

# Changes in Symptom Severity and Sleeping Habits After Earthquake in Children and Adolescents with Autism Spectrum Disorder: The Case of the Kahramanmaraş Earthquake in 2023, Turkey

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## ABSTRACT

**Purpose:** Natural disasters, especially earthquakes, can cause psychological disorders. A review of the disaster literature shows that natural disasters do not affect individuals in the same way; children and people with disabilities such as Autism Spectrum Disorder (ASD) are considered the most vulnerable group. It was aimed to evaluate the post-earthquake effects on the children and adolescents diagnosed with ASD in the Kahramanmaraş-centered earthquake on February 6, 2023.

**Methods:** 22 children and adolescents diagnosed with ASD were included in the study. Children with ASD who applied to the Hatay Field Hospital Child and Adolescent Psychiatry outpatient clinic three months after the earthquake were evaluated. Sociodemographic Data Form, Aberrant Behavior Checklist (AbBC), the Child Sleep Habits Questionnaire (CSHQ), Autism Behavior Checklist (ABC) scales were administered.

**Results:** This study included 19 (86.4%) boys and 3 (13.6%) girls. The age of the participants was 9.92±3.52 years. AbBC-hyperactive ( $p<0.001$ ), AbBC-lethargy ( $p=0.001$ ), AbBC-stereotype behaviours ( $p<0.001$ ), AbBC-other behaviours ( $p<0.001$ ) subscale scores; the CSHQ-sleep anxiety ( $p=0.008$ ) subscale score; the ABC-sensory behaviour ( $p=0.017$ ), ABC-social rating ( $p=0.034$ ), ABC-social and adaptive skills ( $p=0.026$ ) subscales scores significantly increased after the earthquake compared to pre-earthquake.

**Conclusion:** The study's findings give information about the increase in the severity of autism symptoms in this group after the earthquake. This study contributes to the literature by evaluating the impact of an important natural disaster, such as an earthquake on children and adolescents with ASD. We suggest that future studies compare different severity of ASD and further research on areas that have not been studied enough.

**Keywords:** autism, earthquake, natural disaster, child, Kahramanmaraş, Turkey

## Otizm Spektrum Bozukluğu Tanılı Çocuk ve Ergenlerde Deprem Sonrası Belirti Şiddeti ve Uyku Alışkanlıklarındaki Değişiklikler: 2023 Yılı Kahramanmaraş Depremi Örneği, Türkiye

### ÖZET

**Amaç:** Doğal afetler, özellikle depremler psikolojik rahatsızlıklara neden olabilmektedir. Afet literatürünün gözden geçirilmesi, doğal afetlerin bireyleri aynı şekilde etkilemediğini göstermekte ve çocuklar ve Otizm Spektrum Bozukluğunun (OSB) gibi engelliler (persons with disabilities) en savunmasız grup olarak kabul edilmektedir. 6 Şubat 2023 tarihindeki Kahramanmaraş merkezli depremde OSB tanılı çocuklar ve ergenlerin depremden sonraki etkilenimlerinin değerlendirilmesi amaçlanmıştır.

**Yöntemler:** Çalışmaya 22 OSB tanılı çocuk ve ergen alınmıştır. Depremden 3 ay sonra Hatay Sahra Hastanesi Çocuk Psikiyatri polikliniğine başvuran OSB tanılı çocuklar değerlendirilmiştir. Sosyodemografik Veri Formu, Sorun Davranış Kontrol Listesi (SDKL), Çocuk Uyku Alışkanlıkları Anketi, Otizm Davranış Kontrol Lisesi Kayıt Formu (ABC) ölçekleri değerlendirilmede kullanılmıştır.

**Bulgular:** Çalışmamıza 19 (%86.4) erkek ve 3 (%13.6) kız çocuk ve ergen dahil edilmiştir. Katılımcıların yaş ortalaması 9.92±3.52 yıldır. SDKL-aşırı hareketlilik ( $p<0.001$ ), SDKL-letarji ( $p=0.001$ ), SDKL-yineleyen davranışlar ( $p<0.001$ ), SDKL-diğer davranışlar ( $p<0.001$ ) alt ölçek puanlarında; Uyku Alışkanlıkları Anketinin-uyku kaybı ( $p=0.008$ ) alt ölçeğinde; otizm-ABC formunda ABC-duyusal ( $p=0.017$ ), ABC-ilişki kurma ( $p=0.034$ ), ABC-sosyal ve özbakım ( $p=0.026$ ) alt ölçeğinde deprem öncesi ve sonrası için istatistiksel olarak anlamlı şekilde puan artışı olduğu saptanmıştır.

