

## After the 2023 Earthquake in Türkiye: An Assessment of Post-Earthquake Psychological Resilience in Children and Adolescents - A Systematic Review

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### ABSTRACT

Psychiatric disorders can be observed in children and adolescents following an earthquake, with both risk factors and protective factors influencing the development of these disorders. This review aims to compile studies examining the relationship between earthquakes and resilience in children and adolescents after the earthquake disaster in Türkiye. 113 articles were identified using the PubMed database and relevant keywords. After excluding irrelevant studies, 24 that were related to the topic were included in the review. 66.6% of the studies were conducted in China, with 41.6% of total studies having a longitudinal design. In our country, no study was found in this context. Resilience levels were lower in females than males. Resilience was found to be protective against depression, anxiety, and post-traumatic stress disorder, and was positively correlated with social support. High resilience was also associated with significant posttraumatic growth. However, it is not conclusive that all therapy and intervention programs related to resilience are effective. Protecting the mental health of children and adolescents, who are vulnerable and exposed to dangers following an earthquake, is crucial. Identifying protective factors for mental health, particularly resilience, and developing intervention methods for routine and field use to enhance resilience are vital to prevent the development of mental illnesses.

**Keywords:** Earthquake, resilience, depression, PTSD, children, adolescent.



#### Cite this article as:

Gül MK, Özmen S, Demirci E. After the 2023 Earthquake in Türkiye: An Assessment of Post-Earthquake Psychological Resilience in Children and Adolescents - A Systematic Review. J Clin Pract Res 2023; 45(6): 539–48.

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**Submitted:** 02.11.2023

**Revised:** 20.11.2023

**Accepted:** 28.11.2023

**Available Online:** 06.12.2023

Erciyes University Faculty of Medicine Publications - Available online at [www.jcprres.com](http://www.jcprres.com)



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### INTRODUCTION

Earthquakes are among the natural disasters that profoundly impact people both physically and psychologically. Every day, a considerable number of earthquakes occur worldwide,<sup>1</sup> with some of them leaving significant marks in human history. Two earthquakes, one with a magnitude of 7.7 and the other 7.6, struck Kahramanmaraş in southern Türkiye on February 6, 2023.<sup>2</sup> These were the most recent destructive earthquakes globally, severely impacting 11 cities in Türkiye. Official reports indicate that over 50,000 people perished in Türkiye due to these earthquakes. The tremors were felt in many neighboring countries, including Syria, which has been grappling with a major civil war. Sadly, there were also fatalities in Syria.

While physical health and medical care are important during and after earthquakes, protecting mental health and recognizing and managing trauma-related pathologies. Children and adolescents are perhaps the most vulnerable group in terms of post-earthquake mental health issues. Factors such as being trapped in wreckage, sustaining physical injuries, experiencing amputations, losing parents and siblings, having low social support, being distanced from education, migrating, and the uncertainty of the post-earthquake period create risks for psychopathologies in this sensitive group. In addition to acute stress disorder in the early aftermath of the earthquake, post-traumatic stress disorder (PTSD), depression, anxiety disorders, sleep problems, nightmares, fear, and many psychiatric symptoms can be observed in children and adolescents during this period.<sup>3-5</sup> It may be more difficult to protect and improve mental health in those who have a pre-existing psychiatric diagnosis and are undergoing treatment.

The presence of certain risk or protective factors affects the development of psychopathologies in individuals. Factors such as personal differences, developmental stage, and the severity of exposure to adversities play a role in adapting to the experienced disaster.<sup>6</sup> Moreover, resilience emerges as a significant protective factor. Resilience refers to a relative resistance to experiences of risk that develop in the environment or to overcoming adversity or stress, and it differs from traditional concepts of protection and risk as it involves individual differences.<sup>7</sup> Essentially, it can be defined as the ability to cope with a negative situation that impacts the individual and to return to normal functionality after this negative situation.<sup>8</sup> Psychological symptoms are less common in children and adolescents with high levels of resilience.<sup>9</sup>

There are studies investigating resilience and related factors in children, adolescents, and adults after natural disasters.<sup>6,10</sup> However, there is a gap in our country's literature in this field; further studies are needed. This review aimed to gather studies on resilience in children and adolescents after earthquakes. As observed in the literature review, this is the first review of resilience in children and adolescents that covers a wide range of time and focuses solely on earthquakes among natural disasters.

