q24), with each category containing six questions.

The CASC items were administered in Arabic. Bilingual health professionals reviewed the questionnaire to ensure clarity and cultural appropriateness for Syrian children and adolescents. Formal psychometric testing of the Arabic version was not conducted in this study and should be addressed in future research. Reliability testing showed a Cronbach alpha of 0.83.

### Data collection

Constructed interviews were conducted with each participating child. The interviews took place in a relatively private room provided by the shelter's management to make the child and parent feel as comfortable as possible.

The researchers asked the children questions in the language they commonly spoke to avoid misinterpretation. Two researchers collected data during each interview. They met beforehand to divide the tasks, with one asking the questions and the other writing the children's answers on the questionnaire. Each interview lasted 20 to 25 minutes, allowing the children sufficient time to understand the questions and provide their answers. Afterwards, the answers were validated by the child's mother.

Descriptive statistics—including frequency percentages, means, and standard deviations—were used to summarize participant characteristics and CASC domain scores. Independent-samples t-tests compared mean sleep disturbance scores across two-category variables (age group and gender). One-way ANOVA was employed to compare mean scores across school grades (three categories). Pearson correlation analysis assessed the associations between sleep disturbance (CASC total score) and night sleep duration within each age group. Statistical significance was set at  $p \leq 0.05$  (two-tailed).

### Ethical considerations

Ethical approval was obtained under the Al-Furat University Research and Ethics Policy (Ref No.1/2023), approved on 10 February 2023. The shelter management also granted permission to conduct the study. Written informed consent was obtained from parents or guardians, and assent was obtained from the children after explaining the study's purpose, voluntary participation, and confidentiality. Interviews were conducted in a private space, and children were free to discontinue the interview at any time without any consequences.

After explaining the purpose of the study, formal approval was obtained from each shelter's management. The children and their parents also provided written consent after the study's purpose was explained to them, and they were assured that all collected data would remain confidential and be used solely for research purposes.

## RESULT

**Table 1. Demographic data of the participants (n=150)**

| Variable    | n | % |
|-------------|---|---|
| Age (years) |   |   |

| Variable                          | n   | %    |
|-----------------------------------|-----|------|
| 7–12                              | 89  | 59.3 |
| 13–17                             | 61  | 40.7 |
| Gender                            |     |      |
| Male                              | 66  | 44   |
| Female                            | 84  | 56   |
| Grade of School                   |     |      |
| Elementary                        | 82  | 54.7 |
| Preparatory                       | 51  | 34   |
| Secondary                         | 17  | 11.3 |
| Number of People in the Household |     |      |
| <4                                | 4   | 2.7  |
| 4–6                               | 133 | 88.7 |
| >6                                | 13  | 8.7  |
| Place of Residence (5 Shelters)   |     |      |
| Sha'bat Al-Tugh                   | 34  | 22.7 |
| Almalab Albaladee                 | 48  | 32   |
| Female School                     | 30  | 20   |
| Jihad Khair Beyk School           | 23  | 15.3 |
| Al-Basil Center                   | 15  | 10   |
| Loss of a Family Member           |     |      |
| No                                | 142 | 94.7 |
| Yes                               | 8   | 5.3  |

Table 1 summarizes the participants' demographics. The majority were aged 7–12 years (59.3%), female (56.0%), and attending elementary school (54.7%). Most households consisted of 4–6 members (88.7%). The largest proportion of participants resided in the Almalab Albaladee shelter (32.0%). Additionally, most participants reported no loss of a family member (94.7%).