**Sonuç:** Çalışma bulguları deprem sonrasında bu grubun otizm belirti şiddetinde artış olduğu hakkında bilgi vermektedir. Çalışmamız deprem gibi önemli bir doğal afetin OSB'li çocuk ve ergenler üzerindeki etkisini değerlendirerek literatüre katkıda bulunmaktadır. Gelecekteki çalışmaların otizm şiddetine göre farklı gruplar oluşturularak karşılaştırmalar yapmasını ve yeterince çalışılmamış alanların daha fazla araştırılmasını öneriyoruz.

**Anahtar kelimeler:** otizm, deprem, doğal afet, çocuk, Kahramanmaraş, Türkiye

**A**utism Spectrum Disorder (ASD) is a neurodevelopmental disorder that emerges in early childhood, causes children to have problems in performing their daily life functions, is observed in different contexts and degrees, and is characterized by limited and repetitive patterns of behaviour, interest, and activity, as well as social interaction and communication inadequacies (1).

Natural disasters, especially earthquakes, can bring many problems, such as physical injury, loss of property, death and cause psychological disorders (2). A review of the disaster literature shows that natural disasters do not affect individuals in the same way. Considering their dependence on adults, children and disabled persons are considered the most vulnerable group. There is evidence that exposure to a major natural disaster, such as the earthquake in Haiti in 2010, can disrupt children's mental health and psychological development (3). Natural disasters result in severe disruption of the medical follow-up and rehabilitation of children with special needs to develop their mental and physical abilities, depriving them of many opportunities to improve their condition (4). Natural disasters cause sudden changes in the lives of all people and disrupt many life routines. Children with ASD have more difficulty in adapting to their routine changes compared to children with normal development (5) due to their desire to preserve stability (6) and to have limited behavioural patterns (7). Therefore, it is expected that an increase in the severity of autism symptoms and deterioration in functionality will occur in all situations, including natural disasters that disrupt daily routines. It has been reported that sensory-motor development, cognitive skills, sleep, behaviour, and social interaction were significantly affected in approximately 50% of children with special needs, whose routines are disrupted due to the COVID-19 pandemic, who have to be isolated at home and whose special education was disrupted (8). Therefore, while assessing the health effects of natural disasters, special attention should be paid to the individuals affected by psychiatric disorders, especially ASD. Children with ASD often have difficulty falling asleep and staying asleep, and nighttime awakenings are strongly associated with daytime behavioural problems (9). Sleep problems affect approximately 20-40% of healthy children (10). This problem is particularly evident in children with neurodevelopmental diseases, including autism, and can be observed in about 80% of patients (11). It is expected that the sleep problems of children diagnosed with ASD will increase with the earthquake.

On February 6, 2023, Hatay was one of the cities most severely affected by the 7.4 magnitude earthquake that occurred in Kahramanmaraş. Eighty-nine percent of the houses were severely damaged. For this reason, people had to live in containers or tents after the earthquake. As a result, the whole society was affected in terms of financial, social and psychological damage, and security and normality were further undermined by frequent aftershocks. This study was conducted to evaluate the psychological effects of the earthquake, which caused a compulsory transition and change in the lives of children and adolescents with ASD living in Hatay. Autism symptom severity and changes in sleep patterns were compared before and three months after the earthquake.

## Method

### *Ethics Approval*

This cross-sectional study was conducted after obtaining ethics committee approval (decision no: 2023/76-08) from Amasya University Ethics Committee and institutional permission from Hatay Field Hospital. In addition, written informed consent was obtained from the parents.

### *Participants*

Twenty-four children and adolescents with ASD were reached in the study. Parents and children who applied to the Hatay Field Hospital Child and Adolescent Psychiatry Outpatient Clinic between 1-31 May 2023 and agreed to participate were included in the study. Physically disabled, visually impaired and hearing impaired patients were excluded from the study. One child was excluded because he had a severe physical disability (paraplegia) due to an inability to properly evaluate the changes in symptom severity before and after the earthquake, and the parent of one did not volunteer to participate in the study. Twenty-two children and adolescents were included in the study. One participant had a neurological disorder (epilepsy) and received medical treatment. Also, according to the parent statement, five children were diagnosed with Attention Deficit Hyperactivity Disorder and one with Anxiety Disorder. These comorbid children continued their treatment regularly. In addition, none of the 22 children who had special education before the earthquake could continue their education after the earthquake.

### *Measures*

The parents completed the sociodemographic data form; In addition, during the clinical interview by the clinician, parents were asked to fill in The Aberrant Behavior Checklist, Children's Sleep Habits Questionnaire, and

Autism Behavior Checklist-ABC twice, considering both the situation of their children before the earthquake and the current situation three months after the earthquake.