## MATERIALS AND METHODS

To evaluate studies about resilience in children and adolescents after earthquakes, articles published in the PubMed database up to May 25, 2023, were reviewed. The keywords for the literature review were defined as follows: [(earthquake) and (resilience) and (children or adolescents)].

### Eligibility Criteria

Studies meeting the aforementioned criteria and included in the review are resilience-related studies involving child and/

or adolescent participants. Figure 1 shows the article selection method according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram. Detailed information about the studies is available in Appendix 1.

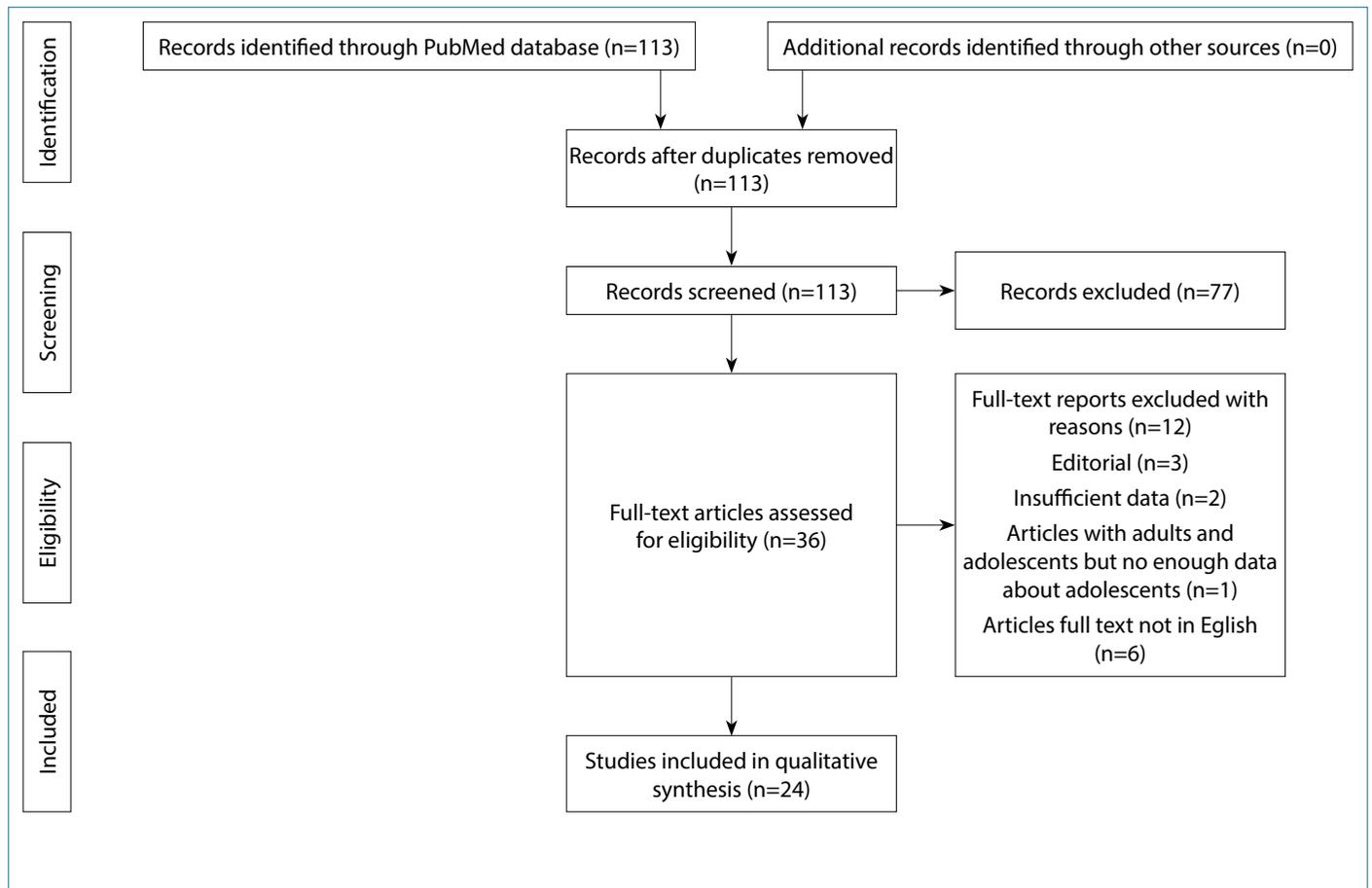
## RESULTS

Among the 24 studies included in the review, the majority were related to depression, PTSD, and anxiety, followed by studies on social support. There were also studies examining intervention programs and posttraumatic growth. Therefore, the studies were analyzed in four different groups based on their results.

### 1. Resilience and Depression/PTSD/Anxiety

In four of the nine studies examining the relationship between depression and resilience after the earthquake, depression was considered independently. Participants were divided into three different groups based on the severity of depression and resilience levels: mild depression/high resilience, severe depression/high resilience, and severe depression/low resilience. The total scores of the Child and Youth Resilience Measure-12 (CYRM-12) and the Patient Health Questionnaire-9 (PHQ-9) were  $36.9 \pm 10.86$  and  $6.05 \pm 6.25$ , respectively. Most participants were found in the mild depression/high resilience group (65%), suggesting that resilience may protect against the effects of trauma experiences on depression.<sup>11</sup> Resilience was negatively associated with depression, and a positive relationship was found between resilience and trauma exposure. While resilience did not moderate the relationship between depression and exposure to trauma, it directly predicted depression.