

REVIEW

Open Access



Prevalence of post-traumatic stress disorder during the COVID-19 pandemic in children: a review and suggested solutions

Zahra Karbasi^{1*}  and Parisa Eslami²

Abstract

Background: The outbreak of coronavirus began in China in December 2019. It became a pandemic and a public health emergency. There have been numerous reports related to post-traumatic stress disorder outbreaks in the COVID-19 crisis. After a natural disaster, children are at a higher risk for post-traumatic stress disorder. The current study is a review of the scientific literature on the effect of COVID-19 on the prevalence of symptoms of post-traumatic stress disorder in children.

We searched PubMed, Web of Science, and Scopus databases until February 02, 2022. The search strategy was based on a combination of the following keywords “child,” “COVID-19,” and “post-traumatic stress disorder.”

Results: By searching the Web of Science, Scopus, and PubMed databases, 173 articles were retrieved. After reviewing the inclusion criteria and in terms of eligibility, 10 articles met the inclusion criteria out of the remaining 46 articles. Based on the findings, 80% of the articles were cross-sectional and 20% of them were longitudinal. The articles reviewed in this study reported an increase in the prevalence of post-traumatic stress disorder in children during or after the COVID-19 pandemic.

Conclusions: In summary, the findings of this review showed that restrictions and fears of COVID-19 had negative psychological effects on children. As well, one of the most important issues that arose at the time of the tragedy was that children were suffering from post-traumatic stress disorder. Given that post-traumatic stress disorder can be treated, it is essential to choose the appropriate therapeutic intervention approach in order to better deal with the negative effects in children.

Keywords: Children, COVID-19, Post-traumatic stress disorder

Background

The outbreak of coronavirus disease 2019 (COVID-19) began in China in December, 2019 [1], which rapidly spread all around the world [2]. Eventually, it became a pandemic and a public health emergency [3]. The crisis caused stress among the public, and the World Health

Organization (WHO) expressed concern about the mental health of people during the pandemic as well as its psychological and social consequences [4]. Restrictive and quarantine measures affected people's lives, especially people's mental health status, and psychological problems such as depression, stress, and anxiety are expected to increase as consequences [2]. Research results showed that anxiety disorders, depression, and post-traumatic stress disorder (PTSD) usually increase after major crises [5–7]. Evidence suggests that the consequences of the coronavirus pandemic are associated with PTSD, psychological distress, psychiatric disorders,

*Correspondence: karbasizahra4@gmail.com

¹ Department of Health Information Sciences, Faculty of Management and Medical Information Sciences, Kerman University of Medical Sciences, Kerman, Iran

Full list of author information is available at the end of the article

pathological and psychological symptoms, and stress [8–10]. Psychiatric disorders and PTSD place a significant burden on individuals [11]. PTSD is a type of psychiatric condition caused either by a crisis or by traumatic factors [12, 13]. This psychiatric disorder caused by critical events such as natural disasters, severe injuries, death, and threats directly or indirectly affect people [14]. The prevalence rate of PTSD in the COVID-19 pandemic varies among different populations. For example, 29.5% of PTSD symptoms were found in the Italian population [15]. The prevalence rate of this disorder in young adults in the USA is reported to be 31.8% [16]. A recent study performed in China estimated the prevalence rates of PTSD and depression among students by passing 1 month from COVID-19 at 2.7 and 9.0%, respectively [17].

It was demonstrated that some age groups are more vulnerable to the psychological consequences of this pandemic. Due to the fact that children are in a critical period of their development, they need special care for their mental health [18]. As well, they can express their stress in different ways [19]. Stress, anxiety, and PTSD were shown to have negative and debilitating effects on a child's performance [20]. After a natural disaster, children are at a higher risk for PTSD [21]. Children may experience various consequences like PTSD in the context of pandemics [22]. According to a study by Saurabh and Ranjan, 68% of children quarantined during the COVID-19 pandemic suffered from mental illnesses [23]. A recent review found that the COVID-19 pandemic has a significant impact on mental health and more negative consequences like PTSD among vulnerable age groups, including children [24]. Based on the research, the prevalence of symptoms of PTSD has expanded due to the prevalence of COVID-19. Accordingly, the prevalence rate of PTSD among people aged between 14 and 35 in China is reported to be 12.8% [25].

Numerous articles [26–28] have previously reviewed the effects of COVID-19 and the prevalence of PTSD symptoms among different groups and individuals. The current study is a review of the scientific literature on the effect of COVID-19 on the prevalence of symptoms of PTSD in children.