**Sociodemographic Data Form:** The form was created by the researchers by examining the literature and consists of 19 questions, including information about the date of birth, sex, residence (tent or container), people living with, parent death in the earthquake, sibling death in the earthquake, relatives/friends death in the earthquake, being left under rubble and the duration of this, seeing the people who were removed from the rubble, father's occupation, autism diagnosis age. This form also includes an open-ended question, 'Please add your observations and opinions about your children during or after the earthquake' for more detailed information.

**Aberrant Behavior Checklist (AbBC):** It is a scale to determine the behaviour problems in children with ASD. The scale consists of 58 items and five subscales as 'Hyperactivity', 'Lethargy', 'Stereotype Behaviors', 'Self-injury' and 'Other Behaviors' and is completed by parents. Evaluation is made according to the scores of subscales. The validity and reliability study of the Turkish version was carried out by Sucuoglu (2003) (12). Cronbach Alpha coefficient was calculated as 0.96 (12).

**Children's Sleep Habits Questionnaire (CSHQ):** It consists of 33 items and determines sleep habits and sleep-related problems in children. The scale was developed by Owens et al. firstly (13). The validity and reliability study in Turkey was carried out by Perdahlı Fis et al. (14). There are eight subscales: Bedtime Resistance, Sleep Onset Delay, Sleep Duration, Sleep Anxiety, Night Wakings, Parasomnias, Sleep Disordered Breathing, and Daytime Sleepiness. In the scale, the parents are asked to evaluate the child's sleep habits retrospectively over the one last week. Cronbach Alpha coefficient was calculated as 0.78 (14).

**Autism Behavior Checklist (ABC):** It is an assessment tool consisting of 5 subscales (Sensory Behavior, Social Relating, Body and Object Use, Language and Communication Skills, Social and Adaptive Skills) and 57 items. The original form of the scale was developed by Krug et al. (15) and validated in Turkish by Yılmaz Irmak et al. in 2007. The cut-off point for the Turkish version of the

scale was determined as 39 (16). Cronbach Alpha coefficient was calculated as 0.92 (16).

### Statistical Analysis

In statistical analysis, the compatibility of continuous variables with normal distribution was evaluated with the Shapiro-Wilk test. The continuous variables were shown as mean±standard deviation. Categorical data were shown as frequency (n) and percentage (%). Wilcoxon Signed Ranks Test and Paired Sample Test were used to compare scale scores before and after the earthquake. The statistical significance level was accepted as  $p < 0.05$ .

### Results

This study included 19 (86.4%) boys and 3 (13.6%) girls. The age of the participants was  $9.92 \pm 3.52$  years. The age of ASD diagnosis was  $3.86 \pm 1.66$  years. It was determined that one of the participants lived in their house because it was mildly damaged, while the others were sheltered in containers or tents because their homes were severely damaged. No child was left under rubble and lost a parent or a sibling in the earthquake; 10 lost relatives/friends; 4 saw the people removed from the rubble. Other sociodemographic characteristics of the participants are summarized in Table 1.

In the analyses, AbBC-hyperactivity ( $p < 0.001$ ), AbBC-lethargy ( $p = 0.001$ ), AbBC Stereotype behaviours ( $p < 0.001$ ), AbBC-other behaviours ( $p < 0.001$ ) subscale scores were found to be significantly higher after the earthquake compared to before. No statistical difference was observed in the AbBC-Self-injury subscale. In the CSHQ-sleep anxiety ( $p = 0.008$ ) subscale scores of the participants, there was a statistically significant increase after the earthquake compared to before. No statistical difference was found in the other CSHQ subscales before and after the earthquake. It was shown that the participants had a significantly increased score of ABC-sensory behaviours ( $p = 0.017$ ), ABC-social rating ( $p = 0.034$ ), and ABC-social and adaptive skills ( $p = 0.026$ ) subscales of ABC. No statistical difference was found in the participants' ABC-language and communication skills and ABC-body and object use scales before and after the earthquake. The increase in the scores on the scales indicates an increase in the severity of symptoms (Table 2).

Figure 1 is added below to visually show the changes in the AbBC, CSHQ and ABC subscale scores before and after the earthquake.