<sup>12</sup> In a study evaluating participants at 6, 12, 18, and 24 months after the earthquake, resilience, depressive symptoms, and post-disaster negative life events at the previous stage had a long-term impact on depressive symptoms in girls.<sup>13</sup> Resilience was identified as a relatively stable negative predictor of depressive symptoms. Females exhibited lower psychiatric resilience and more negative life events than males.<sup>14</sup>

Depression was evaluated alongside PTSD and/or anxiety in the other five studies. One year after the earthquake, depression was detected in 3.23% and PTSD in 4.84% of the participants, with 80.65% of them scoring high on resilience.<sup>15</sup> The mean resilience score was  $110.89 \pm 26.25$ , and it was higher in males and adolescents without siblings. Adolescents with higher resilience displayed fewer symptoms of depression, PTSD, and anxiety, and maternal parenting styles were predictors of resilience.<sup>16</sup> The mean score of the Connor-Davidson Resilience Scale (CD-RISC) was  $69.64 \pm 13.25$ , with scores being higher in males than in females, and in younger students compared to those aged



**Figure 1.** Prisma flow diagram.

over 15 years. There were negative correlations between resilience and depression-anxiety.<sup>17</sup> In a study conducted after the Wenchuan earthquake, a negative correlation was found between trait resilience and PTSD, as well as depressive symptoms.<sup>18</sup> In a longitudinal study spanning three years, high resilience was observed in 28.6% of adolescents who started high school in 2012, increasing to 42.9% in 2013 and 46.6% in 2014. Increases in resilience and improvements in depression were significantly correlated in the earlier period of the observation, but no correlation was found between increased resilience and improvements in anxiety or posttraumatic stress reaction.<sup>19</sup>