**Table 2. Sleep patterns reported by participants one month after the earthquake (n = 150)**

| Variable                          | n   | %    |
|-----------------------------------|-----|------|
| Number of Sleeping Hours at Night |     |      |
| 7–12 years (n = 89)               |     |      |
| Less normal                       | 87  | 97.8 |
| Normal                            | 2   | 2.2  |
| 13–17 years (n = 61)              |     |      |
| Less normal                       | 60  | 98.4 |
| Normal                            | 1   | 1.6  |
| Falling Asleep                    |     |      |
| 20 minutes or less                | 33  | 22   |
| 40 minutes or less                | 59  | 39.3 |
| 1 hour or less                    | 45  | 30   |
| More than 1 hour                  | 13  | 8.7  |
| Quality of Sleep at Night         |     |      |
| Get enough sleep                  | 11  | 7.3  |
| Get almost enough sleep           | 21  | 14   |
| I do not get enough sleep         | 67  | 44.7 |
| Do not get enough sleep at all    | 51  | 34   |
| Waking Up in the Morning          |     |      |
| Wake up by myself                 | 89  | 59.3 |
| My alarm wakes me up              | 13  | 8.7  |
| Someone wakes me up               | 48  | 32   |
| Daytime Sleep (Napping)           |     |      |
| Yes                               | 47  | 31.3 |
| No                                | 103 | 68.7 |

Table 2 presents the reported sleep patterns. Nearly all participants reported shorter-than-normal night sleep duration, with comparable proportions in both age groups (7–12 years: 97.8%; 13–17 years: 98.4%). Regarding sleep onset, 61.3% fell asleep within 40 minutes and 91.3% within one hour, while 8.7% required more than one hour. Perceived

sleep insufficiency was widespread: 44.7% reported not getting enough sleep and a further 34.0% reported not getting enough sleep at all, giving a combined 78.7% who perceived their sleep as inadequate. Just over half of participants

(59.3%) woke spontaneously in the morning, whereas 32.0% were woken by another person and 8.7% by an alarm. Most participants did not nap during the day (68.7%).

**Table 3. Comparison of CASC domain scores by demographic characteristics (n = 150)**

| Demographic Variables | N  | Bedtime Problem |       | Sleep Breathing and Unstable Sleep |       | Parasomnia and Sleep Movement |       | Daytime Problem |       |
|-----------------------|----|-----------------|-------|------------------------------------|-------|-------------------------------|-------|-----------------|-------|
|                       |    | M               | SD    | M                                  | SD    | M                             | SD    | M               | SD    |
| Age (years)           |    |                 |       |                                    |       |                               |       |                 |       |
| 7-12                  | 89 | 12.1            | 2.741 | 8.8                                | 3.323 | 9.7                           | 4.366 | 7.9             | 3.356 |
| 13-17                 | 61 | 12.2            | 3.246 | 7                                  | 3.461 | 5.4                           | 3.046 | 8.9             | 3.575 |
| t                     |    | 0.251           |       | 3.368**                            |       | 6.774**                       |       | 1.772           |       |
| Gender                |    |                 |       |                                    |       |                               |       |                 |       |
| Male                  | 66 | 11.7            | 2.917 | 8.2                                | 3.821 | 7.5                           | 4.760 | 7.9             | 3.671 |
| Female                | 84 | 12.5            | 2.947 | 8                                  | 3.236 | 8.3                           | 3.996 | 8.6             | 3.294 |
| t                     |    | 1.527           |       | 0.430                              |       | 1.120                         |       | 1.263           |       |
| Grade in School       |    |                 |       |                                    |       |                               |       |                 |       |
| Elementary            | 82 | 12              | 2.721 | 8.8                                | 3.294 | 9.8                           | 4.311 | 7.6             | 3.346 |
| Preparatory           | 51 | 12.4            | 3.286 | 7.3                                | 3.642 | 5.9                           | 3.051 | 9.3             | 3.589 |
| Secondary             | 17 | 12.4            | 3.040 | 6.6                                | 3.203 | 4.9                           | 3.436 | 8.2             | 3.173 |
| F                     |    | 0.368           |       | 4.902*                             |       | 22.511                        |       | 3.580*          |       |