**Table 1: Participants' Sociodemographic and Earthquake Death/Injury Characteristics**

		n	%
<b>Age (years)</b>		9.92 *	3.52 <sup>§</sup>
<b>Sex</b>	Boy	19	86.4
	Girl	3	13.6
<b>ASD diagnosis age (years)</b>		3.86 *	1.66 <sup>§</sup>
<b>Neurological disease diagnosis</b>	Absent	21	95.5
	Present	1	4.5
<b>Parent status</b>	Married	17	77.3
	Widowed	3	13.6
	Father death	2	9.1
	Mother death	0	0.0
<b>Housing status</b>	Container	16	72.7
	Tent	5	22.7
	House	1	4.5
<b>Parent death in the earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Parent injury in the earthquake</b>	Yes	4	18.2
	No	18	81.8
<b>Sibling death in the earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Sibling injury in the earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Relatives/friends death in the earthquake</b>	Yes	10	45.5
	No	12	54.5
<b>Relatives/friends injury in the earthquake</b>	Yes	3	13.6
	No	19	86.4
<b>Being left under the rubble</b>	Yes	0	0.0
	No	22	100.0
<b>Being injured in the earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Permanent physical damage in an earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Outpatient treatment in an earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Inpatient treatment in an earthquake</b>	Yes	0	0.0
	No	22	100.0
<b>Seeing the people who were removed from the rubble</b>	Yes	4	18.2
	No	18	81.8

\*Mean, <sup>§</sup>Standard deviation

Parents' answers to open-ended questions about the changes after the earthquake for their children with ASD included: 'Reduced spending time with people', 'Decreased playing with people', 'Increased spending time alone with inanimate objects', 'Making fewer friends with other children', 'He decreased spending time with his peers', 'Spends more time alone than before', 'Prefers to be alone', 'He became withdrawn after the earthquake', 'Repetitive movements increased', 'Repetitive speeches increased'.

## Discussion

The present study evaluated the changes in the severity of autism symptoms and sleep patterns in children and adolescents with ASD, one of the vulnerable and risky groups affected by earthquakes. The study findings showed an increase in the severity of autism symptoms and a worsening in the clinic in the study group after the earthquake. Although there are numerous studies evaluating the impact of stressful life events on the course of psychiatric disorders, such as schizophrenia or mood disorders (17, 18) and an increasing body of literature addressing the psychological sequelae of children and adolescents after natural disasters (19, 20), the current literature is still lack of the knowledge about what kind of an adaptive process is experienced for the individuals with ASD after natural disasters. This study contributes to this deficient part of the literature by evaluating the impact of an important natural disaster, such as an earthquake, on children and adolescents with ASD.

In the present study evaluating children with ASD three months after the earthquake, It was determined that after the earthquake, there was a significant increase in the ABC sensory behaviour, social rating, and social and adaptive skills subscales compared to the pre-earthquake, that is, the children's current clinic worsened, and the severity of autism symptoms increased. By examining in detail which items caused the statistically significant increase in the ABC-sensory behaviour subscale, an increase of 'Covers ears at many sounds' and 'Stares into space for long periods of time' was observed. Parents stated that their children were terrified of the sound emerging with the earthquake, they shouted by covering their ears at that time, and then their children responded by closing their ears to loud noises similar to those during the earthquake. By examining in detail which items caused the statistically significant increase in the ABC-social rating subscale, It was observed that the scale items 'Often frightened or very anxious', 'Actively avoids eye contact', 'Frequently does not attend to social/environmental cues', 'Does not imitate other children at play' were mostly marked.

Table 2. Comparison of participants' AbBC, CSHQ, ABC subscale scores before and after the earthquake

	Pre-earthquake		Post-earthquake (3rd month)		Test statistics <sup>s</sup>	p-value
	Mean	Standard Deviation	Mean	Standard Deviation		
AbBC-hyperactivity	11.86	7.17	17.27	8.95	-3.833 <sup>a</sup>	<0.001*
AbBC-lethargy	15.14	7.28	19.05	8.66	-3.997	0.001**
AbBC- stereotype behaviours	5.05	3.47	7.05	4.31	-4.690	<0.001**
AbBC- self-injury	1.32	1.91	1.86	2.73	-1.480 <sup>a</sup>	0.139*
AbBC- other behaviours	4.77	2.16	6.50	2.74	-4.426	<0.001**
CSHQ- bedtime resistance	9.36	3.09	10.73	3.86	-1.890 <sup>a</sup>	0.059*
CSHQ- sleep onset delay	1.36	0.66	1.36	0.66	0.000 <sup>b</sup>	1.000*
CSHQ- sleep duration	3.36	0.73	3.55	1.22	-1.342 <sup>a</sup>	0.180*
CSHQ- sleep anxiety	6.77	2.52	7.55	2.67	-2.642 <sup>a</sup>	0.008*
CSHQ- night wakings	4.18	1.33	4.18	1.14	0.000 <sup>b</sup>	1.000*
CSHQ- parasomnias	8.09	1.51	8.59	1.89	-1.964 <sup>a</sup>	0.050*
CSHQ-sleep-disordered breathing	3.36	0.73	3.36	0.73	0.000	1.000*
CSHQ- daytime sleepiness	8.23	1.85	8.23	1.85	-.447 <sup>a</sup>	0.655*
ABC- sensory behaviours	6.18	5.19	7.32	5.91	-2.595	0.017**
ABC- social rating	13.77	8.71	15.09	7.99	-2.263	0.034**
ABC- body and object use	13.68	6.95	15.36	7.64	-1.638	0.116**
ABC- language and communication skills	11.18	4.35	12.32	4.83	-1.977	0.061**
ABC- social and adaptive skills	12.86	5.87	14.55	5.37	-2.401	0.026**
ABC- total	57.68	22.21	61.45	24.17	-0.821	0.421**