Resilience was positively associated with posttraumatic stress symptoms in a study examining resilience and PTSD alone. Adolescents with higher resilience had higher posttraumatic stress scores. Resilience was identified as one of the predictors of posttraumatic stress symptoms.<sup>20</sup> One year after the Wenchuan Earthquake, the Chinese version of the Resilience Scale was used for assessment, and the mean

resilience score was  $112.22 \pm 24.19$ . Additionally, resilience was found to be negatively correlated with sleep problems and PTSD symptoms. Resilience moderated the relationship between PTSD symptoms and sleep problems, as well as between PTSD symptoms and earthquake exposure. The relationship between PTSD symptoms and earthquake exposure was significant for participants with lower resilience, and the positive relationship between PTSD symptoms and sleep disturbances was stronger in adolescents with lower resilience.<sup>21</sup> Females had lower trait resilience than males, and resilience was a significant predictor of prominent anxiety trajectories in the study examining the relationship between various factors and anxiety after the earthquake. Adolescents with low resilience were found to be more prone to chronic anxiety.<sup>22</sup> A study was found that dealt with suicidal intention and coping together. No difference in terms of resilience factors was observed between adolescents with and without suicidal intentions in relation to emotional-focused coping. In adolescents with suicidal intentions, no relationship was observed between resilience and coping skills.<sup>23</sup>

## 2. Resilience and Social Support

There are six studies in which resilience and social support were assessed together. In one study, scales were applied at different times (18, 24, and 30 months) after the earthquake. Significant positive associations were found between resilience and social support. Resilience was also negatively associated with internalizing and externalizing symptoms, and it served as a mediator between gratitude and externalizing/internalizing/total symptoms in adolescents. Gratitude had a positive effect on resilience.<sup>24</sup> Ten years after the earthquake, males reported higher resilience scores. Positive correlations were observed between resilience and perceived social support (PSS), as well as general well-being (GWB). Resilience had a partially mediating effect (16.39%) between GWB and PSS and significantly predicted GWB.<sup>25</sup> A positive relationship was identified between resilience and social support in a study conducted after the Sichuan earthquake.<sup>17</sup> Future expectations contributed to the cognitive dimension of resilience and were found to be a protective factor for resilience. The relationship between perceived social support, self-efficacy, and psychological adjustment was fully mediated by the emotive component of resilience. The emotive and cognitive components of resilience fully mediated the relationship between psychological adjustment and future expectations.<sup>26</sup> After the earthquake in Haiti, the mean score of the Resilience Scale (RS) was found to be  $131.46 \pm 21.01$ . No significant differences were noted according to age and sex. The total RS score was positively associated with social support.<sup>27</sup> Five years after the Yushu earthquake, the mean score of the Connor-Davidson Resilience Scale was  $55.0 \pm 12.3$ . Factors positively associated with resilience included social support, regular physical exercise, academic performance, health over the last year, participation in school activities, and good relationships with teachers and classmates, while female gender and being extremely worried were negatively associated with resilience.<sup>28</sup>

## 3. Resilience and Posttraumatic Growth

The relationship between resilience and posttraumatic growth is an important subject. Two studies examining this topic have been found. Adolescents were evaluated over four periods at six-month intervals following an earthquake and participated in an online survey ten years later to examine posttraumatic growth. Three resilience trajectories were identified based on their frequency: moderate resilience (58.7%), high resilience (21.5%), and low resilience (19.8%). Notably, in males, adolescents in the high resilience group reported higher posttraumatic growth compared to those in the low resilience group ten years later.<sup>29</sup> Positive associations were found between posttraumatic growth, resilience, and perceived social support.<sup>30</sup>

## 4. Resilience and Intervention Programs

Two years after the earthquake, participants were followed up for one year, with 58 adolescents included in the intervention group. The mean CD-RISC score was  $53.71 \pm 14.03$ , increasing to  $56.90 \pm 13.953$  after the follow-up. Changes in the scores for depression and resilience significantly predicted changes in PTSD severity and accounted for a significant portion of the variance (18.7%). When cognitive-behavioral therapy was incorporated into the model, it proved to be an important predictor, explaining 33.6% of the variance.<sup>31</sup> In another study, a comparison between psychosocial intervention and control groups after the earthquake showed no significant differences in resilience scores between the groups. Examining the relationship between two different resilience factors and PTSD, rational thinking was found to be more negatively associated with PTSD in the intervention group, while self-awareness was positively associated with PTSD in both groups.<sup>32</sup> In a study evaluating both children and adults, it was observed that PTSD, anxiety, and depression scores decreased, and resilience scores increased following group therapy and individual therapy compared to the outset of treatment.<sup>33</sup> At a four-week follow-up, no significant differences were found in emotion regulation, anxiety, resilience, posttraumatic stress, coping skills, or functional impairment in an intervention program applied in secondary schools.<sup>34</sup>