Methods

Search strategy

This review was performed in terms of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist [29]. We searched PubMed, Web of Science, and Scopus databases until February 02, 2022. The search strategy was based on a combination of the following keywords “child,” “COVID-19,” and “post-traumatic stress disorder.” Boolean search strategies are based on these keywords tailored to each database. PRISMA

flow chart of the article selection process is presented in Fig. 1.

Inclusion criteria

Articles were included in the study if they met the following inclusion criteria:

- Articles published in the English language
- Articles focusing on the effect of COVID-19 on the prevalence of PTSD in children
- Having accordance with the search strategy

Exclusion criteria

- Review or systematic review, books, letters to editors, short communication, reports, and commentaries
- Articles whose abstracts and full text were not available

Screening and article selection phase

In this phase, the retrieved articles were entered into the EndNote software, and duplicates were removed. Thereafter, two independent reviewers reviewed the titles and abstracts of the articles to identify relevant articles. Disagreements were mentioned and resolved through consensus in a joint meeting. Finally, the related articles were downloaded and then evaluated for eligibility and data extraction.

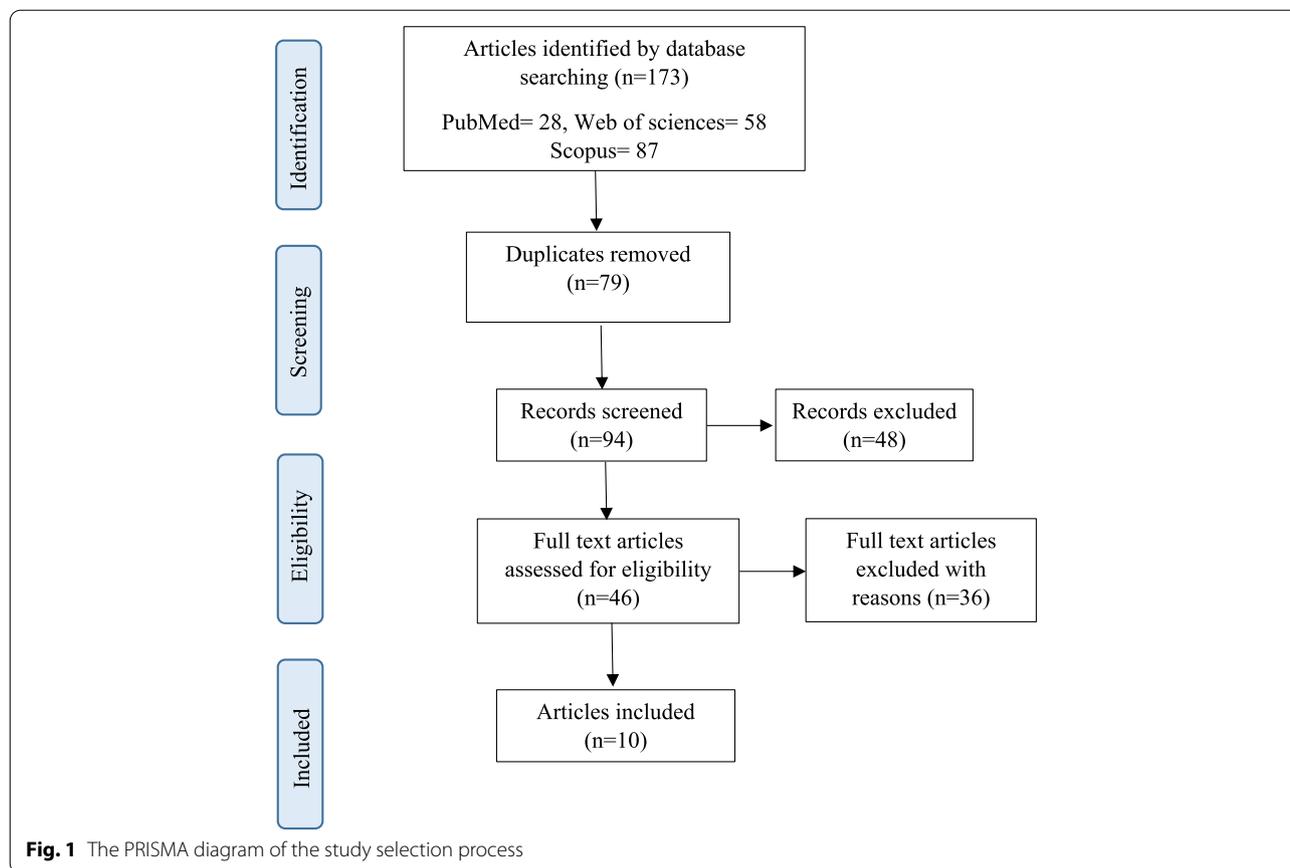
Analysis

The data extraction form of the included articles was designed by the authors in Excel, and the following information was extracted for each article: author, year, country, type of study, objective, participants, age, measures, and the main findings. The obtained data were presented with descriptive statistics and percentages. The general characteristics of the included studies are summarized in Table 1.

Results

Study selection

At this stage, by searching the Web of Science, Scopus, and PubMed databases, 173 articles were retrieved. Of these, 79 duplicate articles were removed and 94 articles entered the screening process. We excluded 48 articles, and after reviewing the inclusion criteria and in terms of eligibility, 10 articles met the inclusion criteria out of the remaining 46 articles.



Characteristics of articles

A summary of general specifications for the included studies is provided in Table 1.

Year of publication

Due to the start of the pandemic of COVID-19 since 2019, most of the published articles are related to the period 2021 onwards. Based on the findings, 90% of the articles were published in 2021 as well as 10% in 2022.

Country

Five studies were performed in China, two in Italy, and the remaining in Turkey, Canada, and Saudi Arabia.

Type of study

Based on the findings, 80% of the articles were cross-sectional and 20% of them were longitudinal.

Participants

According to the purpose of the reviewed articles, which was assessing the prevalence of PTSD related to

COVID-19, participants in the included studies were children, students, and parents.

Age of participants

The age group of the studied children is presented in Table 1.

Measures