<sup>s</sup> Z for Wilcoxon Test and T for Paired Sample Test were demonstrated

\*Wilcoxon Signed Ranks Test

\*\* Paired Sample Test

<sup>a</sup>Based on negative ranks. <sup>b</sup>The sum of negative ranks equals the sum of positive ranks

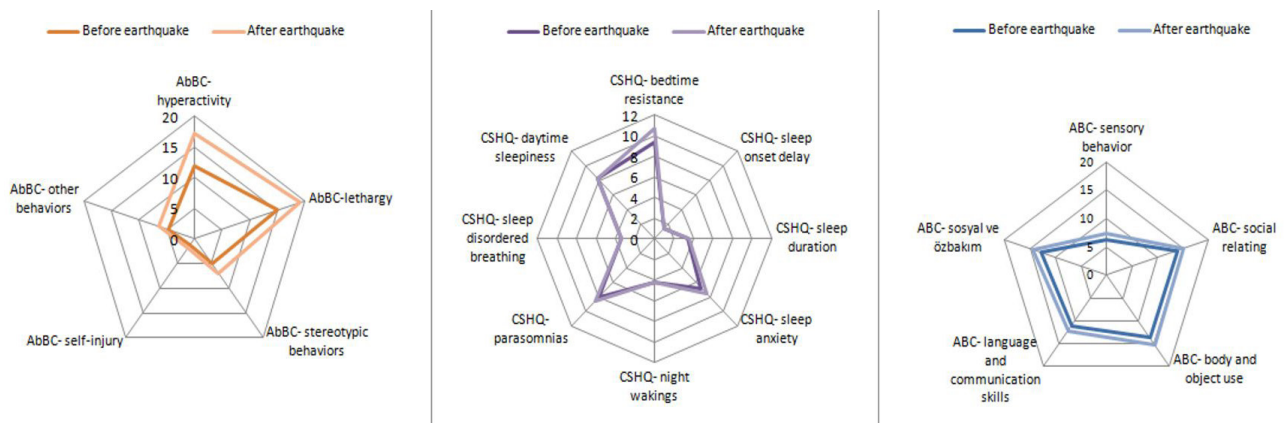


Figure 1: AbBC, CSHQ and ABC subscale score changes with the earthquake

It is seen that earthquake increases children's anxiety and decreases non-verbal communication with their environment. Some parents stated that their children became more timid and cowardly after the earthquake, their desire to initiate contact with people decreased, and they did not pay much attention to communicating with others. When the statistically significant increase in the ABC-social and adaptive skills subscale is examined in detail, it was determined that the scale items such as 'Severe temper tantrums and/or frequent minor tantrums', 'Hurts others by biting, hitting, kicking...', and 'Does not wait for needs to be met (wants things immediately)'. In addition, it was observed that parents who verbally stated that some children decreased spending time with people and playing games after the earthquake and increased spending time alone with inanimate objects also marked the scale item 'Prefers to manipulate and be occupied with inanimate objects' more. Parents stated that after the earthquake, their children developed fewer friendships and reduced spending time with their peers compared to pre-earthquake. Also, they said there was a notable increase in preferring to be alone, and their children became withdrawn. Apart from the direct effect of the earthquake, which is a serious source of stress, it is thought that apparent indirect effects, such as the disruption of education of children after the earthquake, having to live and shelter in places with limited facilities such as tents and containers, and the lack of opportunities to spend time with their peers are also responsible for the current clinical situation. When the ABC-language skills subscale scores were compared before and after the earthquake, there was no statistical significance. We believe that this situation is due to the relatively small number of our samples, and if a larger sample is studied, the difference will be significant in statistics. In interviews with parents, it was frequently heard that there was a substantial increase in children's stereotype and echolalia symptoms after the earthquake. Young people with ASD should be included in intensive rehabilitation programs immediately to regain their pre-disaster functions and return to their daily life routines as much as possible (21). If awareness of mental health problems and early intervention can ameliorate the negative psychological effects of disasters on children and adolescents in the general population (22), appropriate interventions need to be undertaken also for children and adolescents with ASD.