## DISCUSSION

In this review, studies examining post-earthquake psychological resilience in children and adolescents were compiled. A significant portion of these studies focused on adolescents, with only one including both adults and adolescents.<sup>33</sup> Notably, nearly half of the studies were longitudinal. While cross-sectional studies were conducted at a specific time after the earthquake, longitudinal studies mostly obtained scale scores at six-month intervals. Most of the research was conducted following earthquakes in the Asian continent, particularly the Wenchuan and Sichuan earthquakes, with only two studies from the European continent where earthquake risk is lower. The majority of the studies after the Wenchuan earthquake were carried out by the Wenchuan Earthquake Adolescent Health Cohort study group.

Several studies noted differences in resilience between females and males, with resilience being higher in males.<sup>14,16,17,22</sup> It was observed that resilience against stress decreases in females during adolescence due to hormonal effects.<sup>35</sup> The lower resilience in females results in greater susceptibility to trauma and stress-related disorders. The average scores derived from the scales varied depending on the different scales used for measuring resilience in the studies. Discrepancies in scores from the same scales could depend on factors such as

the region where the earthquake occurred, the severity of the earthquake, cultural structure, and accompanying factors like home destruction, loss of parents and siblings. In longitudinal studies, the increase in resilience scores over time may be related to the passage of time after the earthquake and the reduction in its traumatic effects; on the other hand, it may also be connected to increased social support over time.

The number of studies solely focusing on resilience was very limited, with most exploring its relationship with depression, PTSD, anxiety, and social support. In most studies, resilience was found to be negatively associated with depression, PTSD, and anxiety. Consistent with these findings, there are studies in both the general population and among those exposed to trauma, stress, or disasters, demonstrating that depression and PTSD are negatively correlated with resilience in the literature. The results of a study with left-behind children in China, which measured depression at baseline and after one year of follow-up, showed that resilience was negatively associated with depression.<sup>36</sup> Resilience has been identified as protective against depression in adolescents who experienced cyberbullying.<sup>37</sup> A strong negative correlation between resilience and depression was found in a study where female adolescents exhibited higher resilience and lower depression levels than males.<sup>38</sup> The results of a study conducted with high school students indicated a negative relationship between resilience and depression.<sup>39</sup> Low levels of resilience in children were identified as a risk factor for psychological maladjustment during the Coronavirus Disease 2019 (COVID-19) pandemic.<sup>40</sup> In a study involving adolescents exposed to Hurricane Katrina and the oil spill, an increase in resilience was associated with decreased depression, PTSD, and risky substance use behavior, demonstrating that resilience was a protective factor.<sup>41</sup> Adolescents with more severe PTSD symptoms had lower levels of resilience six months after the Yancheng hurricane.<sup>42</sup> High scores on the resilience scale were negatively associated with trauma symptoms in adolescents.<sup>43</sup> Additionally, one study found that resilience predicted PTSD following the earthquake,<sup>20</sup> attributing this outcome to the fact that the participants had been exposed to three different earthquakes consecutively.

There was generally a positive relationship between resilience and social support after an earthquake. Social support is one of the protective factors that garners significant interest in the field of resilience,<sup>44,45</sup> and it is often studied in conjunction with resilience in the literature. In a large sample of adolescents, social support and resilience were found to play an important mediating role in the relationship between quality of life and adverse life events.<sup>46</sup> A positive correlation between social support and resilience was demonstrated in students living under siege.<sup>47</sup>