The included studies have used various measures to assess the prevalence of PTSD. In six articles, an online questionnaire was used, two articles used a questionnaire, one article analyzed patients’ data, and one article used a semi-structured interview.

Objectives and findings

The main objectives and findings of these articles are summarized in Table 1.

Discussion

The COVID-19 pandemic has had a profound effect on people’s lives. In the meantime, children as a sensitive and vulnerable group were affected by the negative

Table 1 Main characteristics of the included studies

Author	Year	Country	Type of study	Objective	Participants	Age, years (mean±SD)	Measures	Main findings
Chen et al. [30]	2021	China	Cross-sectional	To evaluate the prevalence of PTSD symptoms in students in Wuhan	Children	12.26 ± 2.14 years	Online questionnaire	According to the findings, 11.5% of students had clinical criteria related to PTSD symptoms.
Davico et al. [31]	2021	Italy	Cross-sectional	Assessing the mental impact of COVID-19 on adults and children	Adult and children	12.3 ± 3.2 years	Online questionnaire	The results showed that 30.9% of children were at high risk for PTSD in the COVID-19 crisis.
Eray et al. [32]	2021	Turkey	Cross-sectional	Evaluation of admission of children with psychiatric symptoms during and before the COVID-19 pandemic	Children	First group: 14.4±2.53 Second group: 14.2±3.05	Patients data	The results showed an increase in diagnoses of PTSD among children during the COVID-19 pandemic.
He et al. [33]	2021	China	Cross-sectional	To assess children's psychological health conditions in the COVID-19 pandemic	Children	11.83±0.79 years	Online questionnaire	The results showed that children's rates of PTSD were low (the prevalence of PTSD was 2.04%)
Ma et al. [34]	2021	China	Cross-sectional	To assess the impact of the COVID-19 pandemic on psychological health among Chinese children	Parents and children	7–15 years	Online questionnaire	The results showed that the COVID-19 pandemic has caused PTSD, as well as 20.7 and 7.2% of children experienced PTSD.
Raffagnato et al. [35]	2021	Italy	Longitudinal study	To assess the impact of the COVID-19 pandemic on the mental health of children and adolescents with psychiatric disorders	Children and their parents	13.4±2.77 years	Semi-structured interview and questionnaires	No significant differences were found in the psychological behavior of patients, as evidenced by a significant reduction in post-traumatic stress problems.
Raymond et al. [36]	2022	Canada	Longitudinal study	To assess the effects of mental distress in children during the COVID-19 pandemic	Children	9–14 years	Online questionnaire	The results showed that PTS symptoms increased in children aged 9 to 11 years old.
Sayed et al. [37]	2021	Saudi Arabia	Cross-sectional	To assess for PTSD symptoms in children/adolescents in Saudi Arabia during the COVID-19 pandemic	Children	12.25±3.77 years	Online questionnaire	The results showed that the COVID-19 pandemic was associated with the prevalence of PTSD in children.
Xu et al. [38]	2021	China	Cross-sectional	To investigate the prevalence of PTSD in school students in China during COVID-19	Children	8–18 years	Questionnaire	The results showed that the COVID-19 crisis has led to psychological stresses on Chinese students.