Note. CASC = Child and Adolescent Sleep Checklist. Independent-samples t-test for age and gender; one-way ANOVA for school grade. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

Table 3 presents mean CASC domain scores by demographic characteristics with the corresponding inferential tests. Children aged 7–12 scored significantly higher than adolescents aged 13–17 on sleep breathing and unstable sleep ( $t = 3.368$ ,  $p = 0.001$ ) and on parasomnia and sleep movement ( $t = 6.774$ ,  $p < 0.001$ ). Age-group differences were not significant for bedtime problems ( $t = 0.251$ ,  $p = 0.802$ ) or daytime problems ( $t = 1.772$ ,  $p = 0.079$ ). No

significant gender differences emerged in any domain (all  $p > 0.05$ ). One-way ANOVA showed significant differences across school grades in sleep breathing and unstable sleep ( $F = 4.902$ ,  $p = 0.009$ ), parasomnia and sleep movement ( $F = 22.511$ ,  $p < 0.001$ ), and daytime problems ( $F = 3.580$ ,  $p = 0.030$ ), with scores in the first two domains decreasing progressively from elementary to secondary level. Bedtime problems did not differ by grade ( $F = 0.368$ ,  $p = 0.693$ ).

**Table 4. Correlation between night sleep duration and CASC total score, by age group**

| Age group   | n  | r      | p      |
|-------------|----|--------|--------|
| 7–12 years  | 89 | −0.265 | 0.012* |
| 13–17 years | 61 | −0.293 | 0.022* |

R: pearson test, \*:  $p$  value  $\leq 0.05$

Based on the CASC cut-off score of 18, 143 participants (95.3%) met the criterion for clinically relevant sleep disturbance, while only 7 (4.7%) scored within the normal range.

Table 4 shows night sleep duration was inversely correlated with total CASC score in both age groups (7–12 years:  $r = -0.265$ ,  $p = 0.012$ ; 13–17 years:  $r = -0.293$ ,  $p = 0.022$ ), indicating that shorter night sleep was associated with greater sleep disturbance. The magnitude of association was comparable across age groups and small to moderate in both.

## DISCUSSION

In this study, the impact of the 2023 Syrian earthquake on sleep disorders was examined, yielding findings that were particularly relevant to youth. Regarding nighttime disturbances, 95.3% participants had a CASC score of 18 or higher. These results are consistent with cross-sectional studies that have identified trauma as a predictor of reduced sleep quality among youth (Barrera-Valencia et al., 2025; Kahraman & Çubukcu, 2025).

### Trauma and Sleep Disturbances

Disasters such as earthquakes are among the most transformative events and are well known to elicit psychological effects on vulnerable individuals in society,

particularly the young. Ataya et al. (2024) explain that some of the symptoms associated with trauma include nightmares, difficulty sleeping, sleep disturbances, and reduced quantity and quality of sleep. For instance, a study of children affected by the Ya'an earthquake in China in 2013 revealed that sleep disorders, such as difficulty in falling asleep and nighttime awakenings, were prevalent, especially among teenagers (Kakaje et al., 2021).

Parasomnia refers to undesirable transitions between sleep and wakefulness (e.g., nightmares, sleepwalking, confusional arousals). In this study, higher parasomnia and sleep movement scores were observed in younger children (7–12 years) than in adolescents ( $t = 6.774$ ,  $p < 0.001$ ), suggesting developmental differences in sleep regulation and stress responses following displacement and exposure to disaster-related stressors.

Parasomnia, as observed in the participants of the current study, refers to a phenomenon in which individuals relive traumatic events during sleep, often manifesting as nightmares and episodes of nocturnal wakefulness. This creates a cycle wherein inadequate treatment of trauma exacerbates sleep disorders, which in turn negatively affects PTSD symptoms, ultimately hindering recovery. Addressing these interconnected issues is crucial for improving the psychological health of populations affected by disasters

(James et al., 2020).