In recent years, it has been recognized that trauma does not only have negative effects on human life; it can also lead to positive outcomes such as self-actualization and increased functionality, a phenomenon known as post-traumatic growth. Two studies in the literature have examined the relationship between resilience and posttraumatic growth.<sup>29,30</sup> To better understand this significant issue, more studies are needed with children and adolescents who have been exposed to earthquakes, extending into their adulthood. Four of the longitudinal studies investigated the effectiveness of intervention programs. In studies that included intervention, one showed a decrease in scale scores and improvement in symptoms, while no change was observed in two others. After an earthquake, not only the children and adolescents in the region are affected, but also many professionals, some of whom lose relatives and become victims of trauma themselves. This includes mental health workers. It is understandable that studies involving therapy programs are limited, as cities lose their former order after an earthquake. The issues of housing, lack of suitable physical facilities, and the impact on individuals responsible for interventions all contribute to this limitation. For this reason, it would be appropriate to provide therapy for children and adolescents in the locations to which they have migrated or to implement intervention programs in the earthquake zone by professionals from regions of the country that were not affected by the earthquake. Another alternative is receiving support from other countries, similar to search and rescue efforts. For effective intervention through this method, it is crucial that there is no language barrier and that cultural differences are minimized.

## CONCLUSION

Since earthquakes occur suddenly and unexpectedly, beyond human control, the trauma experienced, especially in devastating earthquakes, is quite profound. Following the 2023 earthquake in our country, the importance of precautions for psychological health and the need for long-term interventions have been realized anew. Resilience emerges as an important protective factor for mental health after traumas like earthquakes. It is crucial to conduct school and family-based resilience interventions routinely before and after earthquakes. Providing mental health support, especially psychological first aid, after earthquakes is essential to prevent depression, PTSD, and anxiety disorders that may arise in children and adolescents following such events. These policies will protect the mental health of children and adolescents in the early period, facilitate their adaptation to new life post-trauma, and reduce the potential for trauma-related psychiatric symptoms in the future.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – ED, MGK; Design – ED, MGK; Supervision – ED; Data Collection and/or Processing – ED, MGK, SÖ; Analysis and/or Interpretation – ED, MGK, SÖ; Literature Search – ED, MGK, SÖ; Writing – ED, MGK; Critical Reviews – ED, MGK, SÖ.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

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**Appendix 1.** Information on the selected studies included in the review

<b>Study</b>	<b>Country/earthquake</b>	<b>Participants Mean Age±SD, M/F</b>	<b>Study design</b>	<b>Measures</b>
(11)	China/Lushan	12.83±2.58, 1,346/1,541	Cross-sectional	PHQ-9 CYRM-12
(12)	China/Wenchuan	14.44±1.65, 640/786	Cross-sectional	CD-RISC CES-DC
(13)	China/Wenchuan	15±1.3, 720/853	Longitudinal	DSRSC ASRLEC RS
(14)	China/Wenchuan	15±1.26, 720/853	Longitudinal	ASRLEC SSRS RS DSRSC
(15)	Nepal	12.5±2.33, 27/35	Cross-sectional	CYRM CPSS DSRSC EEAT
(16)	China/Wenchuan	15.98±1.28 1,266 adolescents 43.4% males	Cross-sectional	DSRSC RS PTSD-SS SCARED PBI
(17)	China/Sichuan	14.4±1.7, 1,574/1,340	Cross-sectional	CD-RISC MSPSS CDI SCARED
(18)	China/Wenchuan	15.03±1.65 788 adolescents 54% female	Cross-sectional	CPSS CES-DC CD-RISC EEQ
(19)	Japan/Great East Japan Earthquake	N/A 254 adolescents	Longitudinal	CD-RISC SAS QIDS-J IES-R
(20)	Indonesia/Lombok	16.24±0.98, 158/251	Cross-sectional	CRIES-13 CPTCI CYRM-R
(21)	China/Wenchuan	15.54±1.26 1,342 adolescents 56.9% females	Cross-sectional	PTSD-SS PSQI RS