Table 1 (continued)

Author	Year	Country	Type of study	Objective	Participants	Age, years (mean±SD)	Measures	Main findings
Zhang et al. [39]	2021	China	Cross-sectional	To assess the psychological health status of children discharged in the COVID-19 pandemic	Children	7–18 years	Questionnaire	An increased prevalence of PTSD was observed in discharged children.

consequences of COVID-19. Children's mental health is one of the related and effective factors in their growth and development. In this review, we aimed to provide evidence on the prevalence of PTSD in children in the COVID-19 crisis.

Quarantine at home has reduced interpersonal communication and at the same time increased people's psychological problems. Based on this reason, people become more prone to mental problems and mental disorders [40]. Children may experience different behavioral reactions based on stressful situations [36]. The articles reviewed in this study reported an increase in the prevalence of PTSD in children during or after the COVID-19 pandemic. Similarly, the results of a meta-analysis by Rezayat et al. showed that PTSD was prevalent among children and adolescents surviving from natural disasters [41]. Therefore, psychological support and paying attention to the mental health needs of children in traumatic conditions can reduce the prevalence of PTSD and other mental disorders. The prevalence of PTSD in children after the occurrence of natural disasters depends on various factors, including the time elapsed after the disaster, research methods, and definitions of consequences and symptoms [42].

In two articles reviewed in this case, PTSD symptoms were assessed by parents. Although these studies have been shown to increase PTSD in children, parents may underestimate the degrees of distress and reaction to traumatic conditions in their children [43]. Children may not share their feelings and conversations about the event with their parents; on the other hand, it is possible for parents to understand their children without representing any symptoms. Therefore, in examining the symptoms, it is very important that the children's own report be more prioritized [44].

Solutions

Following the occurrence of disasters and traumatic events, children mostly experience psychological problems, especially PTSD. In this regard, awareness of appropriate treatments and interventions can greatly protect children from serious harm.

Psychotherapy interventions

The use of post-disaster mental health interventions is essential in this regard [45]. Counseling helps children as well as their families to recover as quickly as possible at their home or even at school. As well, therapists can follow the treatment path by performing "play therapy," "communication with the child," and "behavioral therapy" methods [46]. Art therapy is suitable for the treatment of children experiencing natural disasters [47]. In stressful events, the help and intervention of therapists such as

pediatricians, counselors, and mental health therapists can effectively reduce children's anxiety and fear. In addition, it is necessary to know the types of assistive methods in order to meet the mental and emotional needs of children after the disaster [48]. Helping the child to talk about his/her emotional issues and recounting problems and issues related to lost loved ones [49] will be effective in improving post-disaster problems.

In addition to the abovementioned statements, a psychosocial intervention could also help in identifying symptoms and improving children's psychological problems. The use of group therapies for the effectiveness of treatment in children who are at risk of various types of disasters is recommended [50]. In group therapy, people with similar problems are examined in a group [51]. Several articles [52–54] have previously focused on the use of group therapy as an effective tool in the treatment of children affected by disasters. Evidence suggests that various intervention therapies in the COVID-19 pandemic, such as art therapy [55, 56] and psychosocial support services [56], can improve children's mental health status.

Cognitive behavior therapy

One of the most common methods used for the treatment of PTSD is cognitive behavioral therapy (CBT), which is a combination of both cognitive and behavioral therapies [57]. CBT helps the child to control his/her anxiety and negative emotions and to master situations that cause this kind of anxiety [51]. Studies [58, 59] have shown the effectiveness of cognitive behavioral therapy for children after disasters. Findings from Lee et al.'s study showed that CBT programs can be helpful in improving the mental health status of children with autism in the COVID-19 pandemic [60].

Psychoeducation

One of the main components of behavioral and mental health interventions is mental education and providing the necessary training regarding disasters. Involving parents and children in these trainings will facilitate parental support and help to identify and raise awareness about disaster response [61]. It is noteworthy that psychological education for children immediately after a disaster can reduce their psychological damage and be very effective in their treatment [62].