There was a statistically significant increase in the AbBC-hyperactivity, AbBC-lethargy, AbBC-stereotype behaviours and AbBC-other behaviours subscale scores, indicating that the clinic of the children with ASD worsened

and the symptoms increased after the earthquake. We interpreted that the restlessness of the child with ASD, indicated by the increase in the post-earthquake AbBC-hyperactivity score, is associated with irritability. The increased score of the items 'demands must be met immediately', 'mood changes quickly', 'seeks isolation from others', 'repetitive speech' in the AbBC-other behaviours subscale support the irritability of the children with ASD after the earthquake and the increase in echolalia also stated by the parents. Likewise, the increase in the AbBC-stereotype behaviour scores indicates the increase in the stereotype of the children with ASD after the earthquake also said by the parents. The children with ASD, whose routines are disrupted in their normal daily life, are irritable, and their stereotypy and echolalia symptoms increase under distressing situations; It is known that most of them exhibit problem behaviours in their routine lives (23). Children with autism have more difficulty transitioning from one activity or environment to another and adapting to routine changes compared to children with normal development. Because they want to maintain sameness, need predictability in activity or environment changes, and have limited behavioural patterns (5). The changes in daily routines after the earthquake, the necessity of living in containers or tents, and the disruption of education caused compulsory social isolation. We can see the effect of these from the increase in the AbBC-lethargy score.

Sleep problems affect approximately 20-40% of healthy children (10). This problem is particularly evident in children with neurodevelopmental diseases, including autism, and can be observed in about 80% of patients (11). It is expected that the sleep problems of children with autism will increase with the earthquake. In the present study, it was determined that there was a statistically significant increase in the CSHQ-sleep anxiety score after the earthquake compared to the pre-earthquake. Also, it was stated by the parents that most of the children with ASD began to fear sleeping alone after the earthquake.

Life stressors rarely affect the entire population simultaneously. Therefore, identifying subpopulation differences in disaster preparedness is particularly important because different public health messages, programs, and distribution channels may be required to improve preparedness among different subgroups (24). Unfortunately, a devastating earthquake provided an opportunity to explore the effects of such a devastating natural disaster on ASD patients. In the Kahramanmaraş-centered earthquake, most people living in the centre of Hatay lost their homes. Outpatient treatment, rehabilitation centres, and entire

schools were severely damaged, and public services and education were seriously disrupted. It is a major issue that needs to be known regarding proper interventions and how children with special needs are affected in a natural disaster that affects life so clearly in general. Since few studies specifically address the impact of natural disasters on the adaptation to changing daily routines of the ASD patients, the present study will contribute notably to the literature in this sense.

An exciting finding of open-ended statements was that the earthquake effect was more prominent in children with ASD whose symptoms and severity were less before the earthquake and that it was more difficult to detect the impact in children with ASD whose symptoms and severity were more intense. Therefore, considering these findings as preliminary, we strongly recommend further studies to make comparisons between the severity groups of ASD, and the areas that have not been adequately studied should be investigated further.

#### *Limitations and strengths*

One of the limitations of this study is being in a cross-sectional design, and the second is that the sample size is relatively small. Since the pre-earthquake ASD clinical status and sleep habits of the children were questioned retrospectively, it may have created a minimal level of recall bias. Still, three months is not a very distant date to remember. On the other hand, one of the study's strengths is that the mother, the parent who is more interested and spends time with the child, filled out the forms; the second was that the scales were explained to the parent by the clinician in the form of a clinical interview.

#### **Conclusion**

The most important contribution of this study to the literature is that it investigated the effect of an important natural disaster event, such as an earthquake, on children with ASD. There was an increase in the severity of autism symptoms and a worsening in the clinic in the study group after the earthquake. Also, the earthquake disturbed sleep habits in terms of sleep anxiety. Therefore, particular measures and approaches related to children with ASD having special needs should be highlighted in disaster preparedness. Especially the physical conditions should be established as soon as possible after the earthquake for children with autism to continue their special education.

#### **Declarations**

##### *Acknowledgement*

None.

##### *Data availability*

The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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This research received no specific grant from public, commercial, or not-for-profit funding agencies.

##### *Conflicts of interest*

The authors declare no conflict of interest.

##### *Statement of Ethical Considerations*

The study was conducted according to acceptable research standards. Informed consent was obtained from study subjects. The comparative cross-sectional study was carried out after getting ethics committee permission (decision no: 2023/76-08) from the Ethics Committee of Amasya University and institutional permission from Hatay field hospital, where the study was conducted. All authors have read and approved the submitted manuscript.