### Sex- and Gender-Specific Characteristics of Sleep Disturbances

This study indicates that parasomnia and unstable sleep are more prevalent and severe among children aged 7 to 12 years. The findings align with previous research showing that children under seven years old are at increased risk of sleep fragmentation following trauma. This vulnerability is attributed to their developmental stage, limited ability to rely on external structures beyond the control of familiar individuals, and dependence on caregivers (Indriasari, 2022; Runiari et al., 2024).

It is likely that, in cases involving children in this age group, the loss of familiar spaces — including homes — and relocation to shelters intensified feelings of fear and disrupted normal sleep patterns (Efendi et al., 2023). Children under the age of six may experience insomnia or sleepwalking due to their limited ability to communicate their traumas (Giannakopoulos & Kolaitis, 2021). Although less prevalent than in students of other grades, adolescents also displayed sleep disturbances that reflect the elevated levels and highlight the need for coping mechanisms tailored to teenagers.

### Gender and Educational Level

Contrary to previous studies reporting a higher probability among females of developing PTSD and related sleep disorders (Milanek et al., 2019; Richards et al., 2020). This discrepancy may be attributed to the varied stressors participants experienced due to the earthquakes and their impacts on their lives, such as the loss of homes and disruptions to their usual routines and activities. However, analysis of variance revealed that educational level was a significant factor influencing sleep disruption. A comparative study found that children in elementary schools had more severe bedtime disturbances than those in preparatory or secondary school (Tomaso et al., 2021). Younger children, who typically rely more on family relationships and structured schedules, were more vulnerable to psychological harm due to displacement. These findings also align with previous works associating young children with increased vulnerability in disaster contexts (Kakaje et al., 2021).

### Societal and environmental factors

Other cultural and environmental aspects of the Syrian earthquake also provide significant insights into sleep interference among children and adolescents. Ahmed et al. (2023) noted that while the shelters afforded some protection, new stressors—such as noise, overcrowding, and a lack of personal space—were identified as distal factors interfering with sleep, particularly affecting individuals with heightened arousal. These outcomes differ from those observed in other similar disasters, such as Hurricane Katrina in the USA and the 2011 tsunamis in Japan, where mental health promotion, protective measures, and care systems helped mitigate the psychological impact on sleep (W. Tang et al., 2018; Yilancioğlu & Özbaran, 2023).

Overall, it became clear that gaining insight into cultural and contextual aspects is critical when designing interventions for disaster victims. The positive attributes linked to social support within collective living environments can significantly enhance the recovery process, especially in collectivist countries such as Syria (Alfuqaha et al., 2023; Giannakopoulos & Kolaitis, 2021). Thus, increasing environmental press strategies—such as creating personal enclaves and organizing noise-free periods—can amplify the

restorative power of sleep and enhance the continuity of well-being and mental health.

### Limitations

The cross-sectional design precludes causal inference and does not capture changes in sleep over time. The convenience sample, drawn from shelter residents, may not represent all affected children (e.g., those living at home), thereby limiting generalizability. Sleep outcomes relied on interviewer-administered self-reports, which may be influenced by recall or social desirability bias. In addition, the Arabic version of the CASC was not formally validated in this population. Future studies should employ longitudinal designs, broader sampling frames, and objective sleep measures (e.g., actigraphy), alongside validated Arabic instruments, to strengthen inference and inform intervention evaluation (Ataya et al., 2024; Khan et al., 2023).

### CONCLUSION AND RECOMMENDATION

Sleep disturbances were highly prevalent among displaced Syrian children and adolescents one month after the 2023 Türkiye–Syria earthquake. Differences in several sleep-disturbance domains were observed according to age group and school grade, while longer nighttime sleep duration was associated with lower CASC scores. Post-disaster nursing services should incorporate age-appropriate sleep screening, environmental sleep support, caregiver education, and referral pathways for children with persistent or severe symptoms.

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