Schools are places offering psychological education, psychological aid, and group support services and can be used to provide psychological health services or referrals to social services [63]. In the event of a disaster due to the lack of having access to a sufficient number of mental health professionals, trained teachers, or teaching staff can provide counseling services [64]. Holding psychological education seminars and activities such as play

therapy, art therapy, and book therapy after an earthquake has shown that such programs have been useful for children; thus, they can talk about the problems related to the event with others [65]. Cognitive education allows children to express their feelings and to avoid feelings of being in danger [51].

Parental support

The most effective people in supporting children are their parents, who can influence children as agents of change. Parents can help their children to return to their normal routine of life and normal activities and keep them away from negative and bad feelings and thoughts. Parents can also protect their children from being exposed to secondary adversity [61].

Tele psychiatry

Tele psychiatry is used to follow patients and reduce any unnecessary travel [66], which can be used as an alternative method to face-to-face therapy, especially in the COVID-19 crisis [67].

There are several therapeutic interventions used for helping children to deal with the problems caused by experiencing disasters. By better understanding the traumatic conditions and risk factors as well as choosing the appropriate treatment strategy, interventions can be started after a natural disaster [42]. In addition to the abovementioned statement, pharmacological interventions in the treatment of pediatric PTSD based on a step-by-step approach can be effective in improving child performance [68].

Limitations

In this review, only the problem of PTSD was addressed, while the psychological problems caused by the COVID-19 pandemic were more prevalent among children. In addition, due to the start of the COVID-19 pandemic since 2019, the number of studies examining PTSD in children is still limited.

Conclusions

In summary, the findings of this review showed that restrictions and fears of COVID-19 had negative psychological effects on children. As well, one of the most important issues that arose at the time of the tragedy was that children were suffering from PTSD. Given that PTSD can be treated, it is essential to choose the appropriate therapeutic intervention approach in order to better deal with the negative effects in children. In this regard, more awareness of parents as well as institutions related to child education is needed for performing effective interventions aimed at preventing and treating children's stress. Supporting children in the COVID-19 pandemic

or similar disasters using psychotherapy techniques can dramatically improve the negative and destructive thoughts of children. It is suggested that future research address more aspects of children's mental health status in crises and natural disasters.

Abbreviations

COVID-19: Coronavirus disease 2019; PTSD: Post-traumatic stress disorder; WHO: World Health Organization.

Acknowledgements

None.

Authors' contributions

The concept and design of the study were performed by Z.K. Selection and evaluation of the studies and data extraction were conducted by Z.K and P.E. Z.K, and P.E contributed to the drafting of the manuscript. Both authors read and approved the final version of the manuscript.

Funding

The authors received no financial support for the research or publication of this article.

Availability of data and materials

Not applicable.

Declarations

Ethics approval and consent to participate

No human subjects were included.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Department of Health Information Sciences, Faculty of Management and Medical Information Sciences, Kerman University of Medical Sciences, Kerman, Iran. ²Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran.

Received: 17 August 2022 Accepted: 2 September 2022

Published online: 27 September 2022

References

- World Health O. Novel coronavirus (2019-nCoV): situation report, 1. <https://apps.who.int/iris/handle/10665/330760>. Accessed 22 February 2022. Geneva: World Health Organization 2020 2020-01-21.
- World Health Organization. (2020c). Mental health and COVID-19. <http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/novel-coronavirus-2019-ncov-technical-guidance/coronavirus-disease-covid-19-outbreak-technical-guidance-europe/mental-health-and-covid-19>. Accessed 22 February 2022.
- Coronavirus Disease (COVID-19) - events as they happen. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>. Accessed 22 February 2022.
- World Health Organization. (2020d). Mental health and psychosocial considerations during the COVID-19 outbreak. WHO reference number: WHO/2019-nCoV/MentalHealth/2020.1. <https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf>. Accessed 22 February 2022.
- Neria Y, Nandi A, Galea S (2008) Post-traumatic stress disorder following disasters: a systematic review. *Psychol Med* 38:467–480