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### Supplemental Tables

**Supplemental Table 1. Pre- and post-earthquake AbBC items scores of the participants**

		Pre-earthquake		Post-earthquake (3rd month)	
		Mean	Standard Deviation	Mean	Standard Deviation
1	Excessively active at home, school, work, or elsewhere	1.00	0.87	1.55	1.01
2	Injures self on purpose	0.59	0.85	0.73	1.16
3	Listless, sluggish, inactive	0.27	0.46	0.50	0.86
4	Aggressive to other children or adults (verbally or physically)	0.73	0.98	1.55	1.26
5	Seeks isolation from others	1.50	0.67	2.05	0.95
6	Meaningless, recurring body movements	1.09	0.81	1.73	1.08
7	Boisterous (inappropriately noisy and rough)	0.77	0.92	1.18	1.22
8	Screams inappropriately	0.95	0.90	1.18	1.14
9	Talks excessively	0.50	0.86	0.68	0.99
10	Temper tantrums / outbursts	1.23	0.81	1.73	0.98
11	Stereotyped behavior; abnormal, repetitive movements	1.14	0.77	1.73	1.08
12	Preoccupied; stares into space	0.55	0.80	0.82	0.96
13	Impulsive (acts without thinking)	0.64	0.73	0.82	0.96
14	Irritable and whiny	1.18	0.73	2.05	0.95
15	Restless, unable to sit still	0.95	0.90	1.50	1.26
16	Withdrawn; prefers solitary activities	1.36	0.85	1.86	0.99
17	Odd, bizarre in behavior	1.14	0.77	1.64	1.05
18	Disobedient; difficult to control	0.68	0.65	1.32	1.25
19	Yells at inappropriate times	0.86	0.71	1.50	1.10
20	Fixed facial expression; lacks emotional responsiveness	0.41	0.50	0.59	0.85
21	Disturbs others	0.36	0.49	0.73	1.03
22	Repetitive speech	0.95	1.00	1.32	1.21
23	Does nothing but sit and watch others	0.68	0.78	0.82	0.85
24	Uncooperative	0.18	1.10	1.32	1.13
25	Depressed mood	0.59	0.67	0.82	0.91
26	Resists any form of physical contact	0.41	0.59	0.64	1.00
27	Moves or rolls head back and forth repetitively	0.45	0.60	0.64	0.85
28	Does not pay attention to instructions	0.77	0.75	0.91	0.87



29	Demands must be met immediately	1.23	0.92	1.64	1.00
30	Isolates himself/herself from other children or adults	1.41	0.73	2.00	1.02
31	Disrupts group activities	0.27	0.46	0.23	0.43
32	Sits or stands in one position for a long time	0.45	0.74	0.50	0.96
33	Talks to self loudly	0.91	0.81	1.18	1.10
34	Cries over minor annoyances and hurts	1.18	0.66	1.82	0.96
35	Repetitive hand, body, or head movements	1.05	0.95	1.45	1.18
36	Mood changes quickly	1.09	0.68	1.50	1.01
37	Unresponsive to structured activities (does not react)	1.05	1.00	1.14	1.08
38	Does not stay in seat (e.g., during lesson or training periods, meals, etc.)	0.73	0.83	0.91	1.11
39	Will not sit still for any length of time	0.64	0.90	0.73	1.08
40	Is difficult to reach, contact, or get through to	0.86	0.77	1.05	0.95
41	Cries and screams inappropriately	0.68	0.72	1.14	1.13
42	Prefers to be alone	1.27	0.77	1.73	1.03
43	Does not try to communicate by words or gestures	0.64	1.05	0.64	1.05
44	Easily distractible	1.41	0.91	1.86	1.04
45	Waves or shakes the extremities repeatedly	0.64	0.85	0.73	0.94
46	Repeats a word or over and over	0.91	0.87	2.27	4.13
47	Stamps feet or bangs objects or slams doors	0.82	0.96	1.32	1.36
48	Constantly runs or jumps around the room	1.00	1.02	1.09	1.15
49	Rocks body back and forth repeatedly	0.68	0.78	0.77	0.97
50	Deliberately hurts himself/herself	0.36	0.66	0.59	1.01
51	Pays no attention when spoken to	0.77	0.75	1.05	0.90
52	Does physical violence to self	0.36	0.58	0.55	0.86
53	Inactive, never moves spontaneously	0.23	0.61	0.23	0.61
54	Tends to be excessively active	1.14	0.94	1.45	1.22
55	Responds negatively to affection	0.36	0.49	0.45	0.67
56	Deliberately ignores directions	1.00	0.69	1.27	0.88
57	Has temper outbursts or tantrums when he/she does not get own way	1.27	0.70	1.86	0.99
58	Shows few social reactions to others	1.45	0.74	1.59	0.80