**Appendix 1 (cont).** Information on the selected studies included in the review

Study	Country/earthquake	Participants Mean Age±SD, M/F	Study design	Measures
(22)	China/Wenchuan	15 1,573 participants 45.8% males	Cohort	SCARED ASRLEC SSRS RS
(23)	Italy/L'Aquila	206/137	Cross-sectional	READ Brief cope SI
(24)	China/Wenchuan	17.46±0.68, 320/445	Longitudinal	AGS-C SSRS-C RS SDQ-C ASLEC
(25)	China/Wenchuan	16.22±0.80, 1,196/773	Cross-sectional	PSSS GWBS CD-RISC
(26)	China/Sichuan	16.34±0.60 311 adolescents 45% males	Longitudinal	RSCA SAS SDS PSSS FES GSE
(27)	Haiti	14.91±1.94, 381/491	Cross-sectional	RS SSQ CDI IES-R
(28)	Tibet/Yushu	15.7±1.8, 2,215/2,466	Cross-sectional	CD-RISC SS-A
(29)	China/Wenchuan	15.44±0.66 744 adolescents 59.1% females	Cohort	RS PTGI-SF PHQ-9 PCL-5 SCARED ASRLEC
(30)	China/Sichuan	14.55±1.70, 1,717/1,457	Cross-sectional	PTGI-C-R CD-RISC MSPSS CDI
(31)	China/Wenchuan	11.91, 80/123	Longitudinal	CRIES-13

**Appendix 1 (cont).** Information on the selected studies included in the review

Study	Country/earthquake	Participants Mean Age±SD, M/F	Study design	Measures
				CD-RISC CES-D
(32)	China/Sichuan	Intervention group 11.11±1.89 1,031/957 Control group 11.73±2.18 1,063/1,069	Cross-sectional	CD-RISC UCLA-PTSD Index
(33)	Spain/Lorca	N/A 89 children	Longitudinal	SCARED-R STAI CDI SRS
(34)	Nepal	Study group 14.38±1.13 19/23 Control group 14.25±1.40 32/28	Follow-up	DERS DBT-WCCL BAI CPSS CFI RS

AGS-C: Chinese Version of the Adolescents’ Gratitude Scale; ASRLEC: Adolescent Self-Rating Life Events Checklist; BAI: Beck Anxiety Inventory; CDI: Children’s Depression Inventory; CD-RISC: Connor-Davidson Resilience Scale; CES-DC: Center for Epidemiologic Studies Depression Scale for Children; CFI: Child Functioning Impairment Scale; CPSS: Child PTSD Symptom Scale; CPTCI: Child Post-Traumatic Cognitions Inventory; CRIES: Children’s Revised Impact of Event Scale; CYRM: Child and Youth Resilience Measure; DBT-WCCL: Dialectical Behavior Therapy Ways of Coping Checklist; DERS: Difficulties in Emotion Regulation Scale; DSRSC: Depression Self-Rating Scale for Children; EEAT: Earthquake Exposure Assessment Tool for Children and Adolescents; EEQ: Earthquake Exposure Questionnaire; F: Female; FES: Future Expectation Scale; GSE: General Self-Efficacy Scale; GWBS: General Well-Being Scale; IES-R: Impact of Event Scale-Revised; M: Male; MSPSS: Multidimensional Scale of Perceived Social Support; PBI: Parental Bonding Instrument; PCL-5: Posttraumatic Stress Disorder Checklist; PHQ-9: Patient Health Questionnaire-9; PSQI: Pittsburgh Sleep Quality Index; PSSS: Perceived Social Support Scale; PTGI-C-R: Revised Posttraumatic Growth Inventory for Children; PTGI-SF: The Posttraumatic Growth Inventory Short Form; PTSD-SS: Post-Traumatic Stress Disorder Self-Rating Scale; QIDS-J: Quick Inventory of Depressive Symptomatology Japanese Version; READ: Resilience Scale for Adolescents; RS: Resilience Scale; RSCA: Resilience Scale for Chinese Adolescents; SAS: Self-Rating Anxiety Scale; SCARED: Screen for Child Anxiety Related Emotional Disorders; SD: Standard Deviation; SDQ-C: Chinese Version of the Strengths and Difficulties Questionnaire; SDS: Self-Rating Depression Scale; SI: Suicidal Ideation Screening; SRS: School Resilience Scale; SS-A: Social Support- Appraisals; SSQ: Social Support Questionnaire; SSRS-C: Chinese Version of the Social Support Rate Scale; STAI: State/Trait Anxiety Inventory for Children.