6. Utzon-Frank N, Breinegaard N, Bertelsen M, Borritz M, Eller NH, Nordentoft M et al (2014) Occurrence of delayed-onset post-traumatic stress disorder: a systematic review and meta-analysis of prospective studies. *Scand J Work Environ Health* 40:215–229
7. Cao H, McFarlane AC, Klimidis S (2003) Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake—the first 5-month period. *Soc Psychiatry Psychiatr Epidemiol* 38:204–212
8. Sun L, Sun Z, Wu L, Zhu Z, Zhang F, Shang Z et al (2020) Prevalence and risk factors of acute posttraumatic stress symptoms during the COVID-19 outbreak in Wuhan, China. *MedRxiv* 10(2020.03):06.20032425
9. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS et al (2020) Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 17(5):1729
10. Huang Y, Zhao N (2020) Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res* 288:112954
11. Boyraz G, Legros DN (2020) Coronavirus disease (COVID-19) and traumatic stress: probable risk factors and correlates of posttraumatic stress disorder. *J Loss Trauma* 25:503–522
12. Organization WH (1992) The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines: World Health Organization
13. Bryant RA (2019) Post-traumatic stress disorder: a state-of-the-art review of evidence and challenges. *World Psychiatry* 18:259–269
14. Association AP (2013) Diagnostic and Statistical Manual of Mental Disorders (DSM-5®). American Psychiatric Publishing
15. Forte G, Favieri F, Tambelli R, Casagrande M (2020) COVID-19 pandemic in the Italian population: validation of a post-traumatic stress disorder questionnaire and prevalence of PTSD symptomatology. *Int J Environ Res Public Health* 17:4151
16. Liu CH, Zhang E, Wong GTF, Hyun S, Hahm HC (2020) Factors associated with depression, anxiety, and PTSD symptomatology during the COVID-19 pandemic: clinical implications for U.S. young adult mental health. *Psychiatry Res* 290:113172
17. Tang WJ, Hu T, Hu BD, Jin CH, Wang G, Xie C et al (2020) Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *J Affect Disord* 274:1–7
18. Wang G, Zhang Y, Zhao J, Zhang J, Jiang F (2020) Mitigate the effects of home confinement on children during the COVID-19 outbreak. *Lancet* 395:945–947
19. Organization WH (2020) Helping children cope with stress during the 2019 n-CoV outbreak. World Health Organization, Geneva Available from: <https://www.who.int/docs/default-source/coronaviruse/helping-children-cope-with-stress-print.pdf>. Accessed 04 April 2022
20. Kenardy J, Le Brocq R, Hendrikz J, Iselin G, Anderson V, McKinlay L (2012) Impact of posttraumatic stress disorder and injury severity on recovery in children with traumatic brain injury. *J Clin Child Adolesc Psychol* 53(41):5–14
21. Goenjian AK, Pynoos RS, Steinberg AM, Najarian LM, Asarnow JR, Karayan I et al (1995) Psychiatric comorbidity in children after the 1988 earthquake in Armenia. *J Am Acad Child Adolesc Psychiatry* 34:1174–1184
22. Sprang G, Silman M (2013) Posttraumatic stress disorder in parents and youth after health-related disasters. *Disaster Med Public Health Preparedness* 7:105–110
23. Saurabh K, Ranjan S (2020) Compliance and psychological impact of quarantine in children and adolescents due to COVID-19 pandemic. *Indian J Pediatr* 87:532–536
24. Giannopoulou I, Galinaki S, Kollintza E, Adamaki M, Kypmpouropoulos S, Alevyzakis E et al (2021) COVID-19 and post-traumatic stress disorder: the perfect 'storm' for mental health (Review). *Exp Ther Med* 22(4):1–7
25. Liang L, Gao T, Ren H, Cao R, Qin Z, Hu Y et al (2020) Post-traumatic stress disorder and psychological distress in Chinese youths following the COVID-19 emergency. *J Health Psychol* 25:1164–1175
26. Li Y, Scherer N, Felix L, Kuper H (2021) Prevalence of depression, anxiety and post-traumatic stress disorder in health care workers during the COVID-19 pandemic: a systematic review and meta-analysis. *PLoS One* 16:e0246454-e
27. Nagarajan R, Krishnamoorthy Y, Basavarachar V, Dakshinamoorthy R (2022) Prevalence of post-traumatic stress disorder among survivors of severe COVID-19 infections: a systematic review and meta-analysis. *J Affect Disord* 299:52–59