**Supplemental Table 2. Pre- and post-earthquake ABC items' presence ratio of the participants**

		Pre-earthquake		Post-earthquake (3rd month)	
		n	%	n	%
1	Whirls self for long periods of time	5	22.7	6	27.3
2	Learns a simple task but "forgets" quickly	7	31.8	9	40.9
3	Frequently does not attend to social/ environmental cues	10	45.5	13	59.1
4	Does not follow simple commands (sit down, come here, stand up) given once	3	13.6	2	9.1
5	Does not use toys appropriately (spins wheels, etc.)	10	45.5	11	50.0
6	Poor use of visual discrimination when learning (fixates on parts of objects such as size, color, position...)	9	40.9	10	45.5
7	Lacks a social smile (may smile out-of-context)	2	9.1	3	13.6
8	Exhibits pronoun reversal (you for I...)	4	18.2	4	18.2
9	Insists on keeping certain objects with him/herself	11	50.0	13	59.1
10	Seems not to hear (despite normal hearing tests)	3	13.6	3	13.6
11	Speech is atonal and arrhythmic	10	45.5	13	59.1
12	Rocks self for long periods of time	4	18.2	6	27.3
13	Does not (or did not as a baby) reach out when reached for	8	36.4	8	36.4
14	Strong reactions to minor changes in routine/ environment	6	27.3	9	40.9
15	Does not respond to own name when called out among two or more other names	6	27.3	5	22.7
16	Lunges and darts about, interrupted by spinning, toe walking, hand flapping...	11	50.0	12	54.5
17	Not responsive to other people's facial expressions or feelings	11	50.0	11	50.0
18	Seldom uses "yes" or "I"	8	36.4	10	45.5
19	Has special abilities in one area - seems to rule out mental retardation	13	59.1	13	59.1
20	Does not follow simple prepositional commands (e.g., "put the ball in the box")	7	31.8	7	31.8
21	Sometimes shows no "startle response" to a loud noise	4	18.2	4	18.2

22	Flaps hands (or other self-stimulating behavior)	7	31.8	9	40.9
23	Severe temper tantrums and/or frequent minor tantrums	12	54.5	16	72.7
24	Actively avoids eye contact	10	45.5	12	54.5
25	Resists being touched or held	7	31.8	7	31.8
26	Sometimes, painful stimuli (cuts, injections, bruises) evoke no reaction	3	13.6	3	13.6
27	Is (or was as a baby) stiff and hard to hold	4	18.2	4	18.2
28	Is flaccid (doesn't cling) when held in arms	5	22.7	5	22.7
29	Gets desired objects by gesturing	10	45.5	11	50.0
30	Walks on toes	3	13.6	3	13.6
31	Hurts others by biting, hitting, kicking...	5	22.7	8	36.4
32	Repeats phrases over and over again	9	40.9	12	54.5
33	Does not imitate other children at play	12	54.5	12	54.5
34	Often will not blink when a bright light is directed toward eyes	0	.0	0	.0
35	Hurts self by biting hand, banging head...	4	18.2	7	31.8
36	Does not wait for needs to be met (wants things immediately)	13	59.1	17	77.3
37	Cannot point to more than five named objects	4	18.2	4	18.2
38	Has not developed any friendships	12	54.5	13	59.1
39	Covers ears at many sounds	11	50.0	14	63.6
40	Twirls, spins, and bangs objects a lot	10	45.5	11	50.0
41	Difficulties with toilet training	4	18.2	5	22.7
42	Uses 5 or less words per day spontaneously to communicate wants or needs	9	40.9	9	40.9
43	Often frightened or very anxious	8	36.4	11	50.0
44	Squints, frowns, or covers eyes when in the presence of natural light	5	22.7	6	27.3
45	Does not dress self without frequent help	10	45.5	10	45.5
46	Repeats sounds or word over and over again	9	40.9	10	45.5
47	"Looks through" people	2	9.1	2	9.1
48	Echoes questions or statements made by other people	5	22.7	5	22.7

49	Frequently unaware of surroundings and may be oblivious to dangerous situations	11	50.0	11	50.0
50	Prefers to manipulate and be occupied with inanimate objects	16	72.7	16	72.7
51	Will feel, smell, or taste objects in the environment	12	54.5	12	54.5
52	Frequently has no visual reaction to a "new" person	7	31.8	7	31.8
53	Gets involved in complicated "rituals" such as lining things up...	9	40.9	10	45.5
54	Is very destructive (toys and household items are quickly broken)	5	22.7	6	27.3
55	A developmental delay was identified at or before 30 months of age	21	95.5	21	95.5
56	Uses at least 15 but less than 30 spontaneous phrases daily to communicate	13	59.1	12	54.5
57	Stares into space for long periods of time	3	13.6	3	13.6