28. Corsi M, Orsini A, Pedrinelli V, Santangelo A, Bertelloni CA, Carli N et al (2021) PTSD in parents of children with severe diseases: a systematic review to face COVID-19 impact. *Ital J Pediatr* 47(1):1–7
29. Moher D, Liberati A, Tetzlaff J, Altman DG (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med* 151(264-9):w64
30. Chen Y, Zhu Z, Lei F, Lei S, Chen J (2021) Prevalence and risk factors of post-traumatic stress disorder symptoms in students aged 8–18 in Wuhan, China 6 months after the control of COVID-19. *Front Psychol* 4651
31. Davico C, Ghiggia A, Marcotulli D, Ricci F, Amianto F, Vitiello B (2021) Psychological impact of the COVID-19 pandemic on adults and their children in Italy. *Front Psychiatry* 12:572997
32. Eray S, Sahin V (2021) COVID-19 pandemic may have unique effects on emergency admissions for pediatric psychopathology: a single-center study. *Psychiatry Behav Sci* 11:115–120
33. He Y, Li XS, Zhao J, An Y (2021) Family resilience, media exposure, and children's mental health in China during COVID-19. *Fam J* 10664807211061832
34. Ma Z, Idris S, Zhang Y, Zewen L, Wali A, Ji Y et al (2021) The impact of COVID-19 pandemic outbreak on education and mental health of Chinese children aged 7-15 years: an online survey. *BMC Pediatr* 21:95
35. Raffagnato A, Iannatone S, Tascini B, Venchiarutti M, Broglio A, Zanato S et al (2021) The COVID-19 pandemic: a longitudinal study on the emotional-behavioral sequelae for children and adolescents with neuropsychiatric disorders and their families. *Int J Environ Res Public Health* 18(18):9880
36. Raymond C, Provencher J, Bilodeau-Houle A, Leclerc J, Marin MF (2022) A longitudinal investigation of psychological distress in children during COVID-19: the role of socio-emotional vulnerability. *Eur J Psychotraumatol* 13(1):2021048
37. Sayed MH, Hegazi MA, El-Baz MS, Alahmadi TS, Zubairi NA, Altuwiriqi MA et al (2021) COVID-19 related posttraumatic stress disorder in children and adolescents in Saudi Arabia. *PLoS One* 16:e0255440
38. Xu H, Zhang H, Huang L, Wang X, Tang X, Wang Y et al (2021) Increased symptoms of post-traumatic stress in school students soon after the start of the COVID-19 outbreak in China. *BMC Psychiatry* 21:330
39. Zhang A, Shi L, Yan W, Xiao H, Bao Y, Wang Z et al (2021) Mental health in children in the context of COVID-19: focus on discharged children. *Front Psychiatry* 1993
40. Xiao C (2020) A novel approach of consultation on 2019 novel coronavirus (COVID-19)-related psychological and mental problems: structured letter therapy. *Psychiatry Investig* 17:175–176
41. Rezayat AA, Sahebdel S, Jafari S, Kabirian A, Rahnejat AM, Farahani RH et al (2020) Evaluating the prevalence of PTSD among children and adolescents after earthquakes and floods: a systematic review and meta-analysis. *Psychiatric Q* 91:1265–1290
42. Abuse S. Disaster Technical Assistance Center supplemental research bulletin: behavioral health conditions in children and youth exposed to natural disasters. 2018. Available from: <https://cdn.filestackcontent.com/VMxGjSDFRQeIFEM8OwP7>. Accessed 05 April 2022.
43. Dyregrov A, Yule W (2006) A review of PTSD in children. *Child Adolesc Mental Health* 11:176–184
44. Zhou D (2018) The role of family in children with PTSD after natural disasters. *J Biosci Med* 6:111
45. Math SB, Tandon S, Girmaji SC, Benegal V, Kumar U, Hamza A et al (2008) Psychological impact of the tsunami on children and adolescents from the Andaman and Nicobar islands. *Prim Care Companion J Clin Psychiatry* 10:31–37
46. Baggerly J, Exum HA (2007) Counseling children after natural disasters: guidance for family therapists. *Am J Fam Ther* 36:79–93
47. Murphy, Caitlin Frances, Post-disaster group art therapy treatment for children (2014). LMU/LLS theses and dissertations. 55. Available from: <https://digitalcommons.lmu.edu/etd/55>. Accessed 05 April 2022.
48. Speier AH (2000) Psychosocial issues for children and adolescents in disasters: government printing office
49. Kar N (2009) Psychological impact of disasters on children: review of assessment and interventions. *World J Pediatr* 5:5–11

50. Chemtob CM, Nakashima JP, Hamada RS (2002) Psychosocial intervention for postdisaster trauma symptoms in elementary school children: a controlled community field study. *Arch Pediatr Adolesc Med* 156:211–216
51. Koplewicz HS, Cloitre M (2006) *Caring for kids after trauma, disaster and death: a guide for parents and professionals*. New York University Child Study Center
52. Maheshwari N, Yadav R, Singh NP (2010) Group counseling: a silver lining in the psychological management of disaster trauma. *J Pharm Bioallied Sci* 2:267–274
53. Rusmana N, Hafina A, Suryana D (2020) Group play therapy for preadolescents: post-traumatic stress disorder of natural disaster victims in Indonesia. *Open Psychol J* 13(1)
54. Shen Y-J (2002) Short-term group play therapy with Chinese earthquake victims: effects on anxiety, depression and adjustment. *Int J Play Ther* 11:43
55. Malboeuf-Hurtubise C, Léger-Goodes T, Mageau GA, Taylor G, Herba CM, Chadi N et al (2021) Online art therapy in elementary schools during COVID-19: results from a randomized cluster pilot and feasibility study and impact on mental health. *Child Adolesc Psychiatry Ment Health* 15:15
56. Meherali S, Punjani N, Louie-Poon S, Abdul Rahim K, Das JK, Salam RA et al (2021) Mental health of children and adolescents amidst COVID-19 and past pandemics: a rapid systematic review. *Int J Environ Res Public Health* 18:3432
57. InformedHealth.org [Internet]. Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006-. Cognitive behavioral therapy. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279297/>. Accessed 8 Sept 2022
58. Giannopoulou I, Dikaiakou A, Yule W (2006) Cognitive-behavioural group intervention for PTSD symptoms in children following the Athens 1999 earthquake: a pilot study. *Clin Child Psychol Psychiatry* 11:543–553
59. de Roos C, Greenwald R, den Hollander-Gijsman M, Noorthoorn E, van Buuren S, De Jongh A (2011) A randomised comparison of cognitive behavioural therapy (CBT) and eye movement desensitisation and reprocessing (EMDR) in disaster-exposed children. *Eur J Psychotraumatol* 2:5694
60. Lee V, Roudbarani F, Tablon Modica P, Pouyandeh A, Weiss JA (2022) Adaptation of cognitive behavior therapy for autistic children during the pandemic: a mixed-methods program evaluation. *Evid Based Pract Child Adolescent Mental Health* 7:76–93
61. Pfefferbaum B, Sweeton JL, Nitiéma P, Noffsinger MA, Varma V, Nelson SD et al (2014) Child disaster mental health interventions: therapy components. *Prehosp Disaster Med* 29:494–502
62. Fukuchi N (2020) Psychoeducation for children in a psychiatric ward in the immediate aftermath of the 2011 earthquake and tsunami in Japan. *Intervention*. 18:85
63. Schonfeld DJ, Demaria T, Krug SE, Chung S, Fagbuyi DB, Fisher MC et al (2015) Providing psychosocial support to children and families in the aftermath of disasters and crises. *Pediatrics*. 136:e1120–e1e30
64. Pfefferbaum B, Sweeton JL, Newman E, Varma V, Noffsinger MA, Shaw JA et al (2014) Child disaster mental health interventions, part II: timing of implementation, delivery settings and providers, and therapeutic approaches. *Disaster Health* 2:58–67
65. Hisli Sahin N, Yilmaz B, Batigun A (2011) Psychoeducation for children and adults after the Marmara earthquake: an evaluation study. *Traumatology*. 17:41–49
66. Roberts N, Hu T, Axas N, Repetti L (2017) Child and adolescent emergency and urgent mental health delivery through telepsychiatry: 12-month prospective study. *Telemed J E Health* 23:842–846
67. Ibragimov K, Palma M, Keane G, Ousley J, Crowe M, Carreño C et al (2022) Shifting to tele-mental health in humanitarian and crisis settings: an evaluation of Médecins Sans Frontières experience during the COVID-19 pandemic. *Confl Heal* 16:6
68. Donnelly CL, Amaya-Jackson L (2002) Post-traumatic stress disorder in children and adolescents: epidemiology, diagnosis and treatment options. *Paediatric Drugs* 4:159–170

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- Convenient online submission
- Rigorous peer review
- Open access: articles freely available online
- High visibility within the field
- Retaining the copyright to your article

Submit your next manuscript at ► [springeropen.com](https://www.springeropen.com)
